Portrait by Carl A. Gist from the 1931 *Big T*

PAUL S. EPSTEIN
(1883-1966)

INTERVIEWED BY
ALICE EPSTEIN

Beginning November 22, 1965
Completed prior to February 8, 1966

ARCHIVES
CALIFORNIA INSTITUTE OF TECHNOLOGY
Pasadena, California

Subject area

Physics

Abstract

Memoirs recorded by Paul Sophus Epstein (1883-1966) with his wife, Alice Epstein, late in 1965 and possibly into early 1966. He describes his undergraduate and graduate study in physics at Moscow University, 1901-1909, under P. N. Lebedev, and his move to Munich in early 1910 to begin his doctoral study under A. Sommerfeld. He remembers his professors in Russia: N. V. Bugaev, N. A. Umov, B. Mlodziowski, N. E. Zhukovsky, A. P. Sokolov; his Russian student colleagues T. P. Kravets, A. K. Timiryazev, P. P. Lazarev, and V. K. Arkadiev. He acknowledges P. Ehrenfest's influence in the move to Munich and the change from experimental to theoretical physics, and he recounts aspects of Ehrenfest's early career. Educational practices and social conditions of the turn of the century and early decades of the twentieth century in both Russia and Germany are discussed in detail, including the situation of European Jews and anti-Semitic laws and attitudes. Sommerfeld's scientific background and connections in Königsberg, Göttingen and Aachen are described: mathematicians D. Hilbert, F. Klein, H. Minkowski; the philosopher E. Husserl. Epstein remembers his German professors: C. L. F. Lindemann (mathematics), P. H. von

Groth (crystallography), W. C. Röntgen (physics); his Munich student colleagues P. Debye, M. von Laue, A. F. Ioffe, P. P. Koch, P. P. Ewald, and A. Rosenthal; and he recollects important intellectual exchanges at Munich *Stammtische*. Epstein notes his involvement with avant-garde Munich artists from the *Blaue Reiter* circle, including P. Klee, W. Kandinsky, F. Marc, and A. von Jawlensky. World War I delays the completion of his studies and creates financial hardship. He recounts leaving Munich for Zurich (1919), where he meets A. Einstein; his *Habilitation* thesis on the application of the Stark effect to optics creates a stir. He subsequently moves to Leiden to assist Ehrenfest and H. Lorentz (1921). During these years, Epstein marries and divorces Mina (Maria) and develops interest in psychoanalysis; he meets Freud in Switzerland ca. 1920. Epstein meets R. A. Millikan in Leiden, decides to take teaching position at California Institute of Technology in Pasadena. He describes his early period at Caltech and colleagues there (1920s). Epstein ends with an account of Röntgen's career, especially his discovery of X rays; discusses Röntgen's relations with Sommerfeld in Munich.

Administrative information

Access

The interview is unrestricted.

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Preferred citation

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Niels Bohr and Paul Epstein at Caltech, June 29, 1959.

CALIFORNIA INSTITUTE OF TECHNOLOGY

ORAL HISTORY PROJECT

INTERVIEW WITH PAUL S. EPSTEIN

BY ALICE EPSTEIN

PASADENA, CALIFORNIA

BEGINNING NOVEMBER 22, 1965

COMPLETED PRIOR TO FEBRUARY 8, 1966

FOREWORD TO THE
ONLINE ORAL HISTORIES VERSION
DECEMBER 2003

Paul Sophus Epstein was born on March 20, 1883, in Warsaw and was educated in Russia and Germany. He was the first European-trained physicist to teach at Caltech on a permanent basis, beginning in 1921. He began his studies in experimental but soon changed to theoretical physics, with an emphasis in thermodynamics and quantum theory. He was also deeply interested in the theory and practice of psychoanalysis and founded the Los Angeles Institute of Psychoanalysis. Epstein died in Pasadena on February 8, 1966.

In November, 1965, just a few months before his death, Paul Epstein recorded his memoirs with his wife, Alice. Subsequently the tapes were given with Epstein's scientific papers to the Caltech Archives by Mrs. Epstein. They were transcribed and edited in 1991, and the transcript was placed in the Archives' oral history collection. With the launching of the Archives' Oral Histories Online Project in 2002, it was decided to produce an electronic text of the Epstein memoir, preparatory to creating an online version. The new transcript has been completely re-edited and bound in book form. The online version has been shortened by the omission of Part IV, Epstein's family history.

Epstein's memoirs form a true oral history, in that they recount, frequently in exhaustive detail, the events of his own early life. While some interesting information is given about Caltech in the 1920s, the emphasis is on Epstein's family history, his early childhood and his education in Russia and Germany. Of particular interest is his account of his university years in Moscow for his bachelor's and master's degrees, in Munich for the doctorate, and of the many social and professional contacts of this European period, roughly 1901 to 1921.

The technical and editorial difficulties in preparing the transcript of the memoirs were considerable. Frequently Epstein's voice was indistinct; many references were obscure; and finally, the problems of resolving Russian and German pronunciation into written form were occasionally insoluble. The present transcript reflects certain editorial compromises, such as the use of [?] where a word, usually a proper name, is thought to be garbled or has not been confirmed. Additionally, many proper names, especially where only the surname is given in the transcript, have not been possible to confirm. Wherever the editor has included first names in square brackets, the names have been verified. A few editorial decisions have been tacitly made.

Transliteration of Russian words and names has not been completely consistent. For example, well-known names, such as Dostoevsky, Turgenev, Chaliapin, and Ioffe have been cited in their most common English spellings. Generally, spellings of proper names of Russian scientists have followed the *Dictionary of Scientific Biography.* Other Russian names have followed the *Great Soviet Encyclopedia*.

Place names pose a special problem. Epstein tends to use the German names for pre-Revolutionary Baltic and other Eastern European locales. Sometimes, however, he uses both German and indigenous names alternately, for example Libau (German) and Liepaja (Lithuanian). The difficulties are compounded by the widespread renaming of towns and cities in these regions during the course of the twentieth century. An effort has been made to retain

place names as given in the memoirs, but with explanatory notes as required.

A number of people have assisted in the preparation of the Epstein transcript. The final re-editing was done by Charlotte Erwin; Carol Bugé and Paula Agranat-Hurwitz contributed to the original 1991 edit. Valuable advice on Russian names and terms was offered by George Cheron and Mary Zirin at Caltech. The original transcript was produced by Loma Karklins.

Charlotte Erwin
Caltech Archives
December 2003

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CALIFORNIA INSTITUTE OF TECHNOLOGY
ORAL HISTORY PROJECT

Interview with Paul S. Epstein **by Alice Epstein**

Pasadena, California

PART I: UNDERGRADUATE YEARS IN MOSCOW

MRS. EPSTEIN: This is November 22, 1965. Paul is telling me about his early days in the University of Moscow [ca 1902].

EPSTEIN: Bugaev [Nikolai Vasilievich, mathematician] was, of course, a dyed-in-the-wool materialist, but his son and wife were anthroposophists. That, of course, went strongly against his grain and was the root of the difficulties there—the frictions they were having with the young Bugaev, Andrey Bely, born Boris Nikolaevich Bugaev. I lived with him in Munich in the same pension for several months—he was already married, so it was several years later. [Rudolf] Steiner, the head of the anthroposophist group, had his residence in Munich, and that was a center of anthroposophism. They wanted to build there a Goetheanum, a temple of anthroposophism, but since they believed they couldn't use any fire-produced materials—they had to be of wood—and they could not get the permission of the fire department to build such a building of wood, they went to Dornach [Switzerland] and built it there. And sure enough, in a year it burned down.

Andrey Bely, the son of Bugaev, and I never became particularly close, because it was the same thing—the mysticism which was inherent in that anthroposophy, it was strange to me. But I had read some of his work by that time, and I must admit it was an extensive knowledge that he had. Apart from the poems, he had some short novels and also critical articles. He was a very gifted man and in his line was probably even better than his father was in mathematics. I think I

have spoken enough about Bugaev. I may only add that I did not know that he [the elder Bugaev] was in the year next to his retirement; in two years he retired, and soon after that he died. The lectures were good. Differential calculus is not a very modern thing—however, a very important one. I found out soon afterwards that his lectures were available in a lithograph version. You just could buy them and could read them at your leisure at home, which I preferred always to do. I didn't get so much by the oral approach, and so I read for myself on differential calculus at home.

Now the next professor which I had there was [Boleslav] Mlodziowski—it's a Polish name, Mlodziowski. He was also of small stature but very different from Bugaev. He was, in the first place, a marvelous lecturer; that is, his expressions were always right and beautiful, his drawing and writing on the blackboard were perfect. Some students called him the Chaliapin of the mathematics course. [Feodor] Chaliapin was a great basso of the Moscow Opera at that time, the greatest idol of the land. He looked a little like an undersized Mephistopheles because he had in the middle of the head a bald streak, and on the two sides were ridges of hairs something like horns, and then he stood in his evening dress tailcoat like a devil with a tail. But I forgot to tell that the professors also had uniforms, which consisted of a blue formal dress with this tailcoat with gold letters, golden with imperial insignia—and also along the waistcoat were these golden buttons. It is true that the professors did not wear it in private but only in the lectures, so that they had somewhere a locker where they kept that, and the waistcoat was used, an ordinary waistcoat. Also the trousers were ordinary trousers. Mlodziowski was himself the son of a professor, a professor of anatomy, and so it was a second generation, and that accounts for his beautiful Russian when he was of Polish extraction. Anatomy is one of the most lucrative of the professorships, so that his father must have left him oodles of money, and he lived in a house which was above the standards of most professors, because in general they lived extremely simply. But his house was a solid bourgeois home. As I found out before long, his son, Anatole, was my classmate. He also had the small stature like his father and was a very good natured, smiling boy. So that was Mlodziowski. He was also a good mathematician. And his lectures were also available in the lithographed editions, so I wasn't obliged to listen to him, though some people thought it was a pleasure to listen to him.

Then there was the professor of physics, [Nikolai Alekseevich] Umov. He was under sixty, probably, but he had a shock of white hair on his head and a pretty good-sized beard, a

pointed beard, but much larger than that Mephistopheles' beard of Mlodziowski. And he gave lectures together to the physics students, that is, the mathematicians, and the chemistry students of the naturalist faculty. It was always in the same building adjacent to the quarters of the mathematicians—a large room, two stories high, and with tiered seats going up, which, in general, was not the case. The class was different in two ways from those which were usual in Germany. The first was they always had two hours in succession, with usually an intermission after the first hour. The second was that it was twice as long; it was two years. Of course, it was four hours a week, two times two hours. But in Germany they have also five hours a week for a year. Here they had four hours for two years. And this permitted two things. The first is a lot of experiments that required more time than an hour. You have first to set it up, and the things then interact to start to work and are usually ready for observation only in the second hour. You could show many experiments which with one hour lectures you could not. You had more time, considerably more time. And he had a wonderful assistant, that is, what you call a technician. He was the old assistant of the predecessor of Umov, that is [Aleksandr Grigorievich] Stoletov, who was a very famous physicist. Umov was himself not a slouch; he had some international fame.

At this time, I only mention two things. The first is that he was an intimate friend of [Elie] Metchnikoff. Metchnikoff was a great microbiologist at the Pasteur Institute in Paris, a very famous man in his time. He always stayed with Umov when he was in Moscow. The second thing is the impact that I had from the experiments. I told you that the experiments were better than in other places because they could take more time for them. They didn't have to build them up in the lecture room as they have here, because they had a spacious adjacent room where they could have everything ready to wheel in at the last moment—which is important when the lecture room is used by other people, too. Now, I give you one example which made a great impression on me at that time. That is the Foucault pendulum experiment. You know the Foucault pendulum?

MRS. EPSTEIN: No, I don't.

EPSTEIN: The pendulum has the tendency to preserve its own plane in which it once swings; it continues to swing on the same plane. And if apparently the plane changes, it is due to the

rotation of the earth—that is, the earth turns away, the pendulum turns in space—so that it is a very delicate experiment. They have also a Foucault pendulum in the planetarium here.

MRS. EPSTEIN: Yes, I've seen that one.

EPSTEIN: But they are all impressive. You see, in the first place, it is extremely easy for it to go wrong because you have to be sure that nothing interferes with those oscillations. And that was possible there because of the tremendous height of the lecture room. I told you it was two floors high, two stories—but you must also remember that the Nikolaev [?] buildings have quite tremendous turrets which are equal to two such stories; the total height was exceedingly big. The pendulum was then suspended on a thin wire—it was a heavy pendulum so it was not very thin. But on a steel wire the oscillations were not very big, so that under these conditions the main part of it remains unaffected and the plane isn't changed by the suspension. In other places they use universal joints and all sorts of things which, on the whole, they don't understand. And it was done in the following way. The pendulum was suspended on a thin wire and down on the level of the floor below it was initially deflected by a thread. It was a thread attached to a proper place on the pendulum and it was deflected several inches, maybe a foot, and fixed and left to settle in that condition. Then the old assistant of Stoletov set fire to that thread with the help of a Bunsen flame, and the thread burned through more or less symmetrically, and the oscillations got in a definite plane. Now, the plane was selected so that a light which projected the wire on a screen gave a single line which didn't double up; that is, on the way to and fro, [it was] always the same.

First, the theory of the experiment was discussed very thoroughly, and it was calculated how much the pendulum would deflect in five minutes; that is, how much the earth turns in five minutes. Then that light which gave the shadow of the wire was manipulated. It was, of course, already dark, and the shadow projected on the screen, so in the beginning they put a marker to mark the position of the initial wire. Then very slowly the line began to shift; that is, that light always followed, so that the light was always on the plane of the oscillation—which was in space considered the same plane but on the earth was a different plane because the earth rotated under it. Umov sang out every ten seconds: ten seconds, twenty seconds and so on—you have a stopwatch. So that was an extremely exciting sight, how the earth turns, that the shadow shifts

because of the turning of the earth. So they followed it for five minutes, and then they sang out the final reading, "five minutes," and they put a second mark on the new final position. Then the lights went up and the distance which the light had traveled . . . the line it had traveled was measured and found exactly coinciding to what we had calculated before. Now there were about 500 students there—all the students of physics and chemistry together. They all sat with bated breath, not a sound was heard; they were all awed by that phenomenon, that the earth is rotating. I was particularly awed also. That was one of the impressive experiments in the beginning of the first weeks.

Now you might ask: how is it that the mathematicians and the physicists and the chemists got the same course? They have different preparation and they have different needs. The answer is that parallel to the lectures they had so-called exercises, that is, problem courses which were in this case conducted not by Umov himself, but by an assistant professor called [A.] Tsinger—a good man and a clever man. These exercises were different for the mathematicians and for the chemists, and there the mathematicians got some supplements. In general, I didn't go to the lectures because, just in that year that I entered, the book of Umov's lectures was coming out in installments, and a couple of students, whom I later came to know well, were in charge of editing it. So I just was buying the installments as they came out and could read everything at home. These exercises, parallel to the course, also were conducted for analytical geometry. Mlodziowski conducted them himself. Every time we met, problems were assigned for the next time which were dictated by Mlodziowski and by Tsinger and so on. The students were supposed to solve the problems at home and come back with their answers ready. You had a choice then; you could either answer at the blackboard one of the questions, perform, so to speak, and that counted as a credit for the class. That is, if you performed at the blackboard even one time in the whole semester, then you were credited with it. Of course, there were 300 students; there wasn't time for all of them to perform, and the rest didn't have a chance or didn't want to. They had to turn in a notebook with the written questions and written solutions and so on, which also gave them the credit. As it was much more convenient just to perform one time and get rid of it, I always tried to do that and mostly succeeded.

This, of course, touches upon another problem, that is, was the instruction good at Moscow University? You see, the mathematics was not taught in a very modern way. Many subjects were taught very briefly, and some not at all, so that the course was not modern, you

may say. It was not surprising, because most courses were organized in the 1860s and ’70s, and they were given from year to year in the same way. Where mathematics is not a static science, neither is physics—so that you missed many things. It depends on your point of view. Some people would say it was a poor course, because many things remained unmentioned that students are now taught. However, it was a sound course. We learned to do many things, and that is what is important. I came later into Germany and had to compete with the German students who had modern instruction. I wasn’t greatly handicapped; in a few weeks I completely caught up with them. So that it was all right.

Differential calculus and analytical geometry were both six hours a week—three classes, always two hours together. And physics was four hours a week and higher algebra only three hours—three one-hour lectures. I think the professor was a man called Rikhter. I’m not sure. He was a kindly man and in his way a good mathematician—just in his way, because he also did not mention certain parts of higher algebra which some people regard as highly important. But he knew a lot, and in return for what he did not know, he talked a lot about things you don’t hear in other places. For instance, a very complete history of interpolations and so on . . . approximations . . . which is a mark of Russian mathematicians whom nobody knows outside Russia. I later came out to visit his house because he had two sons in the university. This Rikhter was, incidentally, a professor emeritus, lived in a grand style because these professorships took only a small part of his time, and his main occupation was the director of a private high school. And he had a house on the grounds of that high school equipped with all the luxuries that you can imagine. The best crystal and best china you got there for your meal, and everything in proportion, too.

We had chemistry one time a week for two hours in a lecture room in the chemical institute—a comparatively small lecture room—also tiered, but much smaller than the physics room because it was only for the mathematics students. The naturalists took chemistry and mathematics in their own way, and they did not have that. The teacher was a man called [A. N.] Reformatsky. He was a phenomenal talker, very good talker, almost as good as Mlodziowski, but not quite. So that some students said that Mlodziowski was the Chaliapin of the mathematics school and Reformatsky the Sobinov—[Leonid] Sobinov was the star next to Chaliapin in the opera, the tenor. The course was not remarkable, of course, you couldn’t do very much in two hours a week for a year only. But especially they weren’t practical—no demonstrations, no

experiments—that is, what you could do with talking, he did. So the chemistry was not a memorable thing there. Well, you may ask what did I do all day long since I didn't attend lectures mostly. What I did was, first, I tried to read advanced physics, and I got Maxwell's treatise on electricity and magnetism, which is one of the great fundamental books, and I worked hard on it. I could not read it, but it was a concept of mathematics that I did not know—partial differential equations, they didn't have anything like that. I had to give it up finally. The other book which I took was [Max] Planck's *Thermodynamics*. Planck was a pretty famous man in those days, a German professor in Berlin. Later I had classes, relations with him. I could read the book, but I found it excruciatingly dull. That is one of the reasons I myself wrote a book on thermodynamics, and I think I did it better. So, what did I do? I worked problems in mathematics. After all, mathematics is not what you know, but what you can do. Every collection of mathematical problems I got hold of—there is in Russia a very good one by Vera Schiff, a woman. Vera Schiff was a professor in some school in St. Petersburg, and I guess it was the women's university. Also, she had a French upbringing and French background. I got so that I could solve any problem there was. That is, actually, the basis of my whole mathematical education, my knowledge of mathematics.

Fig. 1. Paul Epstein in military-style uniform worn by undergraduates at Moscow University, 1902.

Now, having then spoken about the professors, what about the students? I told you we were 300 freshmen. They all wore the same uniform, gray fatigue uniform and green gray trousers. There were several opportunities—one was the exercises—to watch the people who performed. The exercises I did attend; I always was there. The other was a student mathematical society. We had some common dealings with the sophomores. There was a sophomore student named Florensky [probably Pavel Alexandrovich Florensky], who actually was a seminarist—that is, from a theological seminary which educates the Russian priests. They learned also Latin and Greek, but that, of course, did not lead up to a certificate of maturity, which is what you need to enter a university, so that they have

to take, I think, an examination for the certificate of maturity. But since there are no Jews, that isn't very hard. You can pass [the] examination, you enter the university. You needn't pass it with straight A's. He apparently did.

Now, I am thinking back and remembering things later. I believe he was not only a student, but he kept his connection with the church, and he took the mathematics course under the direction of his ecclesiastical mathematical superiors, who wanted to have a priest mathematician. Well, anyway, he was an enterprising fellow, and he founded this student mathematics society which met in the evening once in two weeks or every week, I don't remember, and the students gave lectures there, and there you also come to notice some good men. One way or another, the good students soon became known to me. You see, what we had there, most of them were just sheep there. Nothing interesting. The good students were very few. In physics there was only one, except myself, namely, Mlodziowski—Mlodziowski the young, the son. Then there were two mathematicians, Bushgens [?] and Goriachev [?]—or maybe three—it's so long ago I don't remember. But [there was] one astronomer, [Aleksandr Ivanovich] Nekrasov, that was a very remarkable man. He was a close friend of Mlodziowski. We were from the same high school; we finished together. He became an astronomer and later an aerodynamicist.

It was very remarkable that after three or four months time, I knew all the outstanding students—and there were maybe seven or eight of them. These students stayed for the whole time; they went on from course to course and all finished together at the same time as I—graduated. Most of these, then, became graduate students. So it is remarkable how early this mathematical ability manifested itself. One mathematician I forgot—Drishant [?]. I doubted him at first because he gave a talk in that student mathematical society. Mostly these talks were not much; they were given by indifferent students who just parroted a chapter out of a textbook. He was really a mathematician who worked for himself and taught himself.

Now of course there were other students who were not so outstanding in mathematics or physics, but who were for some reason interesting to look at or associate with. Most of them wore the student uniform, but a few still had their own uniform. Those in government service in other departments continued to wear their old uniforms until they wore out, and then they got [new ones].

Now one man was remarkable—of course he was much older than any of us—he was

about forty years old, a big, tall and wide man. His name was Lubatovich. He was by profession a surveyor. Well, he was still a freshman. As he told us, it was already the fourth institution of higher education which he entered. For some reason or other he had to give up every time in his other trials to get a university degree. Of course, thinking back now I see that it probably was some minor flaw in him, that it happened to him four times, and it certainly was partly his own fault, but he was interesting to talk to. He gave a talk about his surveying; he led the party which surveyed the railway route to the north. There was no railway from Archangel, and it was decided to build one. It went out 120 *versts*—a *verst* is a kilometer practically. To survey, there were two parties; one started from Archangel south, and the other from Vologda going north. Vologda was at the point where the old railroad ended. And in Archangel he presented himself to the governor, and the governor told him that they had a map of the northern part of that region and produced the map. It was a region of lakes, according to the map. He was glad because where there are lakes there is good drainage—water flows together in lakes and otherwise it couldn't—and therefore the progress would be easy. But it turned out otherwise. He had a pretty big party in order to carry the surveying instruments; they had camping equipment and so on. Therefore they employed a goodly number of transporters. What they actually found was not a dry country with good drainage, but it was a marsh and was all covered with moss and at every step the legs sank in more than ankle deep and had to be pulled out again until then they could take the next step. After they made what progress they could for a few days, Lubatovich decided that he had to reduce the party because a man, a porter in particular, could only carry the food to sustain him for two weeks. They thought that two weeks would be enough, but it turned out that they were to take more than six weeks. So that he sent back all the porters and also every object that was not absolutely necessary—retained in the expedition only the surveying instruments and some cooking pots and of course the camp bedrolls and so on. In particular, they had no bread. He thought that he could rely on the two rifles that they carried with them. There were two pretty good shots in the party, and so they proceeded in this way. This marsh was seemingly endless. They went and went over the same marsh until finally they reached a little river on the shores of which it was drier. Now that puzzled Lubatovich and worried him, because, according to the map, the river arose in the lake which was east of his position. In the place where they were, according to the mark he had put down on his map, his projected map, there should not have been any river there. He was worried, and among other things came to him

the idea that maybe there is a magnetic anomaly there. A magnetic anomaly was not long before discovered, where the magnetic field behaves in a most unusual way. And if that is so, he argued, then since he directed his way by a compass, a magnetic compass, he might have gotten himself in another direction. He decided to check that, to see whether the compass was all right. Now that was quite an undertaking in its way because you had to do it, of course, at night when the polar . . . [tape break]. They had two little lanterns with them they lit with candles. And with the help of these two lanterns, they accomplished the thing; they determined the direction. I will not go into the details, but it took quite some ingenuity to see how the compass agreed with the position of the North Star. Of course, the compass goes to the magnetic pole, not the geographical, which is in the far north, a considerable difference from the geographical. After working part of the night through, he satisfied himself that the compass was all right; it pointed to the magnetic pole, so that was not the reason. The reason was simply that the map which the governor had given him was just based on fantasy.

Now from that time on they began to get out of the bog and on drier ground. But they came into the forest, the primeval forest, which had never been trod on by man's foot before. The progress was better but not fast yet because all the dried branches and so on were lying there on the ground. It was an elevation the Russians call a mountain. He gave it the name Gigolev Mountain, but actually it is an elevation of a few hundred feet only, and not that rocky. It is just earth, but dry. So that under these conditions, having so much delay and trouble with their progress, they couldn't do an adequate job of investigation of the properties of the soil which they were supposed to do, underlying the safety of the railroad. Essentially, all he did was to take the profile, that is, the elevation, in every point. And of course, he had the necessary aneroids and barometers and whatnot, of great precision for that. Now the progress was better, but they suffered from a one-sided diet. They had no bread, and all they ate was the birds that the two rifles shot, which were mostly quail and, what do you call those? Anyway, they are considered to be the most delicious game you could find. But they had to cook them in the most primitive way. They had the pots and kettles all right, but not much else. Of course, every Russian has his tea and sugar—crystalized sugar which he eats with tea, breaking off a piece, holding it in his mouth while he drinks. They also had salt, but that is all. They cooked soup out of these birds and then they simply cooked meat.

Six weeks passed, and Lubatovich thought that they best meet the other party. According

to his figuring, he had passed forty kilometers, which is thirty-two miles about. The other party had started eighty kilometers away, but they had unquestionably a much easier progress; they could do better time. The danger existed that the two parties would pass each other unnoticed. He started to blaze the trees. He took a line at right angles to his progress and for several miles blazed all the trees, so that the other party would find these blazed trees and know that people were there and find them. Pretty soon the party came along and they joined forces. By that time also the leave of absence which Lubatovich had taken to do this work was almost expired, and he had to leave anyway. So he considered his part of the work done and went straight to Vologda, and from there home. Later he received the notification that his investigation was approved by the Ministry of Railways, which wondered him very much because there actually was no investigation. All he had done was take the profiles. But they had very great luck, the Russians; they built the railway according to this route and practically all of it was good. Only a stretch of one or two miles turned out to be on boggy ground. So that they built there an embankment, and soon after completing it, the embankment sank into the ground and disappeared.

But here it was sometime before Christmas, maybe November. I performed in physics this exercise conducted by Tsinger and had a great success. The question was about how to determine the degree of concentration with an aerometer. An aerometer is an instrument which shows you on a scale the actual degree. The simplest and the most well done aerometer is the spiritometer with which you determine the degree of spirits of brandy and vodka and so on. I presented my own theory how to make it absolute; that is, how to make the aerometer an instrument that would not give an arbitrary reading, but a meaningful reading—due to its construction—and Tsinger listened. At one time he thought that he had caught me in a mistake, but I showed him that it was no mistake, but that it was all correct. When I had finished, he repeated several times, “Very interesting.” And this thing also made an impression on the other students. Some of them talked to me afterward, and from that time on I was also one of the outstanding students of that group of eight or nine. Just as I had noticed them, they had noticed me.

There were, in the freshman year, five examinations probably—in all the major subjects an examination. And for each examination you had several days of preparation. These several days of preparation were for me sufficient to learn the whole business even if I had not read it at all. And the examination was conducted as follows. There were about six or so invited

examiners from the assistant professors of the school, and most of them I saw for the first time; they did not teach the freshmen. The students were called up by alphabet. The examiners sat at long tables, several chairs at the side of each were vacant, and you went to the one whom you thought most likely, and sat in the chair next to him and he . . . . I skipped something. After you were called you were presented with a lottery. Namely, the program, the whole course, was very carefully divided into parts, subjects, so that they covered the whole business from beginning to end, and such a program was available to every student at any time. On the table there were a number of cards face down, white cards; on the other side of them, when you turned them around, was a number of questions on the program. That was called a ticket. You pulled this ticket, and on it were what you had to answer—that is, what part of the course. So that you presented then your ticket to the examiner, and he had also the program and looked up what it was and asked you questions out of that particular part of it. Then he added a few questions after finishing that, if you passed it; that is, if you were satisfactory in this part of the program, he asked you a few questions astray, out of the course at random. He also asked you to solve some problems, simple problems that didn't take much time, right here and now. That was the way it was conducted, and it took about twenty minutes to half an hour per student to make him go through those paces. Then the examiner put down his grade in his list; you didn't get it at once. You were then free. This way three hundred students and six examiners usually worked for three days until all the students were examined in the subject. Then you had your time till the next examinations, of five or six days. So that as soon as you were ready with this, you went home and started to study the other subjects, the next examinations. The same thing was repeated again. To make it short, I passed all the examinations with the highest mark—5 in Russia is the highest, here it is an A—so that I had a straight A record at the examinations, which was what an outstanding student was justified in getting. I learned after the last examination that I was a sophomore. Not all were so lucky; that is, many students did not pass one or several examinations. It turned out that 240 failed in something or other and only 60 passed into the sophomore class. So that was a pretty rigorous sorting out of the promising students from the bad students.

MRS. EPSTEIN: Where did you go from, to the university; where had you been living before going to the university?

EPSTEIN: Minsk. You see Minsk is in the education district of Vilna [i.e., Vilnius, Lithuania], which is comprised of a certain number of *galens*, as they are called. It has no university of its own. So the students had their choice to go to three universities. One is in Dorpat [pre-revolutionary German name for Estonian Tartu], which belongs to the Riga education district, and another is in St. Petersburg, and the third is in Moscow. Moscow was by far the hardest to get into, so I decided I will go to Moscow.

MRS. EPSTEIN: Had you ever been to Moscow before?

EPSTEIN: No, I went for the first time to prepare things for getting into the university. I had an aunt living there, Tanya.

Well, [after summer vacation] I came back to the university in the last days of Russian August—the middle of September here. Then I found in the sophomore class 130 students; 60 were passed on with me from the freshman class, and 70 were repeaters—they had also failed some subject in their sophomore year and stayed on for another year there. So it was a considerably smaller class, but the difference was not so very important. The home of the sophomore class was just a room over the room of the freshman class. A room of exactly the same dimensions and the same disposition of windows and doors and so on. The new lecturers I met were quite important men. Bugaev stayed on and continued his course. It was differential calculus the year before, and now it was integral calculus. In his lively manner, he told us that there are tens of thousands of men in Russia who can differentiate but only two or three thousand who can integrate.

The student with a red face and pimples who wrote on the blackboard had fallen by the backside; he was not in the class, and also the dull student whom Bugaev always watched was not there anymore. But Bugaev speedily found replacements for them. He continued to dictate in the way as before, and he was as good as his word—it was a more advanced course than the preceding. But the interest lay in the new men. In the first place, we got [Nikolay Egorovich] Zhukovsky in mechanics—mechanics started with sophomore year. He was also a living scientist, a living scientist not only in Russia but in the world. His specialty was in aerodynamics, and he was one of the founders of modern aerodynamics—theories of flight of

airplanes. He was a big, powerful man, a little leaning to paunch. His course of mechanics was extraordinarily good. I think if it was now published in English or German, it would have a good sale. Of course it was available in lithograph version, and I did not have to listen to it. The other new lecturer was Lochtin [?], a mathematician who lectured on differential equations. Lochtin was then rector of the Moscow university. A rector in Germany is elected head of the university for a year; in Russia it is an appointed official who is permanent. To be rector you had to be two things: politically very reliable—that is, Tory, conservative—and have good connections in the Ministry; and Lochtin apparently had both. He lived on a more lavish scale than most of the professors. I always heard about the wonderful study of Lochtin; it had such deep chairs that you sank in and leather seats. Years later I had occasion to visit him; I found out that this vaunted study was an exact copy of the study of my grandfather in Minsk. My grandfather's was a little old and shabby in the bargain, not exactly the same. The leather of the chairs was badly worn and damaged by his many grandchildren. So that all his daughters and daughters-in-law always talked about the disgraceful study which my grandfather had, that he really can't go on with it and must buy a fine, modern, and elegant study. That was what the wonderful study of Lochtin was. Now, my grandfather never got around to his; it remained the same study to his death. Lochtin was satisfied with his, apparently.

His course about differential equations was adequate in what it covered, and I learned a lot out of it. But actually this shows me only how poorly equipped the undergraduate is to judge the quality of a lecture course, or any course. Because if you talk to the students in Moscow, "Oh, Lochtin, yes, he's a wonderful lecturer, he has a most brilliant course." But in the light of my later experience—I have this lithograph series in my study now—in the light of my later knowledge, I saw that it was not only not very good, it was appallingly poor. The art in presenting mathematics is the order and selection of the subjects. If you are a good lecturer, you have to present every subject with a view of its later connection with other things so as to make this later come out naturally and easily. But Lochtin had nothing of this sort. He presented everything for itself in the most what I should call unintelligent way. So that this "wonderful lecturer" only refers to the fact that he didn't get stuck and was clear in what he explained, but he explained things that really didn't amount to much and didn't matter.

In speaking of my freshman year, I was not quite complete. There is one episode that I should mention because it's very characteristic of the Russian universities. That was a period of

student unrest, as it was called, which is a dangerous thing, of course, as it may get out of hand, and then the university is closed for long periods. As it was not far from the examination times, it might have upset the whole year. When I came in the morning to the university, I heard this story. There is a second student committee, political, consisting of older students—lowly freshmen had nothing to do with it—they received in the morning the message that not all was well. When I came, they were back with the report. It was in the women's university, or the girls' courses, as it was called colloquially in Moscow. The women there had some grievance and went to talk it over with their director, whose name was Guerrier [?]. He [was] a man of late age—seventy years or so. And in the conversation between the deputation of the girls and Guerrier, one member of the delegation, the youngest, was particularly vocal, and as Guerrier gave some answers to something, she said, "I knew that you would say that." And Guerrier looked at her—she was only seventeen and he was seventy—and took her by the chin and asked, "My little one, how old are you?" Now that, the women thought, was an outrage, a disrespect to their sex which they could not let pass, and there was not all well in the women's university. So the executive committee of our university, the students, made the resolve that we must also join in the protest. In an official way the students should express their solidarity with the women's university and protest against the disrespect to the women students and assure them our moral support. Well, it was up to our vote—that was all it was—and there were already several letters of influential students and former students who were in the politics now, especially [I. G.] Tseretelli. The name Tseretelli I heard then for the first time. Later he became pretty prominent and famous, and was also the vice-president of the First Soviet in Leningrad after the revolution. Now, the situation was explosive, and all sorts of things could happen if the police interfered. The university authorities got busy, the professors, and prevailed upon the chief of police in Moscow that the general police would not come into the building, because that would be an irritation to the students—and let them handle it in their own way. What they wanted was to have a number of meetings, that is, every class should have a meeting of its own and make its own resolution of the matter. To the students, they enjoined that they should talk on everything under the sun—about the Chinese and what not—but not about the women's university and Guerrier. And now two days passed in this to and fro, and the students had time to read up on who Guerrier was in the newspapers—most of them were boys from out of town and didn't know the first thing about the personalities in Moscow. They found out Professor Guerrier had

borne the brunt of the struggle for women's rights and women's education for fifty years. He was a founder of this women's university. They saw they had made fools of themselves and, therefore, they were not anxious at all to speak about this episode. So they agreed to have the meetings and speak about other questions. So the meetings took place in every room separately. I had an opportunity of going to the meeting of the freshmen lawyers. That was, of course, immensely larger than ours; there were a thousand students about. The president was invited by the students themselves, it was Professor [A. A.] Manuilov, an economist.

It was really magnificent how clever and skillful this Manuilov handled the students. He told them roughly what they would speak about; he had, in no time, divided the subject into sub-questions—smaller questions which could be separately discussed—and the discussion was started. He was immensely skillful in keeping the students to the point without in any way offending them—stopping them when they were going off on a tangent on irrelevant matters or on questions which had nothing to do with the one which was under discussion at the moment. So that it progressed in a very orderly and nice fashion, the meeting. All these small questions which summed up to the bigger were voted on one at a time, and finally the general resolution was arrived upon which really expressed the opinion of the students and satisfied everybody.

Two or three days later we had our class meeting in our lecture room there in the west building and our invited president was Umov. I thought the whole time how much Umov could learn about handling such situations from Manuilov, because he really was not in charge here, was not the master of the meeting. The students did everything they wanted to, but everything went off without mishap. We also had arrived at some resolution or other so that the whole thing was resolved quite amicably, and in a few days the students were again quiet and the university working as before.

Well, for me personally, that episode had maybe more meaning than for others because just a week before I had been to the director of the chemical institute and had asked him to permit me to work in the lab—in the student laboratory, in the teaching laboratory, because it was just only about a month's time until the examinations, and I could learn something about practical chemistry. He said, "Come on such and such a day, I'll give you a quiz whether you are prepared for the student lab, and if you are, I'll let you work here." But with these political events too much time was lost and it wasn't worthwhile to start. I gave up the idea of chemistry. That was the episode which I wanted to tell you, as this was very characteristic, for it doesn't

happen in America, in Germany and so on.

[Tape interrupted; Epstein returns to discussion of professors of his sophomore year.]

Several men, especially Lochtin and Zhukovsky. I am not quite sure whether we had at the same time also the beginning of astronomy with Professor Skirosky [?] or the beginning of meteorology with Professor Leist [?]. At present I will say a little more about my first experiences with Zhukovsky.

The construction of our sophomore class was exactly the same as of the freshman class. Also the podium, and on it the blackboard at which Zhukovsky spoke. In spite of his great size and powerful constitution, he had a surprisingly high voice, and he was a very good lecturer, but not very accurate. He had also a beard, pretty big, and spoke very well, though he didn't tell us anecdotes as Stoletov did. While he was writing, he rubbed off with his sleeve one of the formulas which turned out always to be a most important one. And then, when the blackboard came around and the formula was needed for reference, it wasn't there; it had disappeared and he was searching for it [laughter]. But as his lectures were available in lithographed editions, I did not attend them, or rarely.

Now, a very important moment in the beginning of the sophomore year was when I saw on the bulletin board an announcement that those students who wished to join the learning laboratory, the student laboratory of the physics institute, should come to the department of Professor [Aleksei Petrovich] Sokolov on such and such a day, which was only a few days later. Now that was my need, of course; I was always aiming at becoming a practical physicist. So I was there with a pretty large group of students, and the meeting was presided over by Sokolov—Umov was one full professor, Sokolov the second. The question there was, since there were more students than places in the laboratory, to select those who should be admitted. The first suggestion of Sokolov was to admit all those who had an A in the freshman examinations. That was satisfactory to everybody, and it settled my hash because I had an A and so I was in. I did not pay so much attention to the rest of the proceedings. Anyway, I noticed that the group also contained from our class Mlodziowski the younger and Nekrasov—two outstanding students of whom I spoke before. The question remained now to assign the other places. There were thirty-six places which they worked in two groups of eighteen students each; the arrangement of the

laboratory permitted eighteen students to work simultaneously. Anyway, I don't remember how the question was settled, but finally it was settled, and the meeting was closed, and the instruction began the next week. Both Mlodziowski and Nekrasov were in my group of eighteen, working on the same day as myself. Now all that took place in the old physics institute.

The institute was built by Stoletov in the seventies, and consisted of two floors. The lower floor was occupied by Umov and his assistants, the upper by Sokolov. There was appointed recently a third full professor of physics, [Petr Nikolaevich] Lebedev, because the university was getting big and needed more. Lebedev had temporarily shared quarters with Sokolov. He had his own room and his particular students, and he had only one special student—worked in one of Sokolov's other rooms. Well, the center of this Sokolov department was the library room which was a large corner room with bookcases on the walls—bookcases under glass and locked up—accessible only to those who had keys. In the middle was a very large, round table around which sat the laborants, as they were called, that is, the men who are assistants and who conducted the whole proceedings. The students sat down and prepared themselves. The preparation consisted of the following. You went up to one of the *laborants* and asked to be assigned a problem. He assigned you a problem, and there were a number of Kohlrausch's *Handbook of the Physical Laboratory* [*Lehrbuch der praktischen Physik*] lying on the table. So you looked up at the right page in Kohlrausch—there was the experiment described in detail with its theory and so on, and all you had to do was read it through and digest it, understand it. And when you thought you were ready, the *laborant* led you to the place in which it was arranged. Most of them were single experiments—that is, every student had his own—but there were a few which required two students to act simultaneously. But they were exceptional. There were then eighteen such tables for the eighteen students, and that was why the laboratory was restricted to eighteen.

Now, I will not tell you about the experiments—of course, we began with scientific weighing, scientific use of special laboratory scales and very accurate scales—but tell you about the *laborants*. There were actually three or four of them. There was, in the first place, Colley, Andrey Robertovich. You always called them by first names and patronymic. Colley was a comparatively small man, with a very powerful voice. It was remarkable that such a small man had such a big voice. And he was of English extraction, as the name implies—Colley. But the

Russians spell it differently, of course, in their own language. The family was a rich banker's family and controlled the whole platinum production of Russia. Platinum was at that time, and maybe is still, practically a Russian monopoly. All the platinum came from the Russian Urals area, in ingots mostly. And the Colleys controlled it.

Now, the father of Colley was Robert Andrevich. Robert Colley was already a professor. He had a share in the business, but he himself worked in the Institute of Agronomy in Moscow, in which I worked later, too. And Colley was a very promising young man. He was himself a pupil of Lebedev's but had finished his investigation for which he later received his master's and doctor's degrees and was ready to go abroad—I think the next year he did go. He was a pleasant man, they were all very polite and pleasant there.

Then there was a man of a quite different stamp; that was Ivanovich, Josef, who was a peasant. Now in America this wouldn't mean anything important, but in Russia it means a lot. Russia was a closed society, and the peasants formed a special class who had been serfs a generation or two earlier and were only emancipated a year before the Americans, 1861, I think. And they were still not completely free. The peasant communities were held by communistic institutions, and the peasants were really dependent on the community. The land which they had, they had only in holding, not their property. A peasant could not, for instance, go to the university because the university is liberal—liberal means liberating also, not only progressive. That is, a man who graduates from the university is no longer a peasant; he is released from the peasant responsibilities, especially those for his holdings. Now, that's all very well, but it seems that the peasants had an extremely fierce hate of the system and their fondest wish was to get out of the peasantship and become gentlemen, become freemen. This man named Ivanovich was from a suburban village near Moscow. It is situated on the railway now, but of course there was no railway in old times. He could not read or write until he was fourteen years old. And from vacationers of the gentleman class who came there every summer he learned something about the textbooks which he had to find and about the organization of high schools. He studied by himself and prepared himself for the examinations, for the certificate of maturity—that is, finishing the high school—and passed this examination. Of course, to enter the university he had to get the release from his peasant society, but that was at the time only a formality. He got the release easily and entered the university. Of course, he was completely self-supporting. It was in those times very much harder than it was later, because the sources of obtaining money were

much more restricted. So he had to make great sacrifices to be in the university. But he had, or he thought he had, some abilities in the mathematical line, physical, so he entered the school of physics and mathematics and in due time he graduated under Stoletov.

[Tape interrupted]

EPSTEIN: I was discussing the *laborants*, who are something between an assistant and an instructor. And I spoke about Colley. I told you that Colley was from a rich family and had, in the course of time, intermarried with some of the Russian aristocracy. For instance, a cousin of this Colley, whom I met through him, was apprentice to Hofskia [?], who belonged to one of the most notable families of Russia. But the platinum was due for a fall. The bottom fell out of the market, and they lost most of their money. This Colley, Andrey Robertovich, he lost it with them. He wasn't destitute; he simply was no longer rich and could not live a gentlemanly existence without doing anything; he had to look for a job with pay. Fortunately, his scientific career was quite successful, and he had very good prospects. I also mentioned Ivanovich, the peasant who got through the university under extremely difficult conditions because he had to provide for himself. Not only self-supporting in the usual sense—having to find his living expenses—but he had also to pay out of his earnings for tuition and clothes. So, well, that required a lot of will power to carry through—will power, and . . . .

MRS. EPSTEIN: Persistence?

EPSTEIN: Persistence of course, but particularly . . . .

MRS. EPSTEIN: Ingenuity?

EPSTEIN: Well, that's a different thing. But particularly it required ambition, very great ambition and persistence. But he got through and graduated. The university examination is at the same time a board examination—government board for teachers. And so he worked in Stoletov's institute. And Stoletov apparently liked him, because through Stoletov's good offices he got the offer of an appointment, a *laborant*, assistant instructor. And it was a staff

appointment. You must understand that the funds of the university came from two sources. One was the government appropriations which were paid every month, and the other were what they call special funds; they were essentially the tuitions of the students as far as they were not committed for special purposes. Now, the staff appointment was paid from government appropriations. The government was responsible for the salary, the salary was better. I suppose he got 100 rubles a month out of his appointment, and it had pension rights, which is an important thing for a man without private means. On the other hand, the special funds laborantships paid less; I got only 60 rubles a month. It had no pension rights, and the salary was paid very irregularly, just when the university was in funds. When there was money in the treasury they paid up, and sometimes this was several months overdue, and you had to wait endlessly for your money.

And now comes the strange thing; the great ambition, it seemed, disappeared. Usually, when a young man gets so far as a laborantship, he takes it only in order to look for a better job—namely, he works for higher academic degrees which give him then master's and doctor's degrees and appointments of assistant professor. But this Josef didn't do anything; he was quite happy with his 100 rubles a month, and it was not visible that he worked at anything else. That was a subject of discussion often at dinner after the meetings—how it happened that the ambition was suddenly exhausted. And they all said that it was overnight, that he had strained himself so much in the university years that now nothing remained, and he couldn't go up. But I came to a different conclusion. I thought that he had no more ambition because his ambition was fulfilled. The ambition was not to become a great scientist, which was beyond his imagination, but to become a gentleman—to get out of the peasant state. And that was a very strong driving force, and he did get out! Now he was a government official with rank, which was probably second lieutenant, corresponding to the second lieutenant in the army, and a title which marked a gentleman. And an income which, from the point of view of the villagers, was completely fabulous. He still lived in the old village there on the railway. With the years, he bought near that village a house with a nice garden. And incidentally, for many years he had also the direction of the exercises—you know, I told you about the exercises.

MRS. EPSTEIN: Yes.

EPSTEIN: Well, there were three different exercises; for physicists, for chemists, and for medics—students of medicine who had also a separate physics course which was not the same as for the physicists. That gave him a pretty penny of income, probably not less than he got from his salary. So for a stretch of years he had an income of maybe 200 rubles a month, which was extremely ample. And he had the pension rights after serving a certain number of years. The full pension in Russia is equal to the salary, a month's salary. I assume he was well provided for in his old age—I think he had no dependents. Personally, he was an unimpressive little man with a gray beard. When I knew him he was already not far from the end of his service and a very good-natured and pleasant fellow. So that was the second *laborant*. There was a third one, namely [Nikolai Petrovich] Kasterin. He was neither a peasant nor a gentleman. He was of Slavic extraction. That Kasterin was a few years older than Colley, for instance, and was already when I met him an assistant professor, a privatdocent, and had a master's degree. He was unquestionably a man of great and vast abilities; he could handle a mathematical problem very well. He spent two years working at the Lorentz lab in Leiden. It was a very good place because [Hendrik Antoon] Lorentz was, next to Einstein, the greatest theoretical physicist of the end of the century. But he [Kasterin] was not a good physicist, that is, he did not understand the problems of the time; he was interested only in special little problems as they came up and could solve them because of his mathematical prowess, but he was not a man of future great distinction. Well, nobody knew that yet definitely. In person, I didn't like him either. He was a very cold and self-centered man; cold and brutal, I should say. He had no human kindness about him as most of the Russians had, though he was always very polite. When Lebedev and I wanted to talk to him and knocked at his door, he answered, "Just a minute, there," and it took him several minutes. What he did was to cover up his papers, all of the things he had been writing at, so that Lebedev couldn't see. And that was to Lebedev, who was a man infinitely resourceful and proficient in problems of his own. So that he would give Kasterin problems entirely unimaginable. His job, in addition to being the *laborant*, was the advanced classes in theoretical physics he conducted, which were thermodynamics, hydrodynamics, acoustics, and what else you had there. And here, too, came his coldness and aloofness to me.

A few years later, when I was already a graduate student, the—what do you call it, the Russian *aspirant*—he announced a course on the theory of electrons. The theory of electrons was a new subject; it was never given before in Russian, and there were no books on it. The

aspirants, the graduate students, did not have the right to listen to lectures; they had the right to work in the laboratory, use the libraries and other facilities, but they were not party to that. It was up to the instructor to permit attendance of that. So I, with another *aspirant*, went to him and asked him whether he would permit us to listen in on that course on the theory of electrons. He said to me, "Oh, now, we have spoon-fed you for three years while you were an undergraduate, and you must have learned in that time to dig the material out of the journals yourself. We do not want to be doing continually your work!" So he did not give us the permission. Fortunately, the same year there appeared a book by Abraham, so I could read that. But that shows that he had no desire to help a man—to bring him along, make it easier for him.

[Tape interrupted]

EPSTEIN: I worked [in the laboratory] twice a week, Tuesday and Thursday, from one to five; and towards the end of the year I had finished. That is, all the problems which they had, I had made. And I was now considering what to do in the next year. I decided to ask Lebedev for a special problem for my own. Lebedev, as I told you, had been quite recently appointed, but he had already a number of pupils. He was a big and very powerful man with a considerable paunch. He was a very handsome man—he must have been extremely handsome a few years earlier—with a big mustache. And the women were completely bowled over by him. And he was really an important scientist. His own upbringing was not in the university but in one of the technical institutes. From there he went to Germany to study physics under Helmholtz in Berlin and [Friedrich Wilhelm Georg] Kohlrausch in Strasbourg—and took his doctor's degree in Strasbourg with Kohlrausch and came back to Moscow, where they had the custom to treat the foreign graduates in physics as our own magistrants. He passed the master's examination and got his master's degree in due time, and eventually also his doctor's degree for the very original and important work he had been doing. Now, he had a very great foreign connection apparently, having been there a long time; and they watched his later scientific output, which was impressive. He asked me whether I had any problem of my own which I already considered working on. And I did have, and I told him about it. It turned out, however, that I was too late—it was done already. Well, he accepted me nonetheless. I mean, he was pleased that I had no problems of my own because he had so many problems of his which needed doing. I was then

settled for the next year, for the next few years even. And from that time on, my real home was the physics institute, where I spent most of the day. The old institute wasn't kept open at night; it closed at half past five. But until half past five I was there, and in the university I was only a visitor, so to speak. I went to special exercises there, but not much else. At the same time I made a discovery in the library. In the library there was a Luginin division, consisting of three rooms, very well stuffed. [Vladimir Fedorovich] Luginin was a professor of thermochemistry—actually a chemist. But when the new institute was built, his laboratory was in the physics institute because thermochemistry is much more physics than chemistry. And he was a man of sickly health—he was tubercular from an early age, and therefore he spent a lot of time in warmer climates, especially the Lake of Geneva. And he collected a wonderful library of books, consisting of the science of physics, magazines back to their beginning. He had the complete *Proceedings of the Royal Society*, beginning with 1660 or something; and he had the complete *Comptes rendus de l'Académie des sciences*; he had the *Philosophical Magazine* and everything. That was the three rooms. One was a pretty big room two stories high completely lined with bookcases, the ones which filled the lower room from bottom to top; and the upper part over the gallery was there from around the landing stack. And that was how I spent my evenings. There was an attendant—they called it administrator—that I had to call every time from another room in the library, and he would come and get the book for me. With time, when I got well acquainted and he knew me, I did it myself. In one of the other rooms there was the literature of the eighteenth century of France, what you call libertarian—a complete Voltaire, complete Rousseau, and all these other authors. He had also, as it turned out, a lot of books which were prohibited in old Russia, and they came out only after the revolution. Luginin was an extremely rich man, and the books were in magnificent bindings, all of leather with leather corners and so on—very elegantly equipped.

I had, in the same laboratory of Sokolov, then, a working place, a table with instruments in a small room adjacent to the library of which I spoke—and I was not alone there; the quarters were pretty crowded. There was another man working there and sometimes even a third. The following year Lebedev acquired an assistant, a *laborant*. His name was Romanov. He was a few years older than I, maybe three or four years older. Though he had not yet passed examinations, he was of a more advanced standing than I and was supposed to supervise me and help me when he could. But it was a very difficult problem, and we made very slow progress.

Lebedev had, besides me, other men working under him. One was a student one year ahead of me by the name of [N.A.] Kapzov, who worked in another room; and one was Lovevsky [?], who also got a problem, a little later than I, but he got one and worked. And there was a man called Albrecht, a Lett, from the Baltic. The name is German but he was a Lett who spoke German. Albrecht had his problem well worked out already and was nearing the end of it—a very energetic and clever physicist. On the other hand, there was a man also who worked under Kasterin—he was also a year older than I was—by the name of Rezhitsin [? possibly Lezhitsin or Lusitsin]. He went to Kasterin, asked him for a special problem, and Kasterin assigned one for him which was of a rather uninteresting and dull kind. Namely, it was—you know the magnetic pictures which are produced with a magnet and iron filings? The filings stand up in the direction of the field and give a form of the field lines and so on. Now a man, I think in Germany or somewhere, had made the similar thing for electric forces. I don't remember what exactly he wrote, but it had similar lines. Now Kasterin wanted to improve and extend this. So that the idea was to find materials where these lines of forces would be produced in liquid medium—and possibly very viscous liquid mediums—so they would stay there for a time. Then when you waited long enough the liquid would harden and you would have a permanent record. Well, they worked with paraffins of different kinds for a time, which they liquefied. What they finally got was soot powder; that is—carbon powder—in the copal balm. That is, copal is a very viscous medium, and they thought it would dry up, but it didn't. He got pretty nice pictures of this soot powder, and then he photographed it; the photographs were the record. But the cases which he treated there were not interesting, they were the same things (poles—now electric poles) which are well known from magnetic measurements—from theory. So that I think, in my opinion, Rezhitsin was wasting his time. He was a good worker, but the problem wasn't worthwhile.

[Tape interrupted]

EPSTEIN: Now, I started work there with Lebedev; but you see, work in experimental physics is primarily manual work. For this you have to do things with your hands or apparatus, and there isn't much room for thinking about how to do it, which doesn't amount to much in your scientific development.

The point where I started to understand how physics is organized and what physical

research is was given by two events. The one was that there was started by Lebedev a colloquium—here it was called a research conference. It was a reporting on new events in physics and literature and so on. And the other was a series of lectures given by Lebedev. This colloquium was in that same library room which I described. The big table was pushed away into the corner, and the people sat on chairs; and it was essentially the Sokolov department of the university. Always the official head of the colloquium was Sokolov, though he did little to direct it, fortunately—Lebedev was the spiritual head of it. There were all the people working in the laboratory present, and a few more who had arrived before and now had other jobs, whom I didn't know. Of course the speakers were only the graduate workers, that is, professors and higher, instructors and so on, but also some *aspirants*. The undergraduates were only permitted to listen and didn't say anything. I remember from the early times two or three men who gave reports—interesting members of the colloquium. One was Zornov [? possibly Sarnov]. Zornov was actually working under Lebedev, but he was in some distant corner in the laboratory, and I hadn't come across him before. Zornov was an able man, and his work was on acoustics. He was the son of the professor of anatomy. You know, Lebedev was well known internationally, because he was the first man who had measured the pressure of light—the electromagnetic theory where Maxwell predicted light pressure and calculated the amount—but nobody had checked it if it were true or not, and Lebedev was the first to measure light pressure. Now then, having found such light is a wave motion of something or other, known now as electromagnetic, he wanted to see if other forms of wave motion also are connected with pressure. Kapzov, a student one year older than I, measured the pressure of surface waves in water. You know, if you throw a stone in the pond there are circles going out of this. The phenomenon has pressure, and Zornov was measuring whether acoustical waves gave pressure. Zornov was far advanced in his work already, and I think he had already found the pressure. Now reversing this, by several checks, he devised a very simple gadget with which one could measure the intensity of the source of sound by the pressure which it produces, and that was a [very] interesting by-product and made the most effect because it measured the pressure of the intensity of sound of famous singers—Chaliapin and Sobinov, and so on. But anyway, he spoke in the early colloquium not on his own work, but on work in literature connected with acoustics. Then there was [Torichan Pavlovich] Kravets—Kravets had been the worker in that same laboratory under Lebedev a year or two earlier. And now he was in engineering school—it was a railway institute. The Institute

of Communications [Moscow Higher Technical School] in Moscow was such an institution of university standing where the professor was [A. A.] Eichenwald. Eichenwald was a friend of Lebedev's, and he was professor of physics at that school, and Kravets was his *laborant*. Kravets was an extremely interesting man—he was the only man of Jewish extraction, though I think he was already baptized the second generation. [He was] not from Moscow and was a very handsome fellow and a wonderful speaker. His reports were always classical—wonderfully arranged and designed. Eichenwald was also of Jewish extraction, incidentally. His father was a photographer, and his mother was a famous singer, and now a voice teacher in her old age. He had a large number of sisters—I don't know whether there were six or eight—who were all either singers or in some way connected with the opera.

But what was interesting is that through this report I came to know of the existence of the main scientific magazines—they were mostly from foreign magazines, the reports—and of the physical problems of the time. The Luginin library was always there; but of course, to make use of the library I had to know what to look for—what magazines and what articles—and this gave me then the first clue to what problems to look for. That was one thing; and the other was a course which Lebedev gave about the problems of modern physics. There he started in elementary—that there came out so many papers a year in various languages about physics, and most of them written by university professors or assistant professors and so on; and [that] there is the *Vorsicht der Physik*—once a year it comes out—which gives an index and catalogues a list of all papers with short descriptions of their content. That's an invaluable thing. It still continues to appear, and without it physics simply couldn't continue to exist. And then he started to go through the important topics in physics and what was done in recent news about it, one after another. That was, of course, immensely instructive because it was exactly what I needed to know. So that was, you may say, the beginning of my scientific development in physics, which I continued with intensively, extensively, and substantially in the Luginin library.

I continued, of course, to attend some of the features in the university—I was in the sophomore year—especially the exercises, because it was required. But my main occupation was in the physics laboratory where I could be found every day from morning till about five o'clock in the afternoon. In the evening, I usually worked in the Luginin library. The research work that I did myself progressed, but not at a very fast rate because I hadn't very much manual skill—and I still haven't [laughter]. My direct supervisor was Romanov. Then, of course,

Lebedev was always in the lab, and he came at least once a day and checked how everything was going. But the problem was a very difficult one, and perhaps it was too difficult for me. But I did deal with that and did all that could be done; and the continuation required some other arrangement—equipment which was not available yet anywhere. But just at this time a new and very large institute of physics was nearing completion and Lebedev had a special department in it. I transferred to the new institute, where in the beginning we had no furniture. We helped make the simplest things with our own hands. The Lebedev department was of two parts. One was in the basement—a very ample one of many rooms and the workshop for the students without a mechanic, just the lathes and instruments and so on, where the students could work themselves and did work a lot. And I was in the long room next to it, which I shared with two other men. One was Kapzov whom I mentioned earlier; and the other, I don't know who it was in the beginning, but later it was a man called Esmarch, of whom I will speak at length later on. There I helped to develop some sort of instrument for measuring the currents which are required. The main trouble in Moscow was the fluctuations of the ground. The immense number of heavy trucks, driving over the cobbled streets with iron tires—the rubber tires hadn't yet come up—always made the ground shudder a little and, therefore, some of the instruments with suspension did not stay put; they trembled. The problem was to arrange it so that it was quiet—and that was done by the so-called Julius suspension. [Willem Henri] Julius was a Dutch physicist who invented that. It was a little table on which the instrument stood with the sensitive instruments suspended from the ceiling by three wires. The ceiling, of course, trembled but the wires absorbed this trembling and the table was quiet. That was the idea of Julius suspension.

[Tape interrupted]

EPSTEIN: I think that in the second semester of the sophomore year I was away from Moscow for a long spell—for about two months—because my sister was marrying. I'm pretty sure it was this year, not next, and I had great responsibilities with the wedding arrangement, so I stayed in Minsk and wrote menus for the dinners there and supervised the decoration of the hall. And it was a very big affair. You see, my grandfather being the most prominent man in the city, everything was on a very big scale. There were, as usual in Russia, actually two parties. There is the evening-before party and then the wedding party itself, with the wedding ceremony and the

big dinner after. In fact, both dinners were for the same people, and there were three hundred guests, which is a good deal. And there came a lot of relatives—the younger brother of my grandfather, Benjamin Lurie, who lived in Vilna and who was manager of his branch of the business in Vilna; and all the people in Minsk, and of course, Fanny came. Fanny was a cousin of my mother's who lived in Libau [pre-revolutionary German name for Liepaja, Latvia (formerly Lithuania)] with her husband. And I had the satisfaction that everybody said that the decorations were very good—in good taste and fine. And my other duties were discharged in a conscientious and satisfactory way.

In the meantime, I had some difficulties in Moscow. There is supposed to be a roll call once in a while, but there actually never was. But I missed several of the exercises, and it wasn't feasible then to do as I usually did, that is perform at the blackboard and have it over in short order. I had to write out a book with all the problems and answers—but when I came back to Moscow the term had practically finished, and I couldn't submit that book. So I went to the house of Novievski [? unclear who is meant], and he hemmed and hawed a little, but finally he said he'd look at them, and if they are good then he will accept them. In the examination itself, he suddenly said to me, "But you have not submitted the book, a book of problems." So then I reminded him I brought it to his house, and he said, "Yes, yes, I remember," and that was all the inconvenience I had.

Now, what I did in the summer I don't really remember. I probably went abroad with my grandfather or someone. I didn't go independently yet, I started the next year only to travel alone. But there were great things happening in Russia. Namely, the Russo-Japanese War broke out. There was no mobilization in European Russia—except the most eastern military district was mobilized—so that you couldn't notice anything—but you noticed it on the railway. Even without mobilization, certain categories were subject to draft, namely the reservists. These were in the first place all the former volunteers. I told you that you could serve in the army as a volunteer, or did I tell it to Sari [Epstein's daughter]?

MRS. EPSTEIN: No, you didn't tell me lately; you told me long ago.

EPSTEIN: I had the good sense to not enter as a volunteer. But all the volunteers were sent to the reserve. And reservists are subject to draft, whether there is a mobilization or not, when there is

war in their district. So all these reservist officers were drafted, and also all physicians. Every physician that graduated in Russia was, at his graduation—which is also the medical board examination—made a medical officer of the reserve. So that the physicians were also subject to draft. And when you traveled from Minsk to Moscow, for instance, you came across these endless lines of officers and of physicians and nurses also. I don't know if nurses were in the volunteers or drafted, but there were lots of them—and especially at Smolensk—Smolensk was a halfway point between Minsk and Moscow, and the station at Smolensk was quite heavy with all these reservists. These reservists were never put into the front lines. The officers mostly replaced regular officers in hospitals all over Russia, behind the lines. The regular officers were then drafted in the army and served in the front lines or not, as the case happened. But these were then in the hospitals behind the lines, especially pretty close to the front lines. I was speaking about physicians or officers?

MRS. EPSTEIN: Well, you spoke about the physicians, I believe, because you said they were sent to the hospitals.

EPSTEIN: Well, that doesn't matter. In the hospitals, they have also non-physicians. They have military staffs there. Anyway, the reservist officers had on the whole a pretty easy life during the war. That is, some were as far back in Siberia as Tomsk, for instance, and spent the whole war there. And the physicians, of course, were close to the front, but not in the danger zone. The interesting [thing] is the point of view of the Russians to the war. The war was immensely unpopular. You see, nobody understood why we had to go into Manchuria and take on the Japanese. It was an idiocy. Of course, the Jews were anti-Russian and pro-Japanese to a man. They were, of course, against the government always in principle; but the Russians themselves were also pro-Japanese mostly. Only the out-and-out reactionaries—the professional military and so on—were Russian patriots. So that in my surroundings, which were at that time practically Russian only—I saw not many Jews in Moscow—the Russians spoke in the same critical tone about the war as the Jews did and made pro-Japanese jokes. The war ended finally without much result, much glory, and by the Peace of Portsmouth.

MRS. EPSTEIN: How long was the war?

EPSTEIN: Well, between two and three years. And after the war, everybody was liberalized; it was a shake up of the whole society. As I told you, that was all during the second and third year. In the second year, I had the same success as in the first. That is, I passed straight A examinations. I had A's in all subjects and also in the final examinations—I had this single B grade as you call it; we call it a 4. I don't remember anything very significant during the third year except that I came in contact with two additional professors.

Skirosky, professor of astronomy, was, by his extraction, Polish. Though he spoke grammatically beautiful Russian, his pronunciation was not Russian; his pronunciation was strange to the Russians. He taught an introduction to astronomy—how and on what the astronomical observations depend; the lengths of the time between night and day, dawn and so on. But it was not astronomy about stars or planets; it was not theoretical astronomy, which were the two things that I was interested in—most people are. So it was a loss to me, these lectures. I didn't attend them, it is true; but I attended his exercises. He was a very well informed, learned astronomer, so to speak. He knew a lot, even if he did not tell it in his course.

Now, about Leist, the meteorologist. Leist was neither Russian nor Pole, but German, though he apparently was a Russian German. That is, he spent his childhood in Russia but studied in Leipzig, got the Leipzig university degree, and then came back to Russia and went through the usual paces—that is, master's examination, doctor's examinations, and what not. He was, in his way, a rather remarkable man. That is, he would take a problem that nobody else had. For instance, he investigated that magnetic anomaly of which I spoke last time—[went] from point to point with very sensitive magnotometers and sensitive gravimeters. And the general idea was that there must be iron somewhere, though the iron has been found only very much later. Another Russian idea was that these effects on the measuring instruments came from onions and garlic. That is a belief which the Russians of Vea [?] have—the lower river area—that if you rub the instrument with onion or garlic, you ruin it; it won't show your route. That's, of course, nonsense. But some serious people asserted at one time or another that the great plantations of onions and garlic in the first government caused this thing. Anyway, there was an enormous speculation as soon as he found there zero, and the land around was bought up by speculators, and that made him a famous man. Incidentally, after the war—the World War, not the Japanese—Leist emigrated and went to live in Germany; and there he died, taking his

manuscripts with him with all the results of his extensive measurements. The Russian government, the Lenin government, requested the Germans give them these manuscripts—if necessary, for a compensation—and they demanded thirty million rubles, which is an outrageous price.

MRS. EPSTEIN: That is, the Germans did; the Germans demanded.

EPSTEIN: The Germans, yes. And the Russians, of course, refused and repeated the measurements—[Petr Petrovich] Lazarev repeated them, made them over again.

He had a meteorological observatory also, which is a rare thing—was a rare thing even outside of Russia. And that came through the offices of his assistant professor, Rachmanov [?], who worked under him. Rachmanov was a Tatar, a Mohammedan, so it was a strange combination—one professor German-Protestant, and the other Mohammedan. And he was a very rich man who owned large brick plants—produced bricks—and he built that institute. In those times, of course, everything was very much cheaper than now. I think the figure which was quoted was that he spent thirty million rubles—and it was a very vast, roomy and sufficient institute, later donated to a university.

[Tape interrupted]

EPSTEIN: You must know that in my high school days, I was a very diligent student of German culture. I read all the important authors beginning with *Sturm und Drang*, which is Schiller, Goethe, then the Romantics, and the later authors of the present time. I was really steeped in German civilization. So that when I had the opportunity of traveling on my own I thought the first thing I'll do is visit the classical places of Germany. I went, as one always must, to Berlin first. That was the first time I traveled in civilian clothes, not in uniform. There I called on some friends. Then, my first stop on my study journey was Weimar, because Weimar was the city where Goethe and Schiller lived, for some time at least, and later there were also Liszt and Wagner there. Wagner I wasn't particularly interested in—I hadn't felt much about Wagner—but Liszt I knew. So it was quite an interesting experience.

Weimar was a small town, pleasantly situated, and the house of Goethe was one of the

grandest. The location of choice is always the market place. On certain days of the week the peasants bring their wares to the central plaza. It was considered a choice location, and that continues to the present time. They have not this American blight—that is, that the good places decay and become slums. They remain the good places.

Goethe had a big house, and the furnishings were very interesting. There were no photographs, no reproductions and so on, in those times. What they did was to draw the shadow [i.e., silhouette]. That is, in the light of a candle on a white sheet, they drew the contours of the face, putting it into a suitable position, profile usually, which is most characteristic, and that was then filled in black. Such shadow pictures hang in profusion in these houses. I do not remember any real paintings that he had; I don't think he was particularly interested in art as such. These shadows were, just as we use photographs, for memories. Also, such shadows of his hand were there. Goethe was a rich man; his salary was tiny, negligible, but he had very large income from his royalties—from his writings. So that he lived in what was considered princely fashion. And I don't know whether you know, but he never really had in his young and middle years any commitment with women. There were a lot of such love affairs which don't amount to anything—but no lasting attachment. And only when he was on the verge of his old age, he married his housekeeper, a woman without an education. He had before that from her an illegitimate son, who was legitimatized. And later, the son married and there were grandchildren. And there were, in the house, signs of all of them. This Goethe house was to me a very interesting experience. Schiller's house is not. If he had one of his own, it is not shown then by Weimar. I saw Schiller houses later in other places—Leipzig, for instance, where he lived a few years—but not in Weimar. But I went to the Liszt house, and there was nothing memorable as I remember, but a very beautiful old tree before the house with a bench around it on which you could sit. Liszt was at that time also in an illegitimate relationship with a woman of the aristocracy, a Countess von Wittgenstein, whom he didn't want to marry—she pestered him to marry her. She was a widow, and he took orders—became ordained—just not to marry.

The region where Weimar is situated is called Thuringia, and there are what people call mountains, which are insignificant elevations—and the other famous mountains in Germany are the Harz Mountains. Harz is a corruption of a Slavic word which means "a mountain." And I went to the Harz from Thuringia, which has also some literary associations, and climbed the main mountain, which is called Brocken. Brocken is often mentioned in the German literature;

in Goethe [in *Faust*] the scene is in the Harz on the slopes of Brocken. Brocken, I think, is about a thousand meters high—that is three thousand feet—which is quite a respectable height.

And now, having done this, I went to Munich where I had a second cousin, George Halpern. Well, he ought to have been there, but he wasn't. He had studied economics under [Ludwig Josef] Brentano, a famous liberal economist in Germany, and became his assistant, either then or later. Well, he wasn't there, but I met a number of his friends, his fellow students and intimates. He was a very devoted Zionist, and being of a very active nature, he played a considerable role in the Zionistic movement: was a member of the central executive council of Zionists. We had a quite interesting time in Munich. It was a little hectic because I had so many things to see and to attend to—all the museums and so on. I made the acquaintance of Hayman [?], who was the closest friend of Cousin Halpern—Hayman was also an economics graduate under Brentano, and a great Zionist—and several others.

They were a rather enterprising crowd. For instance, one day we were sitting in the cafe in the evening—it was nearly ten—and somebody had the idea, why not go into the mountains and climb the Schachen, a mountain in the Bavarian Alps. So everybody cried, "Yes, why not?"

You have to go to Garmisch-Partenkirchen first to start on the Schachen. As it turned out, there was no train; the nearest we could come was to Murnau. So we piled into the train that went to Murnau, from where we had still twenty kilometers to walk to Garmisch. Then we could begin to climb the Schachen. Well, we got to Murnau without any trouble, and by the time we reached Garmisch station, we were pretty worn out. It was already morning when we finally were ready to go from Garmisch to the Schachen. We didn't get very far before one of the company, a man called Katz, was bitten by a fly which he thought might be poisonous—though there are no poisonous flies. Anyway, we were only actually one hour on the way to Schachen. It takes from Partenkirchen six hours to climb to the summit. So we climbed less than one hour. Actually, everybody was glad that Katz ran off in dismay down to the doctor, and we had an excuse to give up the whole expedition.

After some time in Munich, I went to Switzerland by way of the Bodensee [Lake of Constance]; Lindau is the port. I arrived in Lindau at four in the morning and climbed a mountain from which I could see the whole chain. It was not a big mountain; I don't remember what it is called, but I could see the whole of the Alps before me. It was a beautiful sunrise with the Alps revealed. Then we went down to Lindau and crossed on the boat to Switzerland. And

what did I want in Switzerland? In Switzerland was also my cousin, Alexander Eliasberg, who had graduated from the mathematics school in Moscow where I was. He was three or four years ahead of me, and now was, I think, in Vienna with a job, but essentially at loose ends. He was very interested in a girl whom he eventually married. She lived in Basel. I met him in Zurich, I believe, and suddenly he declared that he had to go travel to Basel to buy a watch because his watch had given out. Well, it looked very strange to me, and in reality he had an appointment with that girl. And so he went to Basel to see her—I didn't go to Basel—and came back to Zurich where we started together on a tour of Switzerland. There was at that time the institution in Switzerland of general *avoir de monde*. You paid so many francs in the beginning and could use all the trains except the mountain trains. You had a pass at your convenience. Switzerland has, of course, a very unreliable climate; you never know whether it will rain or not. So that, in the morning, I went to the place where they have the weather report and looked in what part of Switzerland is good weather so that you can see something; and I took the train to that place. I took the train to Geneva where the weather was lovely. And I traveled in a very strange get-up. I had a long alpenstock. That is, they have there rods of two kinds. They have either such walking sticks with crooked edges as I have here, or the long shepherds' sticks which are taller than I was. I had such a rod always indicating that I was a traveler and a tourist. And as I got out of the train in Geneva, the first person I ran into was the brother of Sasha [Eliasberg], namely, Osha.

He was one or two years younger than Sasha and two years older than myself, and [he was] a chemistry student in the University of Vienna. He was in the station seeing off some people and was amazed to see me, and showed me a telegram from Sasha that he was arriving the next day. When Sasha came, we decided to make a tour of Switzerland. They were all places of which I had no idea before, names which were new to me. We went down the Geneva Lake on the boat, and from there we went up the Rhone Valley. Up the Rhone Valley walking—very beautiful surroundings—we went to Zermatt. Zermatt is a wonderful showplace. That is, it is quite high. There is one more than three thousand meters high, which is ten thousand feet, and which is in a kettle, so to speak, surrounded by the tallest Alps. Monte Rosa is a neighbor there, and a glacier coming down from Monte Rosa is flowing right before you, and then there is the Matterhorn. Zermatt is German-speaking, but the Rhone Valley, through which you pass on the way, is French Switzerland. We came into the French region and out again. Now, Zermatt is

really a wonderful place, one of the greatest sights that you can imagine. You go up to it from Brig.

I did not spend the night in Brig but went on foot the night before and saw on the way the sunrise. Zermatt is not the highest mountain, not 10,000 feet, but it is not very far from the top. Well, it was a rather exhausting trip, but I made it. Then we together went from Zermatt to the top of the mountain and back again. We also went a little beyond Brig to the rise of the Rhone River where it comes out from a glacier cave. It is an interesting sight. We made our way back to Lucerne, which lies on the Lake of Lucerne, and there, I remember, just at dawn I received a telegram which called me away so that, almost without saying goodbye to the brothers, I packed up—my whole baggage consisted of a rucksack—and disappeared.

That was not the end of the story yet. I went then from Switzerland through Tyrol to Gmunden, which is in Austria on the lake [Traunsee], and there again I ran into Sasha Eliasberg who had come there with his sister for the summer. His sister lived in Vienna with some friends.

I went to Vienna and called on the husband of Clara Eliasberg, the sister of Sasha, who showed me around Vienna. In Vienna, I bought myself a lot of things, among them is that traveling bag. And finally home again to Russia. The whole thing took me three months and cost me ridiculously little from our present point of view, namely 300 rubles—that is about $150.

That was one vacation. The other was after the junior year. Then I went straight to Munich intending to work on my thesis. George Halpern still lived in Munich. This time he was there. He had a girl, very beautiful—she was English-Irish, but with completely black hair, a dark girl. His father, Joseph, was very firmly opposed to his marrying a gentile and didn't give him permission to marry. So the whole affair was clandestine; they just lived in sin, so to speak. He had an apartment on the Hohenzollern Strasse with this girl. He was now assistant to Brentano, which was a position of some respect, because Brentano was a very big man, and to be connected with him was an honor. He had also obtained his doctor's degree. Halpern was still an ardent Zionist, and the people around him were also Zionists. Being such an active and interesting man, of course, he had very interesting visitors. There were two men I had met on my previous trip—Lessov, who was also a Zionist and a doctor of medicine; and the other was a gentile by the name of Waltz, a very nice man who was just standing that summer when I was there. He passed his doctor's examination under Brentano and received his doctor's degree, and he then set up as a lawyer. As I later discovered, he was a rather ineffectual man as a lawyer, a

very poor lawyer, but a pleasant fellow.

Chaim Weizmann was a good friend of his from old times because he came from near Pinsk. His father knew Joseph Rikhter, and he had known him for ages; and then he, Weizmann, had worked in chemistry under the same professor as had the brother of Eliasberg. Weizmann came on occasional visits; he lived in Geneva, I think, but on some business or other he turned up in Munich once in a while. That is where I met Weizmann for the first time. That he was such a big man nobody knew, but he was a devoted Zionist.

The vacation ended and I had most of the material for the thesis. I had my fourth year to go, and I went back to Russia again.

[Tape interrupted]

Well, you see, then, what kind of fellow this George Halpern was. He had always very interesting people around him, and his wife was also a very nice girl. She had been a governess in the house of [Adolf von] Hildebrand; Hildebrand was a most famous sculptor at the time.

There came a visit of his sister Mina [Emily]. Mina is considerably older than George, who was the youngest of the children of Joseph. Mina was married to Carl Buber, the father of Martin Buber. Carl Buber gave us a very fine dinner and served the best wine I found in Munich. I'll tell you a very short outline of his career. He was a businessman in Galicia—in Stanislav, I think. His business was to buy up the corn from the peasants and resell it in Vienna. And once, when he traveled overland, he saw a strange yellow stone lying on the road. He stopped the driver, got out and collected that stone, and saw that it was broken off from some stony outcrop on the road. He took the stone and had it analyzed when he came to Vienna. It turned out that it was phosphate—a stuff very valuable in fertilizing. So, not telling anything to anybody, Carl Buber had a geologist come and bought up the whole region containing phosphate. That was the source of his great wealth; before that he was a rich man, but now he was very rich. Stanislav is near the Russian border, and that phosphate-bearing region extended into Russia; but he, being an Austrian, could not handle the Russian side of it. Martin Buber, his son, studied at that time in Vienna, writing his doctorate thesis in the history of art. I did not meet Martin Buber at that time; I only met his father. At the end of the summer, we decided—the Halperns, George and Emily and I—to make a trip to Italy, and we did.

We got to Venice; it was my first trip to Venice, and I was extremely impressed by it. Unfortunately, I slept without the screen and netting over the bed, so that I was simply eaten up by mosquitoes. After a few days in Venice and seeing all the more important sites, we went to the Lido—that is a long island at the end of the lagoon which closes the Venice lagoon and is covered with bathing accommodations and parks. So they stayed on in Lido; but myself, I had to go back, so I took the train from Venice to Munich and Berlin. Then I met my sister, and we went together into Russia.

It was, on the whole, a very satisfactory summer for me. Unfortunately, it was not so satisfactory in Russia, because it was just after the end of the war and there was a great surge of liberal feeling; and all were prepared for a revolution, for a small one.

I came back and I still lived with my aunt [Tanya] and her husband Marc. But Marc had not done well in his business and was clearing out. So they decided there is no point for them to stay on in Moscow, and soon after I returned they gave up their apartment. And from then on, I had to live on my own, which, on the whole, I liked, because I came to hate Tanya like poison. Marc was better, but pretty dull.

So I got a good room and set up for myself. The room was pretty close to the university, but on another street—Nikitskaya it was called—which goes north from the university. It was an immense room, and there were the necessary amenities there. That is, there was an electric light and central heating—though it was not of the warm weather type, but of the hot weather, which dries out the air much more—the warm weather is more pleasant. But that was, of course, a minor point. I had my meals in the house; my landlady also provided the board. The custom is that you get with your room three samovars a day. One is brought in the morning for breakfast when you wake up, and then another in the afternoon for tea, and one in the evening. And I could cook eggs in the samovar, if I had breakfast with eggs, and white bread with butter—so a good breakfast. The meals were not bad, and I had only to provide the evening meal—you know, the supper, which was a cold meal. I usually had some fish, kippered or smoked, with bread and butter and tea again. The room was expensive for Moscow—30 rubles a month—but on the whole, I did not spend much more than I spent living with my aunt. The bed was not very good—lumpy—but I complained, and they straightened out the springs, and the bed became quite tolerable.

[Tape interrupted]

EPSTEIN: We came to the point where Tanya moved away from Moscow and I had a room of my own. And now, what did I do for society? Well, there was, of course, a society from the university, from the students, but it was mainly a male society and needed women, too. There were two women whose house was always open to me, and I visited them often. They were both daughters-in-law of Gurian—you remember who Gurian is. The wife of the elder son, Isaac, was called Baldina, and was a very fine woman, really. She was also a relation of the Luries in some way; she was a third cousin or something of Tanya and myself and had been a close friend of Tanya's. But she was very much superior to Tanya in many ways. Tanya was a show-off; she liked to appear very advanced and very interested in many things. This Baldina really was advanced. I had visited there very often, and she had in her house—not in her house, but coming to her house very often—two girl friends, Russians they were, with whom I also started such friendships. So we had at one time a kind of club there, where we reported on papers and trips, things we were interested in, but mostly it was just visiting for dinner, for evening parties, and so on. And the other was the wife of the younger son of Gurian, the youngest, who was Clara Lurie by birth—a girl with whom I grew up practically. She was a year older than I, and I knew her since I was five or six years old.

She had staying with her a younger unmarried sister, Frieda Lurie. She was encouraging my visits, which were fairly frequent without any encouragement, because she wanted to start a romance between me and Frieda with a view of my marrying Frieda. But nothing came of it; I wasn't in the mind for carrying on such close friendships. But she was also a very advanced woman; she was a socialist already at that time, and a pretty devoted socialist. Frieda finally married a second cousin of ours, an Eliasberg, and lived in Berlin. Her son and daughter are in this country now.

Well, these Russian girls whom I met through Baldina were also interesting girls and I visited in their houses; and that was my opening to Russian society actually. I learned the ways and habits of the Russians from them. Of course, I had my work all the time in the laboratory, and the time was pretty well filled with all of this. Not far from me, a few houses away, lived another physics specialist who had been a year ahead of me. His name was Korsakov—a very nice fellow. His father was a roentgenologist [i.e., radiologist]. We visited back and forth—he

to me and I to him. He worked for some time under Lebedev, but nothing came of it actually, though he was a fairly able man.

[Tape interrupted]

EPSTEIN: My landlady turned out to be quite inefficient. She didn't take the pay from the guests in advance and couldn't maintain herself. She had to give up her apartment and move away. So at very short notice, I had to find new quarters, and I did find them, though it wasn't easy. It was in a house that was not far from the university, a few houses away—this was practically in the university. You see, the university filled solidly several blocks, and only one corner of the first block north of the main front was free of the university, and there was a private house, and in this private house the room which I rented was located. So that when I say, "in the university," it's not an exaggeration; it was, really! The house belonged—or, at least was rented by—a man called Uttika. Uttika is a Swiss name, which I learned later; it is a common name in Zurich. And he had a very strange business, namely aquariums and terrariums—you know, these glass cases for fish. And then, of course, fish for the aquariums, and lizards and other such animals for the terrariums. So a part of the building was a sort of factory. They had about thirty workmen, making those glass cases. Uttika was an old man and pretty feeble. The managing genius behind it all was his wife, who was still a little younger and full of vigor—also Swiss, of course; they were all Swiss. But they spoke excellent Russian—spoke also, which is rare there, good German and good French.

My room had the usual conveniences, that is, electric light, heat, and such things. There was a bathroom there in the old room, but I had not the use of it. It was used by the landlady, the family; and I had to go to the public bath, which the Russians did anyway. Of course, this daily bathing was not yet invented, and if I had one bath a week, it was pretty much. Usually, I only had one in two weeks. Now, in this house, there were no modern features. There wasn't even running water. The water was brought in barrels by a traveling man and stood there somewhere, in the barrel. Of course, it wasn't drunken raw. It was drunk either as tea or as kvass. Kvass is a light beer which the Russians make, which is quite tasty, made of dried bread and leftovers of flour and so on. And they made good kvass, these Uttikas, which we drank at meals. I think I had, not only the day's dinner, but also an evening meal there; though I am not sure about the

evening meal. Anyway, it had no central heating—that goes without saying—but a good hearth with the necessary service to heat it. So that it cost only 20 rubles—the other cost 30—so that altogether, I made out quite well there. Especially, as to go to the laboratory, I had only to cross the street, that was all. So that my physical well-being was more or less assured by that arrangement.

The Uttikas lived in Russia for many years. But they were, in the house, still Swiss. They always spoke about the time when they will have saved up enough money to retire and settle in Zurich, on the hills there—have a little house in Zurich. They had a son, who was married and didn't live in the house, and a daughter, who was also married but lived with her parents all the same. The daughter was working in some German firm as a secretary and stenographer. So they were, on the whole, pretty nice people.

When the terrarium or aquarium was finished by the factory, it came to the art department, and the art department was that old man Uttika himself, who made, out of concrete and other things, a medieval castle, which stood in the aquarium. Of course, concrete is not hurt by water; it's improved by water they say; so that he exercised his ingenuity in that kind of art and was quite clever with it.

The son also came once in a while for a visit. He was also a Swiss patriot, and talked about returning to the hills of Zurich. Finally, the time came when Uttika did retire and saved up enough money to go, and disappeared, presumably to Zurich. But a year later, I suddenly met him again in the streets of Moscow. "Oh," he said, "I couldn't get accustomed to it." See, he was so accustomed to Moscow and so bored with the small conditions of Zurich, that when he really retired and lived there, it was too dull for him and his wife, and they came back to Russia. It happens often so—that people talk their whole life about going some place and look forward to it; and when they come there, they are disappointed.

In the meantime, the small revolution [of 1905] had broken out, and Moscow was in an uproar. For a period there was absolute strike; that is, everybody was on strike. There was no streetcar running. Even water was restricted because the workers had stopped in that department. But that was only a few days. This was under the administration of the soviets. That was the first time that the name of soviet came up; it was the soviet of industrial workers in Moscow. They took over the authority and administered the city for a few days for themselves.

Finally, the central government in Petersburg found it necessary to show their hand. The

local troops, the local regiments were not considered as very reliable; they might have revolted themselves if put to suppressing the regime. So they sent out a guard regiment, the Semënovsky *polk* [i.e., regiment], founded by Peter the Great; that was the Second Guard Regiment. And its Colonel was Mintt. And they suppressed the revolution, suppressed it with great cruelty. A large number of men were arrested and dealt summary justice. Many were just shot on the spot by Mintt and his men. The Moscow regime was suppressed—the ordinary administration reintroduced.

Of course, the students had also revolted along with the others, even a little before them, and the university was closed tight. Not too tight maybe, because most of the days I could get into the physics institute. The university yard was not locked all the time. And if it was locked, you could, by a small bribe, always get through just the same. There was a famous case when a number of students locked themselves in our building in the physics institute, the new one, and resisted the government.

Of course they had the sympathy of all the population around. Especially Clara Gurian was big in sympathy, and all the strangest people tried to help there. One was a singer named Reisky [?]. He was a well-known singer, not in the regular opera but in the Italian Opera, which played there at the time. You must know that in Russia, all the operas are given in Russian. But, if the performers are of other nations, then they sing in their language, and the chorus sings in Russian. And this man was particularly accomplished, because when he sang to the principals, to one of the actors, he sang in French, and when he sang to the chorus, he sang in Russian. How he got hold of Clara I don't know, but there he was and wanted to know what he could do to help. Now, she had collected a large number of comestibles, vittles—that is, sausage, hams, loaves of bread, and so on—with which to feed those students in the building, and the question was to get it to them. And this singer was quite willing; he carried the loads, and I had to show him the way. You see, the university yard was separated by the police so that nobody could get in. Except the house opposite to one of the gates of that yard had a double entrance—one entrance from Third Street, which was not occupied by the police, and the other opposite to the university. So, the way was to go through that house on Third Street, then cross the street at the university and get into the yard. That is the way we went. They had to drink, too, the students, so they carried a lot of bottles of soda water and finally delivered it to the students. But, of course, that was all only temporary—the students before very long capitulated and gave

themselves up and were treated comparatively leniently. Of course, the university and its surroundings were a particularly critical area. There were lots of police and troops there. You remember, for instance, I told you that opposite to the university, between the university and the Kremlin, was a long building which was called the Manage [Russian: manezh] because it was built for riders, for horse riding. It is still there.

MRS. EPSTEIN: Where they hold the art exhibits?

EPSTEIN: Yes. Art exhibits, because it is a very, very large hall there. There were soldiers there who shot without warning if you approached at the wrong time, and so on. So it was a dangerous neighborhood to be in. Well, but I lived there so I had to. And there was an absolute curfew; after eight, I think, you couldn't go into the street, but I did go nevertheless. I remember one evening I was at Baldina Gurian's for dinner, and the two Russian girls were there. I originally intended to stay there for the night at Gurian's, but something happened, I don't remember what. So I decided I'd go home, in spite of the curfew. And I did. I might have been shot, and at one moment a policeman called me; he told me only to go on and not loiter. If he had shot me, he wouldn't have anything to answer for; it was quite okay.

And now, you remember, it was the fourth year, the last year of the course; and it was already the springtime. So that we couldn't think of examinations and graduations in the regular time because the whole year was practically lost. And the situation went on indefinitely through the next summer. Of course, it didn't affect me, because I did what I was always doing—I worked in the physics institute. I hadn't attended the courses for years anyway, so that there were no lectures was nothing to me. And only in the middle of the winter of the next, of the fifth year, it was finally announced that the conditions were sufficiently quiet that they would have the graduation examinations at the usual time in this year, the fifth. We did, and that year I graduated.

The graduation took place in the usual way. There is a special chairman of the committee sent out. It is considered not a university examination, but a governing board examination because it gives rights—in our case the right to teach in high school. And they sent out a man called Schiller [?], who was a former professor and knew the examiners, who were the regular professors of our school, and talked to them on even terms.

There were fifty-four men; that is, a few more than in the last year when they had had fifty students. The original three hundred had been reduced to that, but some people came from former years, from out of town, from other universities, so that the number increased to fifty-four, and they all passed. None was flunked—although in my opinion, some people deserved to be flunked. I had the usual straight A, though, for instance, in astronomy I just talked at random and I didn't know whether it was right or not. I mean, I made up the theory myself as I went along because I didn't know it. But Skirosky approved and gave me an A. I looked it up later in the textbook, by the way, and I don't think the theory was right. Most of the subjects I knew, of course, to my fingertips and had no difficulty at all. There graduated with me the younger Mlodziowski, Nekrasov, Luzui [?], Bushgens, and Goriachev—all outstanding students. Well, there were about seven or eight *aspirants* retained out of the fifty-four graduate students. Goriachev was not, and I don't know to this day what his end was, whether he had some disagreement with somebody or didn't want to remain, but he went home. He was from oil country, from the city that is now called Molotov—because Molotov was from there, too.

After the graduation, I immediately went home to Minsk. Then, after a few weeks, I went to Switzerland to a mountain region on the northern shore of Lake Geneva. I stayed there until the end of the vacation, and went back again to the university, where by that time all was in normal shape. I brought back my thesis, which I had written. I hadn't left it in the spring. The thesis I wrote for Umov, I don't know why not for Lebedev, but Umov was the one I had the lectures from, the basic, the fundamental, and probably that was a rule there. Anyway, then I gave this thesis. I had had it bound up nicely; it was a pretty thin book. Umov just opened it and glanced through the chapters and said, "I think for such a big thesis I can give an A." And that was how he examined it, if it was big enough. But it was all right with me.

Now, because I had to enter this thesis in the end of the summer, not in the beginning, there was some delay in my getting the university diploma. I had the diploma theoretically, but I didn't have it physically in hand. So, when I got back, I started again in the same old room in the laboratory, and the first thing I heard was about the colloquium. The colloquium of which I spoke was going on every week, ever since my second year. But now, when the new university opened, it was official—run under Lebedev—and we met every Tuesday in the sophomore room, and it was an extremely interesting colloquium. It was conducted after the fashion which [August Adolph] Kundt, the great German physicist, had introduced in Strasbourg, and Lebedev

had attended as a student. So Lebedev took it on. There were here [at Caltech] in the colloquium, research concerns, and so on. There is always one speaker who gives a complete subject and speaks one or three hours. And it is always very difficult to get that speaker, because it is quite a labor to prepare such a big report. But here [in Moscow] in the colloquium, in our time there were three speakers regularly, and each spoke about half an hour, and there was ample time for discussion. He didn't give the complete subject, since they were the same group that met from week to week. We could give just one new paper that came out, and that was no burden for anybody, because the people were supposed to remember what led up to it—the preceding papers. So that made it easy for the men who conducted, and speakers were always easily available. It was also much more interesting for the listeners, because this big report contained a lot of trite stuff that everybody knows. It's just to round out the subject. So this colloquium was a weekly feature—so interesting that I looked forward to it the whole week. Besides, it was the case that at the head was Lebedev, whom we all adored, and with whom we identified.

PAUL S. EPSTEIN

PART II: GRADUATE STUDY

EPSTEIN: It is the first year of graduate study—*aspirant* as they call it. And I came back into the same laboratory and continued my research work that I was doing all along. And there are two events that took place and which I have to describe: both are pretty long deviations. But I have to take them one after the other. I'll start first from my teaching activities. When I turned up, Lebedev told me that they needed a *laborant*, that is, a student teacher for the physical laboratory in the Institute of Agronomy in Moscow. And that he mentioned to the professor, [Vladimir Aleksandrovich] Michelson, my name—he recommended me. So that I had better go over and settle things with Michelson. And so I did, on the next day or soon after. Now, Michelson, the head of that institute, was a very interesting man, a very remarkable man—a good physicist, a really good physicist. In his early life he had not been very healthy. He was affected with tuberculosis. When he got his degree, in Moscow I guess, Michelson got up all the money he could afford and went to cure himself [in Switzerland]. It's 1,600 meters, almost 5,000 feet high, and they have plenty of sunshine and pure air. And the treatment consisted of good and plentiful food, lots of milk and open air. They sleep in the open, the whole day lie in the open and sleep, too. And those conditions are a pretty big strain, because it is very cold there. But they have worked it out, have special clothes and blankets that keep them warm, and in spite of the freezing temperatures they do sleep in the open. And it works; they improve, and sometimes recover completely. And so it was with Michelson—he improved very considerably and began to recover.

Most people are satisfied with that; they just live a vegetative existence. They eat their food and drink their milk and sleep in the open. But Michelson thought that he was a physicist, and he started to figure what he could do as research work to produce a thesis for his doctor's degree in physics. There was the sun, of course, so he decided to measure the solar constant; that is, the amount of heat radiated by the sun by unit time—that is, usually calculated in one minute. That requires pretty delicate thermal, physical, and chemical measurements. He had to construct a special calorimeter, which he did in a pretty ingenious manner, and he determined the solar constant. He got data for it. Of course, it was pretty long and arduous work—but then he had

nothing else to do. And when his recovery came, he also had his thesis ready for the doctor's degree, which shows his resourcefulness and energy—initiative. The doctor's thesis has to be publicly defended and approved by two men, official opponents. Anybody can come and put in his oar, too, and talk about it. Well, he defended it successfully, was then pronounced doctor of physics, and the doctor of physics has the right in Russia to apply for a vacant university position, full professorship. As there was this Institute of Agronomy professorship vacant, he applied for that and was appointed professor in that school.

The Institute of Agronomy was a nice little institute. It was situated in a village called Petrovsky-Razumovsky because it was the estate of Prince Razumovsky, a favorite of Catherine II. The physics building was still the old main building in which Prince Razumovsky had lived himself, with the old eighteenth-century window panes, which were of glass, not quite white. They didn't know how to make very good transparent glass, so it was a little colored. And moreover, the window panes—they were very large windows with many small panes—were rounded, they were not straight but buckled out. So a quite interesting building. Michelson got a small house not very far away, where he continued the regime. That is, there was always the danger that this tuberculosis would break out again, so he continued the regime in the house. He hadn't married; he lived with his mother and an unmarried sister, who took good care of him. And he slept in the open, with the same equipment—the fur clothes and covers and so on. Now, the institute was not large; it had three hundred students at that time. They intended to become peasants' advisors; that is, agronomists—specialists in agriculture—which were needed very badly in Russia.

To be a student was only accessible to non-Jews. Not a single one was a Jew, because it was excluded, but there existed no such rule for the faculty. I was a Jew, and there were other Jews on the faculty. Michelson just looked at me and said, "All right, we'll start next week," and that was all. I had to work two afternoons a week there; that was from one to five, Tuesdays and Thursdays. There were not two groups as in the university, but just one group of students on these Tuesdays and Thursdays. And there were more of them. There were about thirty or forty—I don't know exactly; I don't remember how many there were who could work simultaneously on the problem. I don't know also whether these were freshmen, these students, or sophomores, but they were young students. I was myself only twenty-three years old at the time, and looked younger than many of my students. When I approached to help them, they

usually asked, “Oh, did you work that problem, too?” They took me for another student.

The pay was 60 rubles a month, which is not a princely income, but you must remember it was part-time, only eight hours a week. And what is more, I had only to be present these eight hours. So for such a restricted work, you could say the pay wasn’t bad.

There was also a full-time *laborant*—assistant—of Michelson. He had to be there morning and afternoon every weekday, and Saturday in the morning. I suppose he received something like 150 rubles a month. So there are two points of view; you can say that actually he had exactly the same teaching hours as I had—that is, eight hours a week—but he had to spend his time there. And the rest of the time he had some administrative duties—pretty small. He had to see, for instance, that the storage battery was treated right and in order; he had to run the air liquefying plant. But considering that there was also a very good mechanic there and a laboratory servant, he wasn’t overworked. Of course, the students came in at all hours of the day to ask him to explain something they didn’t understand in physics, and so on. And you can fritter away a lot of time on such things. But most of the time he had left for his research. His research didn’t amount to anything in my opinion; it wasn’t worth a nickel for the whole thing. But that is beside the point because he regarded it as very interesting and important. He was not a strong mind, this fellow, and not a good physicist at all. Of course, in the teaching hours on Tuesday and Thursday from one to five, Michelson himself was always present. So, we were three there, teaching those forty students. And it was enough. We could get along. I hadn’t the slightest difficulty in starting my teaching and didn’t spend a single minute on preparation. I just started in, and that was all. Of course, many of the problems I knew; they were the same which we had had at the university. There were some new ones, but it was a small matter to get the hang of them. So I think that this assistant had very much of his time left—was not at all burdened with work. On the other hand, Michelson himself was heavily burdened, because in addition to this teaching of the practicum students, he had also the lecture course to give and the experiment to prepare, in which he had the help of his mechanic. And besides the examinations, that was really a very heavy burden on him. That is, to examine all of the freshman and sophomore students who took physics. I explained to you how it was done in the university; but here he was alone, and the students took advantage of him. Instead of coming just once in the year and having themselves examined in the year’s course of physics, they came and asked for an examination in every chapter of physics separately. What it amounted to was Michelson’s

work was magnified four or five times—he had five examinations for every student.

Now, apart from that, the institute was a pretty nice one; that is, there were some very good men on the faculty. I had only one old, pretty good friend, that was the chemist. He was actually a physical chemist mostly—though the specialty didn't exist—but he was interested in physical chemistry and worked in it. His name was Kablakov [?]. He had a small house in Petrovsky-Razumovsky and that's where I met him and continued to see him. Then there was a very good crystallographer—he was either a Jew or of Jewish extraction—and several good men on the humanities side.

The students all lived in a common house—you may call it a dormitory—though each of them had a separate room. And they were pretty comfortable rooms, some with electricity, central heating and all that. The central heating was, however, radiators, which made the air dry, or so the Russians who had it claimed. They always complained that the dry air didn't agree with them. There was no physical education in the Russian schools of university standing. They tried to introduce playing football, but the students hadn't the faintest idea how to play—how many on the sides and so on. It didn't work out in my time, maybe later.

The surroundings of Petrovsky-Razumovsky were full of lakes, lakes with a lot of mosquitoes on them; it was a breeding place of malaria. Eventually, the mosquitoes and the malaria were gotten rid of, but that was much later than my time.

As I say, it was a few miles away, namely about three miles or so. And to get there I had to walk to a place not far from where I lived, and there I first took the electric streetcar, which was incidentally the first and only electric streetcar in Moscow. It didn't belong to the city system, which was still on horse traction, but was owned by a Belgian company. The electric streetcar took us to the starting point of a small steamline—that is, on the private track, not the standard track, and that then went the rest of the way and ended on the campus of the Institute of Agronomy. The journey took altogether about an hour. So [in a week] I had really to spend six hours on it. So much about this teaching activity at Petrovsky-Razumovsky.

[Tape interrupted]

EPSTEIN: Now, changes [had taken] place in the laboratory at the university. Well, I came back to the same table at the same place. I worked in the same room, but the other occupants of the

room were different ones. Kapzov had married and was living in Heidelberg, I understand. So he vacated the corner there, and instead of him was a younger student, Iakovlev [?], of the more recent crop. And there was also a third student named Esmarch; he had worked until then under Umov, I think. He was a few years older than I, maybe three years or so, and was a very good man. I think that perhaps on the theoretical side he was the best in the whole laboratory. He had pretty good mathematical abilities and also a physical understanding of things. Lebedev now occupied a large part of the basement and three very large rooms on the third floor. And some changes had taken place. You must remember that there was a war in between, and that, for instance, Kravets was an ensign of the reserve and was drafted but spent the whole war pretty far from the front lines at Tomsk, which is the capital of Siberia. But, of course, he could not work physics there, and now he was back. Now, they never promote these ensigns of the reserve; they always stay ensigns. So he was back as an ensign of the reserve, but not on active service anymore. Then another man that came back was [A. K.] Timiryazev; he came back not from the war but from two years abroad. Timiryazev was a class ahead of me, together with Kapzov and Korsakov; however I had known little of him. He didn't lose a year because he finished the university when it was still open. His father [Kliment Arkadievich Timiryazev] was a retired professor of plant zoology, a very famous man in Russia. He was seventy years old or so, and went on his own affairs to Heidelberg, and the son with him. In Heidelberg, Timiryazev listened to [Georg Hermann] Quincke [?] and had the theoretical physics courses, and then the second year they spent in Dresden. Dresden had an institute of technology where the only advanced theoretical work on electrotechnics was done in Europe. [Timiryazev] took a course in electrotechnics and then came back as a specialist in electricity, which Lebedev figured might be a good thing. He occupied a room on the other side, opposite to Kravets. These were valuable additions to the group, and especially to the colloquium, where they both talked a good deal in the discussions. Mlodziowski was still there. All the investigations of Lebedev were very difficult and took much time to accomplish, to finish. Mlodziowski investigated the velocity of sound when it gets down to very short wavelengths, so that the structure of the distances between the molecules might become important already. He did not expect, but thought it possible, that this sound may have a different velocity of propagation there. Well, he was a good worker, Mlodziowski, and worked steadily at his problem, but it was far from finished; it was to take a couple of years till he was ready. Then, there was also a new addition; that was Lazarev

Petrovich, originally a medical student. He was in charge of the acoustical institute of the surgical medical faculty which they have there. It was not in the university complex, as we were, but in a different part of town. On his own initiative, he acquired a pretty good knowledge of physics, and then he decided to take the graduation examination in mathematics and physics. He already had passed as physician, by the way. Now, he was also a physicist, approved by the medical board; and he was a very able and good man—though not as good as he thought he was, and made out to be. Then there was also Rezhitsin. Rezhitsin, you remember, was a student of Kasterin and was doing some work which didn't amount to much, but not through the fault of Rezhitsin. Now, he took an assignment from Lebedev about very short electromagnetic waves, you know. The deflections and so on.

Now, there were on the south side, two large rooms next to the student workshop. The occupant of one was Korsakov, who lived near me. Later they were populated by others. That was the set-up, but what really affected me was Romanov, who was the main manager of the whole outfit in the absence of Lebedev. He supervised, in particular, my work, though Lebedev made it a point to visit everybody as often as he could, usually every day. So Romanov told me we have here new rules in the colloquium. The program is not directed now by one man, namely Lebedev, but by a committee of the members, and members are all graduate students. The undergraduates are not members, cannot talk, they can only listen. The members have not only the right but the duty to talk. They can talk any time in the discussion, and they must make at least one report per semester. And so this committee has already met and has made up the program. They have, for the whole semester, assigned every colloquium to a definite student: three students, three talks. If one didn't finish it, it didn't matter because it was very informal—it could be pushed to next time. And it was on a Monday that I came and he talked to me. I think not even that; it was already Tuesday when he said to me, "Your turn is today, so you must have a report ready." The colloquium was from seven to nine, after dinner—in Moscow, seven is a little early, and you have to hurry your dinner, but you can manage it. And at nine, usually a part of the colloquium went together to drink beer in one of the restaurants which served as an outlet to the Kamovrik Brewery; and both the brewery and the restaurants were managed by Ehrenberg, the father of Ilya [Ilya Gregoryevich Ehrenberg, Soviet writer]. So, by seven o'clock, I had to have a report ready. "Well," I thought, "what shall I do?" And it struck me that there was a paper which I had studied very carefully, which was one of the most important

papers of the whole year. On the way back from Switzerland to Moscow, I stopped several days in Berlin, and there looked up the new literature in the Royal Prussian Library and came across that paper. And it interested me very greatly. In fact, it had to do much with my thesis, with what I was writing. It interested me so much that I spent practically a whole day with this paper and learned it practically by heart, so that the paper was still well in my memory. In fact, I worked the usual hours until twelve, when I had my lunch—sandwiches which I had brought from home—and with these sandwiches I went to our library in the institute and got out the same number of *Die Physik*. The paper was by [Walter] Kaufmann, a very promising younger experimental physicist. And I went briefly through it and saw that I still knew it practically by heart, so that there was no difficulty in presenting it. All I did in that hour was to figure the best Russian expressions. That is, how to tell it concisely and tersely in Russian. It was in German, of course. So I had my report. I borrowed that issue and took it home. In general, it was not permitted to take out magazine numbers, especially recent ones. But in the case when you have a colloquium report, an exception is made. So I took this home when I came home at half past five, and in the evening I presented it. It was my first year as a member and my first report. I was in civilian clothes—an elegant suit I had had made somewhere abroad—and I started on that paper. And I made a great hit with it. I spoke longer than usual; it took about fifty minutes to talk, while the usual length is twenty minutes. The colloquium was very well attended, it being the first of the year. Lebedev was there, of course, presiding. Sokolov even appeared and sat in the front row. And all the members—Kravets, Esmarch, Timiryazev, Mlodziowski, and so on. That report had a great influence on my general standing in the laboratory because they saw for the first time that I was really a physicist, that I understood things and could talk coherently about them. And from then on, Lebedev told me that I was an unusually mature physicist for my age—and that he repeated hundreds of times later—so that it enhanced my standing in the laboratory considerably. And Kravets said that he was sorry that I gave it because he was preparing to give it himself on another occasion when his turn came, but that it was a good report.

[Tape interrupted]

EPSTEIN: I have talked, I'm afraid, about a lot of details. I enumerated the last time the members

of the colloquium. Now I want to add something which characterizes them, namely, about their occupation. They had to make a living either full or part-time, and they did it in the following ways.

Let's start with Iakovlev. Iakovlev was an undergraduate, not a member actually. He was characterized by uncommonly clever hands. He could make the most complicated things in the laboratory without trouble. Screw in screws that other people didn't even see, they were so small—he had a watchmaker's outfit for that. In that respect, he was a rather depressing neighbor for me, because I haven't any manual skill, and it was such a great contrast between him and me. On the other hand, his head was only average, was not too good—wasn't bad either. Well, he remained in the laboratory and was also a great politician. He knew how to get around Sokolov, and so on.

The other in my room, as I mentioned already, was Esmarch, a very able man. And he worked, as most of the laboratory did, on a problem that had grown out of other writings in the laboratory, so it naturally arose there. The problem was not difficult, and he was making good progress with it. He was from a pretty well-to-do German family apparently. I don't know what his father was, but he had a cultured upbringing—a well-educated man. But he needed the money apparently, and he worked part-time in a high school—that is, almost full-time in the high school. The Russian high schools are, in that sense, somewhat flexible; they permit different grades of part-time work. And I think he made his whole household expenses by this work. But he was every day in the laboratory and working away like a beaver.

Now then, there was Romanov. Romanov was, of course, a full-time assistant under Lebedev in the laboratory, so that he received pay and that was his occupation. And next to him was Lazarev Petrovich, the doctor of medicine who taught physics. Lazarev was an extremely clever man. And in my opinion, he was a bit of a humbugger, partially a fraud; he never admitted that he didn't know something. For instance, Kravets was working in the next room to Lazarev on the other side, and he obtained a very strange result. He was working on optical properties of solutions—a problem which he had started himself. And he told it to Lazarev, that strange result; and if Lazarev would have been completely on the up and up, he would have said, "Wonderful! I didn't ever hear of such a thing." But he said, "Here I was waiting for someone to get that result, because I had it so many years ago and I didn't believe my eyes. You have come up with a very nice confirmation." But he somehow impressed Lebedev. Lebedev did not see the

phoniness of Lazarev; and I think he had a part-time assistantship in the laboratory himself, receiving pay from Lebedev. I am not sure about that. But he also had some private means. Though a quiet young man, he was married to a wife who owned a house and had some money; so he was not in straits in any case.

Kravets, as I told you, came back from the war and became full-time *laborant* and main assistant of Eichenwald in the so-called engineering institute—that is, the Institute of Communication. And he was a pretty hard-working man. Apart from that work, and the work in our laboratory, he also did translations from other languages into Russian, and he received pay for that. Kravets was a very likable and interesting chap. He was a great talker, and of all men of the laboratory, I had the closest friendship with him. Lazarev was a phony, but became a big man just the same because of his cleverness.

I don't remember who there was on the other side of Kravets, so we go to the north side. There was Mlodziowski in the first place. Mlodziowski had graduated the same time as me and now was a part-time teacher in a high school—not as many hours as Esmarch but enough. His father had some money, so he lived at home and had also other assistance from home. At setting up experiments and so on for lecturing, he was very good. And later on, he even became an authority on that. Now then, Rezhitzin, the assistant. I confess, I don't know exactly what he did on the side; I had no very close relation with him. And as with most men in the laboratory, he worked on problems that had come up from Lebedev's previous work. He worked also with very short waves, but with electromagnetic waves this time, not, as Mlodziowski did, acoustic waves. That was a famous paper of Lebedev's that came before his light pressure paper—that is, extending the range of the electromagnetic waves to the short side. You must remember that this was the middle of the [18]90s, not long after the discoveries of Maxwell and Hertz. Also it was [not] understood what light actually is—electromagnetic oscillation. And so there were separate regions. There were the long electromagnetic waves several meters long, as discovered by Hertz; and then there were the very short, invisible, infrared waves of the optic. And of course everybody tried to show that they were one and the same, and bridge the gap. Lebedev made important strides in that direction; he succeeded in making electromagnetic waves of only a few millimeters, of maybe four or five millimeters long, while those of Hertz were many, many meters. And so he was interested in the short waves generally, and out of that grew the work of Mlodziowski with acoustical short waves, and Rezhitzin with radio shortwaves, a couple of

centimeter waves, which he tried to show had the same properties of refraction as the longer.

Then, after Rezhitzin came Timiryazev. Timiryazev, as I told you, had come back from abroad, and he was the only one that didn't have an outside occupation. He lived somewhere with his father and mother, and was a full-time worker in the laboratory. Also he was at that time preparing for his master's examinations, which are a big grueling business in Russia. He was an outstanding photographer himself—an amateur photographer, but so good that he got prizes in exhibitions of photography. And so, when photographic questions came up, Timiryazev was the authority there. And after Timiryazev, that student whose name I had forgotten yesterday, his name was [Vladimir Konstantinovich] Arkadiev—a very simple name, but the simplest always slip away. He was a very able man, though he was not yet a member—an undergraduate at that time. But he soon became a full member and had both physical insight and some mathematical ability; and he became an important man of science eventually.

Of course, there was myself; but I had my salary from the Institute of Agronomy—which was a staff appointment, incidentally. I presented myself every twentieth of the month at the treasurer's, and he paid me sixty rubles in cash. Checks were not then used in Russia, not by private persons. But that was for the appearance of things because money was no object with me; I had enough from home. As a matter of fact, each month I spent far more than this sixty rubles.

That covers the members as far as the institute [of physics] is concerned. But there were also a few members who did not belong to the institute, who were just interested in physics—and stimulating, interesting men themselves. And they were invited to become members of the colloquium and attended quite regularly. Among them was Eichenwald who, unfortunately, was very busy and could come only rarely. Eichenwald was professor at this so-called engineering institute, and had to work up a department which was completely in decay—so much so, that you may say that he had to start from scratch, from the beginning. Incidentally, he worked on very modern things which were connected to the theory of relativity—part of the foundations of the difficulty which led to the introduction of Einstein to the theory of relativity. So then, that was outside the sphere in which we worked, and he was interesting on that score.

Then, there was a man called Tsitov [?]. Tsitov was a privatdocent of physical chemistry in the university, and a remarkable fellow. In addition to being privatdocent and a scientist, he was also a vice-president of a commercial company—his family business. The Tsitovs were a

very rich family. And not enough with that, he was also interested in politics. You must remember, that was the time after the war when Russia was recovering and liberalized, and the Duma was already working. Now, he was a member of the so-called Labor Party. They were not socialist, but close to socialist. There were practically none of them in Moscow. They were strong in Petersburg, and when he went to Petersburg on either political business or on his own, he was received with great welcome because he was the only one from Moscow. He was then in the thick of things; they told him all the political plans and intentions in secret. So that it was known by us that if you wanted to be well informed about political matters, keep on the right side of Tsitov.

Then there was a young man called Shertsov [?] who was also a privatdocent somewhere or other, in one of the schools of university standing—it was not the Institute of Agronomy, but another one. A very well-intentioned and pleasant young man.

Then there was the main assistant to Luginin, the thermochemist with the laboratory right in the physics institute. And Luginin was a sickly man who didn't do much work personally. This man was practically head of the laboratory. They did a good deal of teaching in physical chemistry. And the institute was distinguished by the amount of platinum which their apparatus contained. Wherever possible, the instruments were made of platinum—which cost, of course, a fortune. But Luginin had the money.

[Tape interrupted]

EPSTEIN: Lebedev rejuvenated the physics lecture class. The lectures were devised by Stoletov twenty-five years earlier; they were wonderful experiments, but they got antiquated. Many of them had no point at all now in modern physics, and it was high time to modernize the course; and that was what Lebedev was doing. Now, of course, there was a difficulty. If you got good equipment for the teaching lectureships, everybody, all the scientific teachers, wanted to borrow it—in name, to borrow, actually to appropriate it—so that they came to the following organization of the whole institute. There were three departments of the full professors—Umov, Sokolov, and Lebedev—and a fourth department, the lecturing department, in which each had his own collection of instruments and his lecterns and so on. The watchdog over the lecture department was Ivanovich, that old assistant of Stoletov, who helped Lebedev in building it up

and modernizing it. Of course, if it was a very useful and expensive piece of equipment, such as the opticals for instance, it was sometimes lent out to workers, but under such conditions that it could not get harmed or disappear.

The lecturing also needed reorganization. There were three classes given. There was the freshman course for physicists and naturalists—they were together. Then the sophomore class was the same, and so the medical course. And as the fees which the professors received were proportional to the number of students, there were great inequalities in this. So they made a rotation. Each professor took turns; one year he lectured to the freshmen, and the next year to the sophomores, and the third year to the medical students. The medical students, I think, had a one-year course only, not two years. So, in this way, all the inequalities were ironed out. That essentially finishes the business of organization of the laboratory and colloquium.

I wanted to say something about my private matters. Coming back, I lived a few days in an apartment hotel, to look around and find a place to live. And the first thing I noticed was that the Uttikas' house, where I lived previously, had disappeared. The university had bought that corner. No building is pulled down in Russia because the walls are too substantial for that; they are simply remodeled. That is, if the windows aren't right, and the doors, they just make new windows and close the old ones. Because of the rigors of the climate, the outer walls are several feet thick, and it wouldn't do to pull it down. They just made this house a continuation of the university, and you could not see where it had been even; it was just one building there. After some looking around at rooms which were not satisfactory, I finally rented two rooms from a pair of girl dentists. They were old; they were around thirty. I considered this very old because I was only twenty-three. And they had their office, their waiting room/receiving room, and a room for their own quarters. And the other half, the big two rooms which looked out to the yard, they rented, and that is where I established myself. It was a very convenient and pleasant location. The location was, incidentally, in the building owned by the main Russian bathhouses. Chaliapin lived in the same house. Over our apartment was an apartment of Chaliapin's close friend, Melnikov—Chaliapin himself was on the other side. It was a very large house and some apartments went to another street. It was handy for taking baths, but that was not the main advantage. It was also a location close to the center, with the elegant shopping street not far away. I had there full board, that is, breakfast, dinner, and supper—all was supplied to me by those two girls.

I had known them slightly before, and they had many friends which I knew from before, too. One of their close friends was Adiumov [?], who soon became a member of the Duma. There were among my acquaintances in Moscow a lot of physicians that did not follow their vocation—who changed it and did something else and took a second degree. So Adiumov had been a medic and became a doctor of medicine actually, and worked for a time in a doctor's office. But he also took a law degree and became an attorney. He put his name up for election in his native city of Rostov and was elected there to the Duma. He was quite a close friend and dropped in pretty often to dinner or after dinner. And to hear from him about the workings of the Duma was quite interesting. Then there was the brother of one of the girls—the name was Panakov [?]—who also was a doctor who didn't work in medicine but became instead a merchant. And so on, many men who came to dinner, or after dinner. It was then not only a room and board but also entertainment, company. So that this part of my life was settled. Of course, I continued the other acquaintances, too, which I had, but not on such an intensive scale as before.

I spent, of course, more than the sixty rubles a month, but that was no object. The bedroom which I had was comfortable, and I slept in it every night. But my study room I used little because I was out the whole day, and used it only in the evening after dinner. Even with my many acquaintances, I stayed most of the evenings at home and read and studied. But in daytime, I hardly ever was at home because of my occupations in the university. The dinner was, as Moscow custom is, at six o'clock in the evening; and at noon, I could have a light lunch at home, but I preferred to take my lunch with me and eat it in the laboratory, because then I didn't have to go back and forth.

Now then, the year progressed not very eventfully and there was a general rise of prosperity, and business was good. And everything would have been very fine in the political sense if not for the revolutionaries who were preparing for further action. It was a time when Lenin was in Krakow and directed the expropriation campaigns. Stalin was one of his henchmen. They alienated the public very strongly, because they took money from the rich and poor alike and did not discriminate. Now, I will tell you a personal experience which I had, and that is with my pay in the agriculture institute. As I told you, it was paid out every twentieth, in cash. And it was handled so that on the day before, the treasurer with an old servitor, a laboratory servant so to speak, went in the buggy to the treasury in Moscow—it was about three

miles—and they made the ride by horse traction. They had to pass a small woods on the way, and bring back a box containing the amount due for the next day in order to have the money on hand when the time came. And on that occasion, they were returning from the treasury, these two old men with the horse and buggy, and as they came into the little forest, into the woods, they were stopped. It was the revolutionaries, the expropriators. They made short shrift; they took away the box with the money and took away the buggy, and turned out the men and rode away in the buggy. The old men had to trudge home the rest of the way on foot and arrived with the money expropriated. It was the money due for salaries, belonging to the professors and instructors and whatnot, many of whom were needy men, very dependent on that salary. If the salary wasn't paid on time, they wouldn't have anything to eat. When I came the next day, I heard the tale. Of course, the treasurer had no money, and the salary was not paid to me on that day. And in fact, it took an unconscionable time until it was paid. It was paid years later. That was the activity of Stalin and his companions there.

MRS. EPSTEIN: What year was that?

EPSTEIN: That was, I think, still the first year after my graduation; it was spring, 1907.

MRS. EPSTEIN: And Lenin and Stalin were active in this early revolution?

EPSTEIN: It wasn't the revolution, it was the preparation for the revolution.

MRS. EPSTEIN: Well, I mean, I didn't know they had anything to do before 1917.

EPSTEIN: Oh, that was quite separate. No, you see Lenin was an expatriate, and he lived in Krakow to be near the Russian border. But he had to maintain his organization; he needed money for making things happen.

MRS. EPSTEIN: So he grabbed the money where he could get it.

EPSTEIN: It didn't exactly endear him. Of course, the public didn't know who he was. They

only thought of the expropriators, and they were extremely unpopular. In other respects, everything was hunky-dory. Only my sister was ailing. She lived in Berlin at that time, and I received notice that she had had the scarlet fever in a very heavy form—a grown-up person is endangered by such things—and the scarlet fever was passed now, but it had left her with bad kidneys. I decided that as soon as I can in the spring, I go to Berlin and visit her, and see to things in general. You see, this I can place definitely because I was only this one year at the agriculture institute.

In the meantime, there were things developing in the physics department. The activity of Lebedev started to pay off, to bear fruit. That is, his pupils became independent and obtained different positions in other places in Moscow. Already a couple of years earlier Kasterin, who was not a pupil but of the same department, had defended his doctor's thesis. For the doctor's thesis there were two official opponents whose names are printed on the title page of the thesis when he presents it. And those official opponents in this case were Zhukovsky and [Dimitry Fedorovich] Egorov. Zhukovsky was the specialist in applied mechanics, and Egorov was the pure mathematician, the successor of Bugaev. He was a good mathematician, thoroughly trained in Göttingen. He came back and really brought the teaching of mathematics up to modern standards and created a school of mathematics. Well, that was because the thesis of Kasterin bore a pretty mathematical character. It was a problem of diffraction which he had still carried out from his stay in Leiden—brought it from his stay with Lorentz—and it was a rather difficult problem. The theory of diffraction in this period in optics is a little vague on what the process actually is, and therefore he wanted to carry it through in a case that is perfectly clearly defined. And that was a rather formidable task. The opponents had the duty to belittle the paper, to scorn it, so to speak, and the defendant, or the master, must defend it. So they looked for all sorts of mistakes, and usually hit on many mistakes. Zhukovsky didn't say much. He said, "It is a rather complicated and involved mathematics that is needed here. I personally do not like such involved problems with six-fold summations and so on, but when it can bear fruit, that is the justification." And Egorov, also at the end, after having picked on all the misprints and so on, said that he enjoyed the paper, and it was a good continuation. Anyway, he had passed his defense and had become a doctor of physics. Now, as I told you, the doctor of physics can apply for any vacancy for a full professorship when it occurs, and Kasterin was only too ready to do it. And in a year's time, there occurred a vacancy in Odessa. And he applied and was appointed full

professor in the University of Odessa. He left Moscow for Odessa, taking with him a few of the men. Of the better ones, I noticed he only took Atberg [?], the man who worked under Lebedev in that north room.

Kasterin was the first one to go; then the next was Colley. You remember that, after speaking of the laboratory, Colley dropped out of the whole discussion, and I didn't mention him at all for the rest of the time. That was because he got a leave of absence abroad. He was commandeered to go abroad, you see, with his expenses paid—not lavish expenses. But since he had some money of his own, he got along comfortably. He stayed in Göttingen and Berlin, continuing the work he was doing in Moscow. This work was on short oscillations in liquids, in troughs filled with water, alcohol and so on. Rebanov [?] worked in the same lab. The Moscow school continued with that work. [Gennady] Potapenko, I think, was one of them who worked and brought this work here [to Caltech]. Well, so that Colley was away and sent back, in the course of the two years that he was away, four papers on four investigations which he had carried out there in Berlin or Göttingen—he worked mostly in the analysis—and was a great physicist in Germany. Well, these four papers then, when put together, made a pretty bulky and impressive doctor's thesis. It is true, he had not passed any master's examination, and no master's thesis or defense. But he was a man of very delicate health. I don't know whether I mentioned it, but he was a bleeder, a hemophiliac. Every effort or mental strain aggravated his condition, and he deserved special consideration, and through Lebedev's influence an exception was made for him. He was directly admitted to the doctorate; that is, his thesis was accepted without any preliminary master's degree or master's examination, and also without the formal defense. He just got the doctor's degree without any such formalities. He came back a short while before his thesis was turned in, and he was just the old colleague. He had the milk and peaches complexion like a high school girl as always—a man of small stature but with a terrific voice; the voice was very sonorous and just filled the lecture hall. He could apply for a professorship, too, and in a short time he did. In Warsaw there was a professorship vacant; he applied for it and he got it. Now, Warsaw was not considered a very desirable place for Russians, because the Poles hated the Russians. They were a foreign element planted there, and the Poles were, in general, inimical to these Russian professors in the university. But you can't have everything, so he went, and he was full professor.

There was also an associate professorship vacant for physics, and Esmarch got that. He

finished his investigation. It was, in contradistinction to other investigations, a comparatively simple one, which did not require very great skill. But he showed much understanding and initiative in writing it up. So that he got for it, with the examinations he had passed before, a master's degree and possibly even a doctor's degree. I don't remember what he was, but for an associate professorship, sometimes a master's degree is considered sufficient. Anyway, he was the second physics professor in Warsaw. So that was quite nice for them to be together again—two Moscow men.

I must say that after studying Esmarch's paper by which he got the degree, I found that his analysis was not too good. It wasn't complete, could be easily carried beyond and made much better. So that as a mathematician, he had his limitations. But on the other hand, he had a very clear physical insight. He wrote, before long, a really very remarkable paper on diffraction dispersion in optics—a paper which is read and recommended even today. It appeared in *Annalen der Physik*, and is a paper noticed by the whole world, not only in Russian physics. They also took along at least one good student, Bogoslovsky—I didn't speak of him yet, but you can't speak about everybody. So that now both Odessa and Warsaw were dominated, so to speak, by Moscow.

The third was Zornov. I don't remember exactly the year; it may have been a year later or so. He went to Saratov—Saratov is a big town on the Volga, which had had no university. A new university was just being opened, and Zornov was the first physics professor appointed there. So that Lebedev was extending, so to speak, his empire. His school began to dominate all the physics professorships in Russia. As to me personally, I finished my investigation without much glory. That is, I really did not get the results which I hoped to get, but I got some results, and I thought it was enough. I noticed that I was not made to be an experimental physicist—my hands were not clever enough. And I started to work for the master's examinations. Now, the master's examinations are a formidable and gruesome barrier in Russia. There were, in Moscow at least, five examinations. You had to pass separate examinations in experimental physics and theoretical physics, then [in] mathematics and mechanics and geophysics and meteorology. Every one of these examinations was after a faculty meeting. The faculty had a meeting every second Wednesday, I think, if it wasn't a holiday—of which the Russians have a good many. You announce that you want to take examinations on such and such a day. And Leist, who was secretary of the faculty, puts you on the program. And as the professors go into the conference

room, they pass a pretty spacious anteroom with several tables and other facilities, and there sit the candidates for the master's examination. On the way in, they say to you the problems which you have to answer. Of course, it is all prepared in advance to some extent, because months before, you go around to every professor who is on the committee and tell him that you are going to take the master's examination and, well, what will be required. And he usually gives you a list of books to read. If you read all of them, it would take not a month, but several years. You make your choice according to your own understanding and are, more or less, prepared. Then, for the time the professors confer in their meeting, you write out your answer on a sheet of paper which you have to bring along—with pencil of course; ink is too messy. When the examination is finished, they either call you into the other room, where only those who will give examinations remain, or they stop in the anteroom again, and at a suitable table look at what you had written and put to you other questions. It is not physically possible to pass the examination in a much shorter time than a year, because there are just enough faculty meetings, taking into account the holidays and so on. There are just about five or six faculty meetings there, with several weeks between one and the next. I passed the master's examination without much ado in one year.

It is a common thing there that you are found not sufficiently prepared and have to take an examination over again on the same thing, but that didn't happen to me. Of course, I also figured—and it was true—that the earlier I take it, the better it will be for me, because then questions of prestige will not enter. When a quiet young man, as I was, who only a couple of years before sat at the feet of those professors in the lectures and is well known to them, of him they won't expect a perfect answer; or if he gives one, it will be particularly noted. So that was also a consideration. When you have finished the master's examinations, you are called a magistrant. You have still to be a master, you have to submit a master's thesis and defend it after passing the examination. Now, I was a magistrant.

But I didn't tell you about the second year. The first year I was in the agriculture institute, and the second year I was in the university in the same capacity as a *laborant*. Namely, the organization of the new, big institute got underway, and a student laboratory was organized under Sokolov, in the Sokolov department. And where he had before a very restricted number of working places, now he had 100 working places; that is, 100 students could work simultaneously. Since there were two groups for each of these two days a week, there were 200 students working at that time. Now, they did not expect that the mathematicians alone would

take all the places; so they made it accessible also to the chemists, the naturalist students, and there were six *laborants* conducting it, and I was one of them. The others were also all well known and most are already mentioned here.

[Tape interrupted]

EPSTEIN: So, I passed my master's examinations and was a magistrant. Now, the magistrants have the right to apply for an assistant professorship, and it is almost without exception granted because the university doesn't assume any responsibility for the assistant professors. If they are very good, later they can pass on to higher degrees, and so on. If they don't, they just stay assistant professor. Timiryazev had gotten his magistrant standing a little earlier than I; he started his examinations considerably earlier. And about that time, he had his first lecture. It's called the proving lecture. Actually, there are two lectures—one on a topic selected by the faculty and another on a topic selected by the lecturer himself. That was a memorable event. The lecture was not particularly good because it was too complicated a topic that he treated there. The most interested man was, of course, his father, the old Timiryazev. I was not in a great hurry to apply for my assistant professorship and applied only later.

But I should tell you a little about my private affairs. I lived in those two rooms at the dentists', and it was rather pleasant and profitable. I say profitable because they had so many interesting people coming in at times. I also had other events, of course, and there was one house which I visited for some years. In fact, very soon after my arrival in Moscow, Tanya introduced me to them. They were the Goldbergs. Mr. Goldberg was a military officer, a doctor of soldiers, so to speak. But he was not on active duty, and he simply practiced as a physician. Mrs. Goldberg was an extremely active woman, a great busybody. They came both from Kaluga, a city in the northwest. Their visitors were all sorts of people, but the Kaluga people were strongly represented. I made the acquaintance there of Phillip Blumenthal. Phillip Blumenthal was a small celebrity in Moscow. He was from Kaluga also, a physician who early became aware of the necessity of medical laboratories. This was not in the medical courses in the university; they had very little stress on microbiology and medical chemistry and so on. But medicine developed, and that became an important part of it, as it is still today. Blumenthal made a thorough study of these things—microbiology and so on—and being a very enterprising,

resourceful man, decided to do something about it. Not only did he open a medical laboratory, but he instituted a school for medical practitioners who wanted to study these things, like microbiology, and medical laboratories in general. His medical laboratory developed very well. There was one in the university, too, which opened up not long before Blumenthal's, but his was, in the public estimation, of equal importance. Every physician sent his patient, and his patient's liquids, and so on, to Blumenthal's laboratory. And his school also took off like fire. He had a very able young man in charge by the name of Karvarsky [?], and he developed a course of four months for this study. All the viruses were not yet known, but all the microbes and so on were treated in the four months. Then they went out and opened medical laboratories in the cities. And that was not the end yet. This Phillip Blumenthal was also a great supplier of all the materials needed for these laboratories. He made serum and vaccines and all these sorts of things. So that it was a very large and interesting business. But he was a nice and modest man and interested in science. He had a brother younger than himself who was still a student when I came, though a senior student—Jacob Blumenthal. Incidentally, they were, for some reason that I never found out, Swiss citizens. Jacob remained a Swiss citizen, but Phillip, by means of much pull and bribes, got Russian citizenship.

The Goldbergs had three children—two sons and a daughter. The sons were a little older than I; the younger was just one year older and was a sophomore when I was a freshman. We were not in the same school; he was in chemistry and turned out to be an able man and made a name for himself in chemistry. He became interested in scientific photography. He eventually became the director of a camera factory in Dresden. And later, I think, he was in this country also. The older Goldberg was an engineer. He graduated from his engineering school about the time I came, and later he went for practice to Germany. The daughter was the youngest; she was a little younger than I, a pretty and nice girl. Mrs. Goldberg was an excellent pianist in my regard—no artistic merit, but for home purposes quite sufficient. She played all the operas very well, if she had the score, and so on. When they had a large party, the proceedings were as follows: the guests come late, they begin to dribble in at half-past ten and usually the party is completed at eleven only. And then the maturer people will go to the card tables in the next room. The parlor where they first arrived was the Goldbergs' waiting room. When you came at half-past ten or so, you got a glass of tea with cake and candy and so on. They kept you entertained until the party really started, which was at eleven. Then the younger people, the

guests of the children, remained in the parlor and the entertainment was social games, music. Mrs. Goldberg herself performed, and there were also some professional musicians coming—both pianists and violinists. And sometimes dancers, but not too often. The time passed very pleasantly until about two o'clock. That was the general trend of the parties, not only Goldberg's, but everywhere. At two o'clock the hostess announces that a supper is served.

MRS. EPSTEIN: At two o'clock in the morning?

EPSTEIN: Two o'clock in the morning. The supper is, of course, cold, because most of the servants go to bed and do not want to cook anything in the middle of the night. So it usually consists of fish, and then dessert after. The main meal is cold fish, three fish in particular: salmon with mayonnaise, sturgeon with horseradish sauce, and a fish that is peculiar to Russia called *silyk*—I don't know what its name is in other languages. *Silyk* is a very delicate fish from the rivers near the Baltic. It is sold slightly smoked, not heavily smoked, as a kipper, and it is eaten with mustard sauce.

Everybody filed into the dining room. The Russians don't eat supper on their knees as they do here in America. They sit around the table. Even the smaller households have long dinner tables with twenty-four chairs, and you can supplement them by a few side tables. The success of the supper depends on whether there is a good talker who makes the people listen or not. For instance, the cousin of my mother, Max Eisenstadt, was one of the most brilliant talkers, and if he was present on any occasion, dinner or supper or whatnot, the party was a success. He was, of course, worth his weight in gold to all hostesses. But he did not play cards, and so at eleven o'clock, when the others started their card play, he got a bed in a bedroom in the house and slept until two o'clock, and then he was awakened to entertain at this supper. Now this was another branch of society different from that which I had at home, at the dentists'.

And now I must tell you something that I rather wouldn't tell and which was the greatest stupidity that I committed in my life. There was a girl there—I believe I met her at Goldberg's, but I may have met her somewhere else—an artist, a pianist, and a very brilliant pianist at that, by the name of Maria—called Mina. She was also from Kaluga; her parents were from Kaluga. She had been in Kaluga as a child, but now they lived in the south of Russia, in the Crimea. And she was a big girl—that is, well, with a good figure—and most people thought her very beautiful.

And perhaps she was; it was a question of convention. She went for a year to Berlin after finishing the conservatory. And she went after that and studied a year with Leopold Godowsky, which in itself is already a sign that she was a good pianist, because Godowsky didn't take any other students. She had the most brilliant technique, but that was all, as I found out later. She really had not much real musicianship in her; it was all hands and not head and feeling. Well, I was stricken with this girl for some time, and I saw a good deal of her. In due time, I visited her at her home. She lived in rented quarters. Her parents were in the south; she lived alone. And in fact, we grew so close that she took it for granted that I would propose at any moment. And so I did. That was in the third year of my graduate study, after I had already gotten my magistrant's standing. However, in that close association which comes from being engaged, I noticed that actually we hadn't really much in common—not only not very much, but nothing in common. When I made the proposal, it was just at the end of the second summer as a graduate in Moscow, and she, of course, insisted that I come down to Simferopol and visit her parents; and I went to Simferopol. Her father was a physician who had migrated to Sevastopol because the climate in the north didn't agree with him. Being in Simferopol I, of course, could not forgo a visit to the Crimea, too. So I took the train from Simferopol to Sevastopol, and from there the boat to the Crimea. The Crimea is like the riviera in Italy or France; it is just a cross strip south of the Crimean mountains.

Then we went to Yalta. Yalta had a head of government who made his own rules for who could live in Yalta and who could not. And he decided that Jews could not. Jews were not permitted, whether they were university graduates or not. Just the same, I went to Yalta, registered in the hotel, and started to take in the sights. The first day, we went to Alushta. Alushta is on the Crimean coast, next to Yalta. It was once the residence of the governor of the whole region in early times. There was his house—or rather, a little palace—and a very fine garden, a very fine park. And that garden affected me very strongly—all the tropical or subtropical trees and shrubs. They are, of course, in Pasadena also. There was an arbutus, the strawberry tree, which grows here, too. Then myrtle and laurel and whatnot, not to speak of lemons and oranges, though it was not the season for oranges—they were only leaves and no fruit on them. In fact, I liked the garden so much that I thought, "Why do people live in northern climates when it is so beautiful out here in the south? After all, my family comes from the south, from Palestine, and what business have we to live in Moscow?" The other feature of the garden

was a reproduction of the Black Sea in miniature. The Black Sea was on one side in nature and real, and there was also this little Black Sea. That had much to do with my later resolve to come to the south and eventually to Pasadena.

The first day in Alushta, when I came back, the hotel porter told me that the police had come and asked about me. Because I had no right to be there—I was a Jew—they asked me to come to the police station and talk with them. Well, I felt that I would, but, of course, the same night I didn't; I slept in the hotel room again. And next morning I also didn't because I had already reservations for a trip into the Crimean mountains, up and down. All those trips were, of course, on horse carriages or buses. I took Mina along with me, of course, on all these expeditions, and we went through the mountains. That trip was very interesting and rewarding. And in the evening, there happened again exactly the same thing; again the porter told me the police were there and asked me to come next day. Now, for the next day I had also a program, but I went first to the police. And the police kept me there, talked to me a good time, and saw that I was a university graduate. He said that I may have all the rights, "but we have special rules here." I understood from his behavior that a small bribe would fix it. If I had given him ten or fifteen rubles, then he would have desisted. But I didn't see any reason why. I was through with Yalta anyway. So I said, "All right, I'll leave today." "Now," he asked, "should my men see you to the boat?" "No," I said, "we'll go by carriage." And we did go; we hired a private driver and went to Alupka. But Alupka was closed—that is, the estate of the czar. At the gate they told me, "No visitors today." The czar wasn't there, of course, but the estate was interesting, and the palace itself.

Yalta was a big town with many hotels and many houses and so on. Gurzuf was a smaller place, still more rural than Yalta, but also a watering place for tourists, and very lovely. In fact, later, a relative of mine by marriage bought Gurzuf and developed it. But this time, I just indulged in the fine vegetation. I saw magnolias for the first time—the white ones, you know, which we have here. I went to a hotel there in Gurzuf and spent the night; and that was the end of the Crimean journey. We then took the boat back to Sevastopol and the train to Simferopol and eventually back to Moscow.

I knew by that time that I didn't really love Mina and that I had nothing in common with her and marrying her was a mistake; but I had such a false sense of obligation. I made the proposal, and I told her father certain things about my prospects and so on; so that I thought that

my duty was to go through with it, which was a great idiocy, of course. I should have broken it off then and there, because it was a great calamity. I went into that marriage, which cost me at least two years' time and could have broken me for life. We went back to Moscow, had a wedding there, and settled in a second-hand apartment—second-hand because it was rented by the renter, by the people who should have lived there but didn't—and it was fully furnished. It was a very good apartment, incidentally, and a very good cook made excellent dinners. But I started to suffer from depressions. And strange as it is to say, I didn't realize that these depressions came just from my marriage. I thought it was some organic thing. I had some trouble with my digestion already before that. I went to a good doctor, and he told me that the best thing for me is to go to Berlin—I told him that we planned to go to Berlin anyway—to Professor Boris, who was the best specialist on such stomach trouble, and to talk things over with him. He, that doctor, was a pupil of Boris. Well, anyway, I stayed on one more half-year in the laboratory and continued my teaching of the students, and then I resigned and went to Berlin and consulted Boris. Well, Boris said that I should come to his clinic and there, under controlled conditions of food and living, he could say what it was, this stomach trouble. The depressions also held on. Well, he said to stay in the clinic two or three weeks; but after one week, he decided that nothing organic was wrong with me. It was all nervous stomach trouble, which, incidentally, was not at all a pleasure to me because it's much harder to fix. After a week I left, and I do not know how I managed it, but I sent this girl Mina away to Paris, alone. And I remained to go and recuperate physically in the Alps. And I did to some extent. In the fall, I went back to Moscow, and Mina still remained in Paris. So our married life was quite short, about one winter only, and then we were separated.

The preceding year, my grandfather died, and I inherited some money, which did secure me so that I had no cares on that score of making a living. That was the end of the year 1910 [1909?]. I was at a congress of all the naturalists and physicians of Russia. The physicists were in this case counted as naturalists. To this, I gave a short paper also, but what is particularly remarkable there was that I met Ehrenfest. Ehrenfest was a Zionist, and from the west, but he married a Russian and came to live in Moscow, where he expected to be of great value to the Russians. You know Ehrenfest personally, but I must tell you who he was. He was probably the best trained theoretical physicist of the younger generation in the world. He had an upbringing in Vienna, at a very rigorous school. Then he had a couple of years in Göttingen. All the great

mathematicians and physicists were there; and there were at the same time a lot of very fine students who later became great scientists with whom he associated, and he also was a year with Lorentz in Leiden. So that talking to him was really a revelation to me. To see for the first time a man who really knew theoretical physics, and not only knew, he was the *best* authority on theoretical physics. And I immediately attached myself to Ehrenfest and became his guide in the congress for the two weeks that he was there. Incidentally, our first meeting was quite interesting because he has the same name and patronymic as myself. He is Paul also, but he is also Siegmundevich, which is not at all common in Russia; it is a pretty rare patronymic.

He gave a paper in that congress, and I got up and objected to certain things in it. And we talked to one another, Paul Siegmundevich, I to him and he to me back, and my colleagues who didn't know him very well thought to themselves how absent-minded Epstein is to call this man by his own name and patronymic [laughter].

[Tape interrupted]

EPSTEIN: Well, Ehrenfest made a great impression on me through his very vast knowledge of mathematics and mathematical physics. And I began to suspect that here is a specialty that suits me better than the experimental physics that I was working on. And I might also become a theoretical physicist. Now, he impressed me by his knowledge, but he didn't impress me very much less by his discrimination, by his insight into physical processes and so on. We were together most of the day during those two weeks of the meeting and talked without end, and sometimes we had disagreements. Whenever disagreement arose, it turned out, either sooner or later, that I had been right and he was wrong, because there was a chink in his armor. He had persuaded himself that he could not calculate—that he knew mathematics theoretically, but was a poor calculator. And once you have taken such a conviction, you are a poor calculator because you don't calculate. So that his critical abilities on which he prided himself very much, regarding himself as the most critical man in the field of younger physicists—and he was perhaps—was impaired by this inability to calculate. Because sometimes it needs a little calculation to carry through an example and see whether the theory is right or wrong. And he did not have that. I, with my very much more limited mathematical knowledge, had a natural bent for calculation. Whether it was a talent or I acquired it through those endless problems that

I worked as a young undergraduate, I don't know. But calculation came easy to me. I told Ehrenfest about the attacks of depression which I had, so that whole periods of time I couldn't work at all; and he told me, by all means, that I must become a theoretical physicist, that experimental is not the thing for me. He asked me whether I could go abroad, whether I had the necessary money, and I told him I had. And he said, "Then go to Munich and try to become a pupil of Sommerfeld. Sommerfeld is the best calculator in the world today, and he handles problems which involve very complicated calculations. So you work a couple of years under Sommerfeld, and you'll be quite a good theoretical physicist." Well, that had a great influence on me and carried conviction, and I decided to do that. My program was as follows: Mina—I had a wife yet—was still in Paris. And I wrote her to stay in Paris until the summer, when I may come.

So we had a family meeting in Minsk. All the heirs and sons of Chaim Lurie assembled in his house, in the old apartment where I grew up, and we had a very pleasant week there deciding all sorts of family questions.

From Minsk, I went straight to Berlin where my sister lived, and spent several days with her and then took the train to Munich and to Sommerfeld's. It was then the middle of the term, but as it happened, Sommerfeld had just started a new subject in his advanced lectures, namely the theory of relativity—that is, some new additions to the theory of relativity which he had worked out himself. They were presented for the first time to the wider public. I came to Sommerfeld and spoke to him about my antecedents—that I was a magistrant of Moscow University and an assistant professor there—and asked whether he would take me on to work under him as a pupil. And he said, "I will take you on approval, certainly. That is, I will give you a small problem, and if you work all right on the small problem, then you will get a thesis problem." That was satisfactory to me, and I started then to attend his lectures. He had a very big and stimulating group of young students. And the students looked at me askance at first, but they saw that I followed the lectures and understood things and they accepted me very soon. An accidental circumstance helped very much, as is often the case: namely, in the first lecture which I attended, everything went all right until pretty late in the hour; then something was wrong. It just didn't fit. And the conclusions which one had to draw from the formula that he derived were quite preposterous, obviously wrong, and everybody had a different suggestion. Sommerfeld himself claimed that maybe it was not wrong, maybe the conclusions were right. Such complicated

matters as the theory of relativity, you never know; they always look different from what they seem. But I just went back on the blackboard a couple of lines to where the formulas that had led up to the final result were still written out, and I discovered that two lines back he had made a miscalculation which was a childish error. A formula was copied from a former place and it was

Fig. 2. Sommerfeld's group in the physics institute, Munich, prior to World War I. Paul Epstein is in the back row, far right. Sommerfeld is in the first row, third from left. Others identified are: P. P. Ewald (Epstein's right), W. Friedrich (top row, second from left), J. A. W. Zenneck (second row, far right), A. Rosenthal (Sommerfeld's left), Grahl (between Rosenthal and Zenneck), and Weber (on floor in front, killed in WWI). Present but unidentified: Lenz, Ortvy, Fischer, P. P. Koch, Hamburger (Stamburger?), Echert (Eckart?).

written upside down. This upside-down formula had then served as a basis for the conclusions which he did obtain. And I pointed that out, that the formula was wrong simply—it is an error, a slip of writing. And Sommerfeld looked at it and said, "Yes, perhaps that is right, perhaps you have the solution." Now the others also checked it and saw that I was right, and that enhanced my standing there—that I not only could follow, but I even could critically follow. So on the

next lecture, Sommerfeld said that, yes, the solution of the error was what Epstein had pointed out, and went on from there with his theorem. I was, from that time on, one of the group, you might say. They regarded me as one of theirs. There was an event in the life of this little community, namely a triple doctor's dinner. That is, three men had finished their doctor's theses and obtained the degrees. Usually a doctor who has gotten his degree offers a dinner to the others. But here there were three of them, so they had a big dinner. That I was invited to this dinner was a mark of their confidence in me, and I felt quite at home among them from then on. The dinner was perhaps, to other tastes, not so very good; the main meat course was wild boar. And, of course, plenty of beer to drink. We went home in, more or less, happy moods. And as I say, I was one of them.

Before long, Sommerfeld gave me this special assignment, a small problem, and asked me whether I knew theory of functions. I did not know because we had no course in Moscow in that, though in Germany it is regarded as one of the most important parts of the mathematics course. I glossed it over, said that I know it but I haven't it very clearly in my memory, and I bought a textbook and worked it out. It took me not more than two weeks to learn the theory of functions quite well. And I started that assignment of Sommerfeld's and made substantial progress in a comparatively short time. I showed it to Sommerfeld and he was satisfied. He said, "It is very well that you did it so fast; in a short time you have already a substantial lead to the solution." All that remained to do were some numerical calculations, which I did in due time, and the paper came out in a journal for telephony and telegraphy. And after that, he made me an assignment of a thesis which required the knowledge of special functions, which we also didn't have in Moscow, but which a physicist, especially a theoretical physicist, should know. There are so-called spherical functions, cylindrical functions and so on. And I not only knew them after a short time, I became a prime specialist of them. Nobody knew them better than I. So then these handicaps that I had with the antiquated course in Moscow didn't amount to much; I soon overcame them.

There was still one subject which I hadn't had; that was the theory of elliptic functions. Although I didn't use them in any of my papers, I learned them. But I never got to the point that I completely assimilated them. I knew them enough for a few weeks, and then they slipped my memory. But as I say, I never felt the particular need for them. From that time on, I was theoretically fully equipped and could go on.

I still had my depressions occasionally and the stomach disturbances. The depressions were sometimes pretty severe, and for weeks on end I couldn't work at all. That was, of course, a great nuisance, and if it had continued, the whole thing would have come to nothing. But fortunately, there was an event which had a great influence on my future life, namely, I became aware of psychoanalysis. It happened as follows. After his graduation, [Ludwig] Hopf went to Zurich and became the assistant of Einstein, who was an associate professor of theoretical physics there. Being in Zurich and being an inquisitive man, he became acquainted with the whole psychoanalytical group—that is, [Carl] Jung and the Jung pupils—and of course learned about Freud and so on. And when he came back a few months later on vacation in Munich, he told me about psychoanalysis, and I heard Freud's name for the first time. That conversation had a very deep impression on me because at once I got the feeling that here is something that might fix me, might help me. I started to inquire whether there was a psychoanalyst in Munich, and there was, by the name of Zeiss. Well, I got an appointment with Dr. Zeiss, and I presented my case and my situation to him. And he told me, "Yes, psychoanalysis is the right thing for you. You must have a psychoanalytical cure. I cannot give it to you here; I am too overloaded with patients already. But you go to Kreuzlingen in Switzerland, on Lake Constance, and they will take care of your case." Now, that address in Kreuzlingen was a sanatorium of Dr. Binschwanger. Binschwanger was a psychoanalyst trained by Jung. Jung was, at that time, still a regular Freudian and was even soon appointed president of the International Psychoanalytic Society. Binschwanger was a noted psychoanalyst himself and had other psychoanalysts on his staff. The uncle of Binschwanger was a famous psychiatrist in Germany with great connections in Russia and America, who sent him many patients. I think he was a partner in that sanatorium, and the administrative direction of the sanatorium was managed by Binschwanger's younger brother. Now, it was a wonderful vacation, on Lake Constance. And I went into that psychoanalysis with full vigor. I, of course, had read up all I could get of Freud's books; also of other authors as they came out in the psychoanalytic journals. And I was fully equipped to help along—to conduct part of the psychoanalysis myself. My doctor, the psychoanalyst who treated me, had the name of Stockmeyer; he was also a pupil of Jung's. Now, my psychoanalysis lasted not one hour, as the usual case, but twenty-four hours practically, because every minute I was analyzing myself and collecting recollections and so on.

Because of this very intensive analysis, it progressed very rapidly, and I made very great

improvement—both in the depressions and in the stomach trouble. I was there two times—about three months the first time and three months the second. Altogether, it was six months, which is very little for psychoanalysis. It was a very vast sanatorium in a garden, a very beautiful garden they had; and the light patients who were not cases that needed restraint all dined together in a great room. And there were pretty educated and interesting people among those guests, of different nationalities, especially German, then also Americans and Russians. For relaxation and exercise we bowled; there was a bowling alley in the back of the main hail. I had already bowled a good deal in Munich, so here I continued it and became a good bowler.

There was also a famous earthquake. Earthquakes are very rare in those parts of Europe—it is nothing like California at all. An earthquake comes maybe once in a century, and here there was a pretty severe earthquake. It didn't shake down any buildings, but it shook down many chimneys and ruined the roofs of buildings. It ruined also the roof of the Dom [i.e., cathedral] in that town. It came about eleven o'clock at night when I was in my bed and just dozing off to sleep. The first impression was as if somebody was shaking the door very severely. So I cried through my sleep, "Come in," but there was nobody. It was only the earthquake. And then after a minute or so came the transverse; that is, the room started to shake the other way from window to window. And a couple of minutes later came the main earthquake which was a wave, as if your bed is on the waves and now one leg is being raised and now the other is. From the spacing, I could conclude how far away the earthquake was because I knew the velocity with which the different waves propagate. The first is the longitudinal wave, the second the transverse which is slower, and the third is the main earthquake of the surface. And I figured out it must be some sixty kilometers away, and knowing the geography of the place I decided it must be in the north, because in the south were solid big mountains that couldn't be the heart of an earthquake. So in the morning, I inspected the damage done in the city, which was mostly to the good. Some very hideous decorations fell down and were broken from different places and especially from the post office building. Also the cathedral was damaged, but it could be easily repaired. At dinner we had a great discussion where the earthquake was, where the heart was, and I told them that it was sixty or seventy miles away. Some people contradicted, [claiming] the newspaper said it was in quite a different direction, and so on. But I turned out to be right. It was in the north of Switzerland, which I had occasion to visit a little later, on private business. An earthquake was a rather vivid impression, and I was glad that I had had it.

Incidentally, by this time Mina, my wife, was already back. I left her in Paris when I went to Sommerfeld's; that was in early spring. And in late spring, I went myself to Paris and visited her there, and looked over things in Paris, which I knew very little—I had been there once with my grandfather. It was an interesting visit. After that, she came back to Munich. We rented a suite of rooms in a boarding house for the summer, and in the fall we rented a furnished apartment of our own. But I started again to have the depressions and trouble. That was one of the reasons why I went for the psychoanalysis, and one thing that became clear in the psychoanalysis is that Mina is behind the whole thing, that really, she was very irksome to me, and I wanted to be alone and on my own. The depressions were an answer to that situation which I was in, my marriage. And so the first thing I decided is, I must get a permanent separation, at best a divorce. Now, a divorce she didn't want, but a separation we did make, and she went away and lived somewhere in Switzerland, I think. And I remained alone in bachelor status in Munich, though I was not legally free to marry again. That was the end of the marriage. And whether it was the first year in Munich or the second I can't say quite positively. It must have been the second, 1911, remembering the date of the earthquake.

[Tape interrupted]

EPSTEIN: With those depressions and stomach trouble and so on, I had lost considerable time in Munich. I think that this escapade with the marriage had cost me at least two years in work and progress. But I considered being rid of it as a great boon, because it might have broken me for life. After that, I was starting to work on my doctor's thesis, and as it turned out, I didn't take any subject of Sommerfeld's that he suggested to me, but I found my own subject. Eventually, I presented my thesis and got the doctor's degree for it. In Germany they have two minors. The major was physics. One minor is prescribed to a physicist—namely mathematics—and the other one can be selected. Many people take philosophy, but I took crystallography. So I had examinations with [Wilhelm Conrad] Röntgen and [Carl Louis Ferdinand] Lindemann, the mathematician, and [Paul Heinrich von] Groth, the crystallographer—all very big and famous men. Röntgen was a very poor examiner. He was very impatient and didn't listen to the answers, so that to get an A with him was practically impossible. But I got magna cum laude, which is the next best after summa cum laude. Lindemann was once the teacher of Sommerfeld

in Königsberg [now Kaliningrad], many, many years before that, and then he was professor in Munich. And at the time of which I speak, he was practically no longer a scientist; he did not do any mathematical research but was an administrator. He administered the building program at the university. The director is an elected official for one term, but this Lindemann was permanent. He had a wife who had been an actress, and she liked to give public readings. She had big parties at the house for the younger members of the mathematics and physics department, which I attended pretty regularly. Incidentally, they had a daughter of their own, but for some reason she was not present, since they treated her pretty badly. There were plenty of other girls—girl students, associate professors from the mathematics department, and so on—but not their daughter. And I never met the daughter. Groth was the most famous mineralogist and crystallographer in the world at that time. He was already of pretty advanced age, about seventy-five, and he had such a compulsion to talk that, when he asked me a question, it was immediately answered by himself. I had no opportunity to show off my knowledge, whether I had it or not. But he gave me a good mark. Groth was a very pleasant old fellow. As the Germans often do, he married his housekeeper, and she was not quite acceptable to the faculty wives, so that they were socially looked at a little askance. But they were very nice old people.

A week or two before the examination, you went around to the examiners, as they did also in Moscow with the master's degree, and asked them what they would require. And those visits were formal, so you had to wear evening clothes—a swallow-tailed coat—in the morning to go to these examiners. In Munich, everybody walked, did not take a taxi. It was a pretty strange sight—evening clothes at eleven o'clock in the morning, and with a silk hat. Then the examination was also formal, in a swallow-tailed coat. But the examination was late in the day, so it was not quite so bad.

MRS. EPSTEIN: Was it the same day that you went to call on them?

EPSTEIN: No. The examination was a week or two later.

I donned my swallowtails and went to the examination and got through and received grades from all three. And finally, I received a diploma, which I have in the chest here. And they have a very good arrangement; they give you a diploma on sheepskin with the signatures of the rector and dean and all the other big men. In addition to that, they also give you twenty

copies printed from the same plate as the diploma itself—but on paper, not on sheepskin—for any future needs, because you often want to show what your credentials are. I never had the opportunity to use them; I think nineteen or twenty are still in the box with the diploma.

PAUL S. EPSTEIN

PART III: END OF GRADUATE STUDY; WORLD WAR I: TEMPORARY POSITIONS IN ZURICH, LEIDEN; ARRIVAL IN PASADENA AND FIRST YEARS AT CALTECH

EPSTEIN: I spoke about the fellow students in Sommerfeld's department, but I did not speak about the graduates. There was his chief assistant [Peter Joseph William] Debye, who was a complicated character. He had unquestionably great talent and a lot of mathematical knowledge. He had been with Sommerfeld in Aachen for several years, and he [absorbed] a lot of information there about theoretical physics. Then when Sommerfeld was appointed to Munich, he took Debye along. Debye was a very clever man, a very rapid thinker and worker, while Sommerfeld was rather slow on the pick-up. But when Sommerfeld understood a problem, then he could handle it far better than Debye. Besides being a clever man, Debye was very self-centered. He was, in my opinion, not a lovable character, but very self-centered, and a great politician. That is, he had a psychological understanding of other men and knew how to impress them. He thought of himself as a good experimental physicist. Having no experience in that, he thought that anybody who has two hands can be a good experimentalist. He tried to be an experimentalist, but he realized before long that he was not an experimentalist; he couldn't do experiments well. By the time I arrived in Munich, he had already given up—but he thought it expedient to maintain the reputation that he was both a great theoretical physicist and a talented experimentalist. He was not a man of the very highest professional integrity. Having this talent to impress people, he completely captivated Sommerfeld. Sommerfeld thought that Debye was a really great man, that he had a big future, similar to Einstein's. That was, of course, nonsense, because Einstein was a much bigger man. But Sommerfeld, being a naive fellow, implicitly believed the fiction that Debye was a promising experimenter, and so Debye had very plain sailing. He had obtained his doctor's degree already, before I came, and was in the process of becoming a privatdocent [i.e. assistant professor]—or maybe he was already privatdocent.

[Peter Paul] Koch was one of the assistants of Röntgen's. It was a separate institute, not the same as Sommerfeld's, which was theoretical; this was experimental. Koch was a pretty naive fellow on the theoretical side. He was a good experimenter, but he looked at Debye as a sort of half god because of his theoretical knowledge. He could ask him questions when he needed, not realizing that most of it was routine stuff that anybody who had listened to the

theoretical physics lectures knew. So between them, Sommerfeld and Koch had persuaded Röntgen that Debye was a great man in physics. Of course, he was only an assistant to Sommerfeld, and the pay was small, but he thought of his future career. After he became privatdocent, I listened to a course of lectures of his about the theory of radiation, and it was not too good. He followed Planck's text—Planck had a book on theory of radiation—and where Planck made blunders, he made the same blunders. He did not analyze it critically.

Debye's chance came when Einstein resigned his position in Zurich, despairing of the future there because they did not appreciate him. They did not realize what a big man they had there. And the pay was very skimpy, so that he could barely exist with his two children and a wife. That was, of course, not the reason that he left, because I never saw a man less interested in money than Einstein was. But still, when he was offered a position in Prague with a salary about three times as large as that in Zurich, he took it and went to Prague. And the Zurich professorship became vacant; it was an associate professorship for theoretical physics. Sommerfeld put in all his influence, which he had as the leading theoretical physicist in the field, and prevailed on Professor Kleiner, the experimental physicist in Zurich, to take Debye as successor of Einstein, promising them that in a few years Debye would be as good as Einstein.

In addition to Debye, there was another privatdocent, a little older, namely [Max von] Laue. He was not yet von Laue, he was simply Max Laue. Max Laue had had good training under Planck in Berlin. He had two or three years of Göttingen, where he learned all the tricks of mathematics and theoretical physics on the mathematical side. And he was some of the time together with Ehrenfest, and they addressed each other by "du," that is, "you," quite intimately. Ehrenfest was a very good critic but not creative. Laue was creative and published a series of quite good and interesting papers. He worked principally in Planck's field, that is, the theory of radiation and similar things. He was extremely nervous and neurotic. However, that didn't affect his capacity for working; he had no depressions. He was an extremely poor lecturer—so poor that to keep students was a great challenge with him. He was liable to start with a dozen students and lose them in a couple of weeks and end up with no students.

Now, that was all before I went to the psychoanalyst. As I told you, I lived in a rented apartment there, with my then wife Mina. Ehrenfest was in Petersburg [Leningrad] the whole time. He went with great expectations and hopes, but they came finally to very little. The Russians did appreciate him—that is, the scientific men. His close friend was [Abram

Fedorovich] Ioffe. Ioffe also had been chief assistant to Röntgen for several years—predecessor of Koch—and then he went to Leningrad and became professor in one of the engineering schools there, and became a very close friend of Ehrenfest when Ehrenfest came to Leningrad. Through Ioffe's influence, they arranged for Ehrenfest a course of lectures so that Ehrenfest could show off his tremendous knowledge of theoretical physics, which I told you impressed me very greatly. His audience were all professors of universities and other institutions of university standing, and he had great success with them. On the other hand, he was there illegally; he was a Jew living in Leningrad. He got through by some lucky chance, and he had no future with the university at all. It was quite out of the question that he would get an appointment. Also, to get an appointment as privatdocent, he had to pass the Russian master's examination, which in Leningrad was still more formidable than in Moscow. That was too much for him; he gave up and decided to establish himself in Germany or in a German-speaking country. And that was the occasion of his visit. He went first to Berlin, to Planck, to see whether Planck had a position for him. You see, for Germany, he had the necessary credentials to become privatdocent right away. Planck told him that he was sympathetic and that he would have taken him, but he had just promised a privatdocentship to another young man. In contradistinction to Russia, Berlin had only a limited number of privatdocents. You see, they were unpaid; therefore, it wasn't fair to just let them work without any hope of future preferment. And he had promised that position and couldn't take in a second one; there simply was not an open position. From there he went to other big universities—Leipzig was one. But Leipzig did not recognize the doctor's degree of Vienna. That was an old quarrel of a hundred years' standing or more. So far as Leipzig was concerned, Ehrenfest had no doctor's degree. And that, of course, prevented his getting a privatdocentship. They even recommended that he go to another university which was not in quarrel with Leipzig and get a doctor's degree there. He went so far as to consult the professor in Freiburg about it, and then again he ran up against red tape. The men in Freiburg said, "Yes, you have published good papers for which we would gladly give you a doctor's degree, but we have here a residence requirement." That is, to receive his doctor's degree, a man must have three semesters in Freiburg; only after the third semester of residence can he get his doctor's degree. So that was too much, again, for Ehrenfest, and he gave up Leipzig and moved on to Munich.

In Munich, we had an unoccupied room in our apartment. So he stayed with me for two

or three weeks. He went to Sommerfeld to become a privatdocent in Munich, but Sommerfeld had lots of pupils of his own. The Debye position was not yet filled—Debye was gone to Zurich—but it was promised to [Wilhelm] Lenz. Lenz was a pupil of Sommerfeld and Debye. And then they had Laue. Two privatdocents in the department was all they required, so that there was no opening in Munich. But while in Munich he had a short trip to Würzburg. In Würzburg there was a very outstanding physicist, Wilhelm Wien, and Ehrenfest went there to talk to him and look over his laboratories and see what they were working on. He came back much satisfied with the Würzburg setup.

Ehrenfest gave a talk in the physics colloquium. His particular friend had been Walter Ritz. Ritz is a Swiss and a cousin of Caesar Ritz of the Hotel Ritz in Paris and London. It's apparently a very able family, these Ritzes. This Walter Ritz was really an outstanding young physicist—unfortunately of weak health; he died not long afterwards. But Ehrenfest was a close friend of his and really loyal to him, so that he talked about a theory of Ritz's which should replace, in Ritz's opinion, the theory of relativity of Einstein. In my opinion, that theory was a mistake, and it didn't persuade anybody there in Munich. Sommerfeld and Laue both were skeptical. Ehrenfest, incidentally, is an excellent speaker, and he is also a very witty speaker; that is, he is capable of holding an audience roaring with laughter for hours. He did not apply his wit in that case, but it was a good lecture, though unsuccessful, because the theory of Ritz was no good.

So far, Ehrenfest was unsuccessful. He had not found a university that would take him. The conditions in Vienna he knew, being a Zionist himself and having family there, and he didn't like it. So he did not try Vienna, but he went from Munich to Krakow, which is not far from Galicia and the Russian frontier. The professor there, [Marian] Smoluchowski, was a good theoretical man, though he had the reputation of being anti-Semitic. But he received Ehrenfest with great hospitality, and he helped him in one respect, to get back into Russia. You see, Ehrenfest had an Austrian passport, but no certification that he could live in Russia. As a matter of fact, legally he couldn't, being a Jew. So what Smoluchowski did was to send the servant of the institute in a parade uniform with golden braid to the Russian consul, an official representative, so to speak. And the consul, seeing such a magnificent servant, just stamped the visa and gave him entrance to Russia. So he came back again legally and went home to Leningrad—a little disenchanted because this whole trip, which had taken several months, was

for nothing; he did not achieve his purpose. But lo and behold, now comes the remarkable thing. At home, a letter was waiting for him which arrived, in his absence, from Lorentz in Leiden. And Lorentz wrote him that he was retiring in a year—he had reached his statutory age, it was seventy, I think—and he thought that he could make Ehrenfest his successor. Now, that was a tremendous boon for Ehrenfest. To be successor of Lorentz, the greatest theoretical physicist after Einstein, and the greatest man of the late nineteenth century in physics, was a great honor. And to make the story short, he did go to Leiden and got the professorship there as successor of Lorentz.

Now, I went through my psychoanalysis, and it helped me very considerably. I saw and understood what was the matter with me. It was minor. You see, in psychoanalysis they always dig up old complexes from your childhood which are not resolved and which are still active in the subconscious and take up a lot of your energy, and that causes the depression. Still more important than the old conflicts, which remain over from your childhood, are the present conflicts. If you have a conflict late in your life, that is a worse thing and that must be settled first. So I told nobody, but I decided then to separate from Mina, and I did. And after that, I had a comparatively depressionless time. There were small remainders of depression and stomach trouble, but they disappeared eventually.

[Tape interrupted]

EPSTEIN: I was now ready for an assistant professorship somewhere. I had an offer from Göttingen to be the theoretical assistant of [David] Hilbert. Hilbert was a great mathematician, one of the greatest in the world. Hilbert and [Felix] Klein were two great mathematicians from Göttingen. Hilbert became interested in physics and wanted to have a man trained in physics who could work out his theories, criticize them and understand them, and so on. Probably Sommerfeld recommended me. But I didn't want to go to Göttingen. It was too much of the old grind to work on things that others had devised, and I politely declined. But I did not want to go back to Russia either. I did not like Russia on political grounds. There was a Duma, that is correct, but it had no power, so that the administration was really autocratic, and I was a liberal. I think perhaps I was the only liberal in existence there. For the same reason, I did not want to settle in Germany or Austria because there, too, though they had the parliament and the

paraphernalia, they were very undemocratic countries. They had their emperors, who were in essence absolute rulers, and there wasn't very much difference between Kaiser Wilhelm, Nicholas II, and Kaiser Franz Joseph of Austria. So I wanted to go to a free country. I could go to Switzerland or America or Palestine, of course. But Palestine had no scientific organization yet, though in a couple of years they got the Balfour Declaration and the Zionists took over. But at that time, they didn't. By this time, Debye had left Zurich without becoming a second Einstein. He was offered a professorship and took it, in his own country, in Holland—professorship for theoretical physics. And went there with a girl he had married, a girl that he courted in Munich, whom we all knew.

The chief professor in Zurich had finished his term, was over seventy and retired, and his successor was Edgar Meyer. Edgar Meyer was a good friend of mine. I met him at a meeting of German naturalists and physicians. And Meyer was very glad to have me as a privatdocent there, and I decided to go to Zurich. However, I was in no hurry yet. I did not go until later, which was a mistake, because in the meantime the war broke out and Germany was practically sealed off; and I was an enemy alien and not permitted to leave Germany. I had to stay in Munich the whole time. If I had known that, of course I would have gone to Zurich before the war broke out—and taken along my Russian money. So the money was in Russia and was finally nationalized—that is, taken away from me—and I was in Germany without money. Well, I was not quite out of money because part of it was in a Polish mortgage. Poland was an independent country at that time, just after the war, and I received a small, but sufficient, income from that Polish investment I had.

MRS. EPSTEIN: During the war, while you were in Munich?

EPSTEIN: While I was in Munich. They were very straitened circumstances—I had a look at every mark twice before I spent it—but it was enough to live on. But I settled the question with Meyer, and I must tell you that to become a privatdocent, an assistant professor, you have to submit a second thesis. The doctor's thesis is one thing and in the past, but you must have a new thesis [i.e., *Habilitationsschrift*] for an assistant professorship. With that new thesis I had a very remarkable success, because I hit upon a problem that was both very interesting and important. It was the application of the quantum theory to optics. I wrote up that paper, and it attracted very

wide attention. I became a sort of celebrity. The first thing I knew I had a letter from [Wolfgang] Pauli in which he approved of the work and made several suggestions. So that in Zurich they accepted this thesis, which was much better than anything they had expected, and I was made a privatdocent. I only needed the formalities of the proving lecture to start lecturing, but I had to wait through the whole length of the war in Munich till I could get away. Then I went to Zurich.

[Tape interrupted]

EPSTEIN: My account of the journey of Ehrenfest wasn't quite complete. I forgot to mention that he went to Prague, where Einstein was, and met Einstein for the first time. Einstein had recently published two papers where he showed that the old physics without relativity could not survive, that relativity was necessary and must be fitted in. Now Ehrenfest was still on the platform of the train where Einstein met him, when he started his attack. He said that Einstein was not right because he had not considered another possibility—namely, he thought of the Ritz theory. Now, Einstein listened to him and then put his question. As it turned out, Einstein had considered this objection. Perhaps he hadn't read the Ritz paper, but he had considered equivalent kinds of possibilities and found them wanting. So before they left the station, the scientific part of the meeting was already finished. Ehrenfest had made his attack on relativity, and Einstein had disproved it. But they went into town and had a lovely time, spent several days together. They visited the Czech university and the men who worked there and saw the sights of Prague, which are very interesting, and in general had a good time. And from that time dates the close appreciation of Ehrenfest for Einstein and his later friendship with him. Only he went to Smoluchowski [in Krakow], and after that, eventually, he was appointed professor in Leiden.

The other thing is I did not give you a sufficient characterization of Ehrenfest. Ehrenfest was very witty and could keep an audience in stitches for hours. But he was, on the other side, a man without humor. That is, when the slightest problem came up in his own life, either professional or private, he couldn't treat it lightheartedly. He always treated it with deadly seriousness, at great length. Besides which he was very aggressive sometimes in his bitter attacks on other people, to the point of being impolite. He did not tolerate the slightest witticism at his own expense; he resented it immediately. His attacks sometimes were so severe and

aggressive that Laue gave up. He said, "Ehrenfest is too insulting, I can't talk with him."

Also about Debye I have to supplement something. Debye, as I said, had a knack of impressing people through his different, various qualities, and so he impressed Sommerfeld—he had him in his pocket actually—and Röntgen, but he couldn't impress me. I saw through him, and he didn't like me for that reason. He thought I was giving myself airs. When this question of the succession of Lorentz came up, everybody expected that he would select some young Hollander, Dutchman, and he wanted to, but he wasn't impressed by Debye either. I think he also saw through him. And he decided that Ehrenfest was a better choice, and very likely he was.

Apart from having those defects, which I enumerated, Debye was also a profoundly uninteresting person. That is, he had no culture; he was from a pretty low social stratum and had no general education. That is, he couldn't talk about literary problems or art problems or philosophy problems, and his language was somewhat pedestrian and simple. While Sommerfeld and Planck had beautiful, very cultivated modes of expression, Debye spoke with a street accent and outlook.

After Debye went away [from Zurich], they made Laue his successor. That took some doing because Laue was such a poor lecturer. A professor and another important man from Zurich came to Munich, and Sommerfeld prevailed upon them to take Laue. They listened to his lecture, which was as usual very poor, but in the end they took him on. So the successor of Debye was Laue.

MRS. EPSTEIN: This is in Zurich?

EPSTEIN: In Zurich. Zurich was a pretty nice place. Meyer, the experimental professor, was all for making me the successor of Laue. But he had quarreled with other faculty members who tried to get back at him. What happened was they didn't get back at him, but at me. I was, so to speak, the arena on which they fought out their battles. So that, while they wanted to aggravate Meyer, they actually acted against me, because I was in the thick with obtaining the professorship. But there it was, it couldn't be helped, and I stayed on in Zurich for a time. I must tell you that by that time the war was over and many people had come back.

Also, a little earlier—I get mixed up, the dates—I recall a great event in the physics

laboratory [in Munich], namely, a monumental discovery. It was still before the end of the war and I was on my vacation in the Tyrol. I stayed in a place which once had belonged to the Dukes of Tyrol, a little hunting palace. It was rented by a hotelier who was also a cattle raiser. It was over 5,000 or 6,000 feet high, and the meadows, with the profusion of wild flowers, were very beautiful, and the cattle throve in it. He brought the cattle in at the end of the winter and fed them up on that good grass and made them handsome and fat. They were steers only; he had only enough cows to supply the milk and butter that they needed in the hotel. The daily fee was quite low—something like four Austrian crowns—and the cooking was good and plentiful. There had been a Bohemian cook the previous season who had taught the sister of our landlord how to cook.

I stayed there until I got a letter from Munich that great things were happening in the laboratory. What really was happening was the following. When [Paul Peter] Ewald was still finishing his thesis, he had some doubts, questions about the diffraction of crystals—how crystals diffract and reflect light. And he asked Laue, who was a specialist in thermodynamics and such similar theoretical things, about the doubts he had. Now Laue, for the first time, heard that a crystal deflects light and emits secondary light of pretty short wavelengths, and it was to him highly interesting. He was thinking that it would be a good method to discover both the constitution of the crystal—that is, what the lattice was—and also the length of the waves that are diffracted. And he spoke about it immediately before Ewald went away to Göttingen. In fact, he hadn't yet gotten his doctor's degree or his master's thesis. He proposed this idea to everybody he could get hold of, and some people approved and some people disapproved. Sommerfeld and Debye both said that it wouldn't work because of the irregularities of the crystal; the motion of the molecules would obliterate all the regularities which Laue hoped to detect there. On the other hand, I supported him; I said that it might work. Anyway, nothing much was done about it until that summer when I was in the Tyrol. In the meantime, [Walter] Friedrich, who had his doctor's degree—I told you about his doctor's dinner—was around Röntgen's laboratory. And as he was a very clever experimentalist and a good head, Laue asked him to supervise this experiment. And there turned up also a third man, [P.] Knipping, who was hanging around the laboratory without doing anything, who also joined the group. Laue, of course, was completely incapable in an experimental way, but Friedrich and Knipping were not. So they set up Röntgen's apparatus and started the investigation. And lo, from the very

beginning, there were positive results. That is, they had a conical array of axis areas falling on the crystal plate, and a photographic plate at some distance to catch the diffraction, the reflected rays. They began with a very unlikely substance, namely, copper sulfate, and got some spots on it which might have been caused by this diffractive operation. One thing led to another, and they investigated closer and found before long that they really were diffracted. In the end, they had beautiful photographs which brought out the symmetry of the crystal very nicely. The spots were quite separated, and the whole thing could be evaluated well; it was a great discovery. In fact, that was the discovery of the decade, the best piece of work done then.

They started it in the vacation time, in the absence of Sommerfeld, because Sommerfeld was against it; he thought it wouldn't work. When I came, they showed me the beautiful photographs, and it was unquestionable that it was a great discovery, and Laue was a hero. Of course, some merit was due also to Friedrich, who knew exactly how to set it up, and Knipping in a lesser degree. I was quite impressed because it was something very beautiful. The question was about publication. You see, it had to be kept secret because if it leaked out, then somebody else would claim it as his discovery. When Sommerfeld saw it, he was, of course, converted. They made use of Sommerfeld's privileges as a regular member of the Bavarian Academy of Sciences. They have, in the Academy, the institution of the closed, sealed deposit. That is, the invention, or whatever it is, is described in a short statement, and it is sealed in an envelope and deposited in the safe of the Academy. So that if another person claims it, the priorities are established. They had it on such and such a date.

It became necessary to make it public, and Laue decided the best way to do it was to just break it suddenly to the German Physical Society in Berlin, of which he was a member. A talk of Laue and Friedrich was announced with a pretty noncommittal title, something about properties of X rays, or something like that. Laue got up and reported on the theoretical side of the great discovery and showed the pictures, which made a tremendous furor. So it was now public, and Laue had the priority, even apart from that sealed envelope. Then after Laue, Friedrich spoke about the experimental details of the arrangement, and the meeting ended in great approval. That was just before Debye moved to Holland and the position became free in Zurich. So that when this man Weiner came to look Laue over, Sommerfeld had a great talking point, because Laue had made one of the greatest discoveries of the decade. A small thing, like that he could not lecture, could be overlooked. And that was one of the things that prevailed

upon them to appoint him.

As I said, the war ended by this time and I could go to Switzerland to claim my assistant professorship, which I did. And I must tell you that my Uncle Samuel [Lurie] lived through the whole war in Switzerland, in Zurich, and my younger cousin Henry lived with him. Henry was a student in chemistry at the University of Zurich and had just obtained his doctor's degree before I came there. And Samuel, of course, was a very rich man, had plenty of money, and was willing to lend me any sum; but I was very reluctant to take much. I took a little from him and lived in Zurich very skimpily. The privatdocentship doesn't carry any salary, as you know, but I had occasionally teaching orders of the university, which brought me in several hundred francs every time, so that I made something there and could make ends meet, though with great difficulty. Selma was, of course, with Samuel. The whole family was there.

MRS. EPSTEIN: But not Ted?

EPSTEIN: No. Ted was in Russia.

Well, I found a pretty decent room there in Switzerland where I lived and had dinner, at first, with the Luries, who had a pretty big apartment and a full outfit going. So that it was in part a family gathering. Samuel made some very poor investments. If he had just kept his money in francs, as they were, he would have been very well off, but he speculated on all sorts of things. He bought and sold wares, which was a very good business as long as the war lasted, because the prices always went up. But now, after the war had finished, it was a doubtful thing. You oftener lost than won. And then he speculated in marks. The German currency was not secured; the marks underwent a devaluation, a natural devaluation. They were so low, in fact, that everybody thought they can't go lower, they must go up now or something. But they didn't go up, they went lower and lower, and finally you could just paper the wall with these marks; they weren't worth anything. And Samuel was caught in that to a great extent. He still, in the end, had enough. He had an apartment house in Warsaw that brought him a pretty good income, and had the rest of his money in marks, though it wasn't worth much. He was not a poor man by any standard, but he was no longer so rich as he had been. Sollie Lurie, a nephew of Selma's, put him up to all these speculations, and speculated himself unsuccessfully. Then Selma and Irene went back to Poland where Tadek was. They had rented their very sumptuous apartment in

Berlin, which they had outfitted just before the war, to Heinrich Halpern, the brother of a banker in Berlin. He was paying a good rent, but they wanted to repossess it, and finally they succeeded in getting rid of Halpern. You see, in Berlin, during the devaluation, the rent being fixed by law, the apartment didn't cost anything to speak of, so that it was the cheapest way to live. And Selma and Irene, after some time in Warsaw, went back to Berlin. And before long, Samuel also followed them there. Before that, he was living in a pension in Zurich, a very good pension, and I was there a great deal with him. But then they went away, and I was left alone and had my meals in another pension, less splendid than that. I realized, however, that it can't go on for very long. I must have a paid position. This living from hand to mouth was nonsense. So I looked around for a position somewhere else, and Ehrenfest got me one in Leiden as an assistant to Lorentz himself. Lorentz was retired and lived in Haarlem, which is half an hour by train from Leiden—a nice town. There he was head of the so-called Gestift [officially,Teyler's Stichting]. It was a purely scientific laboratory where his main assistant was van der Pol [?].

One day a week he spent in Leiden, and I was his assistant for that day, and the rest of the time I was at the disposal of Ehrenfest. And they paid me some money; I don't remember how much it was. Anyway, it was not a princely salary, but I could exist on it. I continued to look for a position in another free country. And, of course, I turned my eyes to America.

As accident will have it, [Robert] Millikan came to Europe on some scientific business and spent a few days in Leiden. Everybody visits Lorentz if they can. So I met Millikan there and talked about the possibility of getting a job in America. Millikan was, at that time, a professor at the University of Chicago, but he was already under contract to take over the job which he held for so many years in the California Institute of Technology. I never heard of the Institute before I spoke to Millikan, but when I heard Pasadena and remembered the beautiful peaches and other fruit that were here, and fine dark foliage, I thought that that was the place to go. And fortunately, that was just the suggestion of Millikan, too. He invited me here to Pasadena to lecture on theoretical physics for a year, and I accepted. Of course, he couldn't make it definite. He had to get the approval of the trustees and what not; and therefore, I just had the promise that he would do something about it. And I waited and waited; nothing happened. I didn't hear from Millikan a sound until, suddenly, I got a cable—I don't remember what the wording was—anyway, that I am appointed and will be sent expenses. So I wrote him back to send me five hundred dollars, for I had to clean up some debts in Leiden and pay for the passage

and the railway from New York. And I got a reservation on the largest ship afloat at that time. When it was a German ship, it was called *Europa*. Now it was expropriated by the Allies and was in the Canadian Pacific fleet and was called *Empress of Britain*. So I had the reservation on the *Empress of Britain*—not in first class, as I traveled the first time in splendor, but second class, and it cost me plenty. I don't know exactly how much, but it cost me much more than the first class passage cost the first time.

That was the end of my European teaching and the beginning of my American teaching. I came on the Santa Fe train to Chicago with great misgivings, because we were late and I was afraid that we wouldn't make it, but we just made it in time. The conductor, on hearing my name from the Pullman reservation, said that he had a wire for me. And the wire was from Millikan, not to take the train from Chicago but to go to a hotel and wait for him because he was leaving Pasadena and he would like to talk things over with me in Chicago. And so I went first for a night at a hotel. Then I went to the faculty club, the Quadrangle Club of the University of Chicago, where Millikan arranged a reservation for me. It was still vacation time, toward the end of August. The university was not in operation yet, but most of the professors were there, and I met them all in the afternoon. [A. A.] Michelson was there, and [Leonard E.] Dickson the mathematician, and all the rest. And Millikan came only after three days. In the meantime, I had seen the sights of Chicago, had been to the Art Institute and the others. Chicago was disfigured by a railroad track right along Lake Michigan, which cut off the sight of the beautiful shore.

[Tape interrupted]

MRS. EPSTEIN: Now, it's Saturday, December the 4th, 1965.

EPSTEIN: Well, yesterday I made some supplemental remarks about several men of Munich; and here I make a few of myself, because I was too short about the analysis. Well, you remember that I was in Zurich with my uncle and aunt first, and then alone. And I met also some other interesting people there, which I did not mention. There was, in the first place, [Gregor] Rabinovich.

MRS. EPSTEIN: The artist?

EPSTEIN: The artist. He was from Minsk also. He was several years younger than I, and I had met him only slightly before. He got his artistic training in Paris actually. But during the war, Paris was an uncomfortable place, and he moved to Zurich with his wife that he had acquired in the meantime. The wife was also an artist, and an attractive woman, too. So I saw a good deal of Rabinovich.

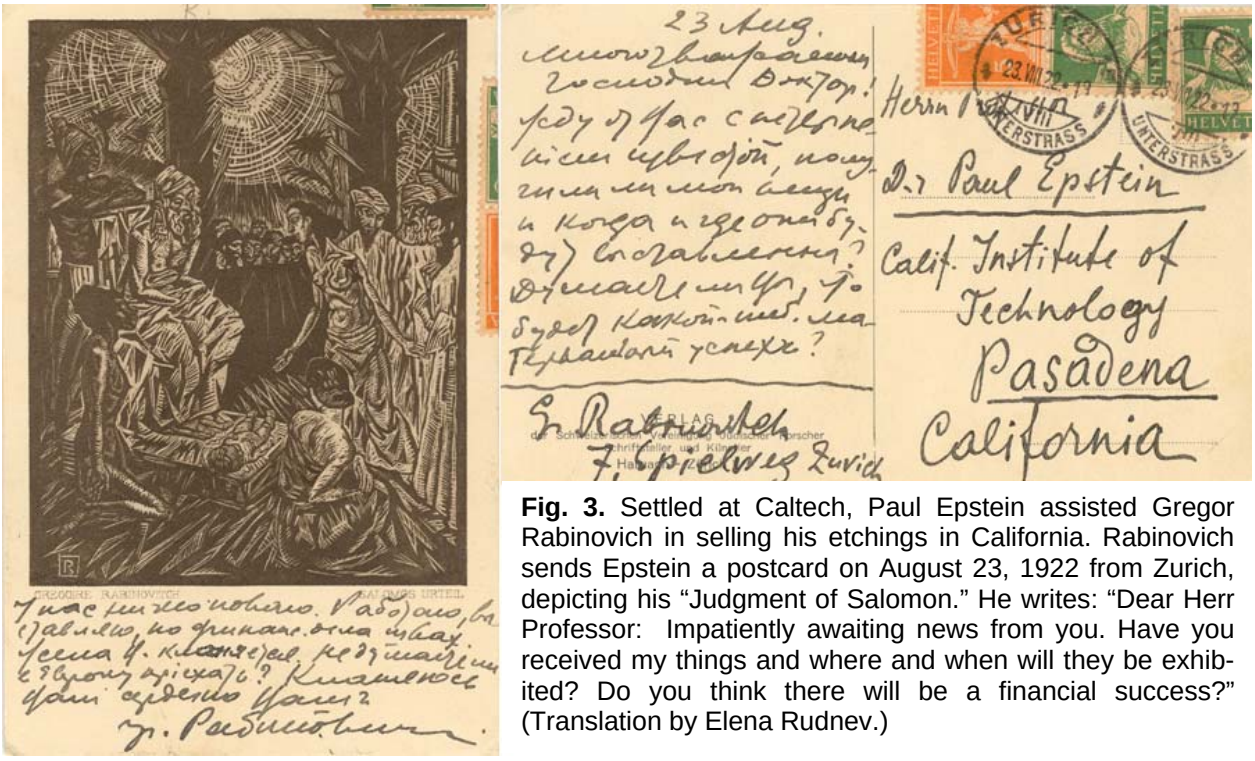

Fig. 3. Settled at Caltech, Paul Epstein assisted Gregor Rabinovich in selling his etchings in California. Rabinovich sends Epstein a postcard on August 23, 1922 from Zurich, depicting his "Judgment of Salomon." He writes: "Dear Herr Professor: Impatiently awaiting news from you. Have you received my things and where and when will they be exhibited? Do you think there will be a financial success?" (Translation by Elena Rudnev.)

Among the psychoanalysts, I should mention [Oskar Robert] Pfister. Pfister was a pastor, a clergyman, who used psychoanalysis in his profession. A clergyman has to give advice and is almost a curer of the soul. He was the most interesting of the psychoanalytic group. There were also others, especially that fellow who was the president of our group, who is in New York now [person remains unidentified].

Also, I made the friendship of [Hermann] Minkowski, who lived in the same pension with myself. The Minkowskis are from Königsberg originally. His father had been a partner of my uncle in some enterprise in Warsaw, and I knew his father quite well but had not met him before. He was there as a psychiatrist—they called them neurologists, actually, but it is the same thing—and assistant of Melnikov. Melnikov was a professor of neurology at the university. Anyway, Minkowski became a member of the psychoanalytic group, but was always very resistant; he

never was convinced. I worked on him to convert him, but he didn't stay converted. He didn't accept psychoanalysis, and in a few days he was again doubtful. Nevertheless, he attended the meetings.

The main omission that I made was in connection with Jung. I was not living yet in Zurich, but it was my second time in the Binschwanger sanatorium. I told you something about Stockmeyer and his treatment. The following year I continued to stay another three months there, under Stockmeyer's analysis. What I did not know was these were critical years for Jung, too. Jung had been made president of the International Psychoanalytic Society by Freud and was to all intents and purposes a Freudian and wrote passable papers, which were very well written usually. But now, suddenly, he wrote a paper—or a series of papers they became later—under the title *Wandlungen* [*und Symbole*] *der Libido*; that is, changes or transformations of the libido. In this paper, he virtually renounced Freud and set up his own psychoanalysis. Well, what he renounced was the fight against the philistinism of the public, which was one of the main things that Freud did and which he considered very important. You remember that Freud suffered very much for his antagonism to philistinism and to what we call today Victorianism, to such an extent that he was proscribed by the medical profession; he was completely lonely and alone and suffered under this isolation. However, to give in, to accept even a small compromise, he considered as a betrayal of his faith and a cowardice, an act that should be avoided at all costs. This lack of compromise caused him a lot of personal discomfort. The medical profession shunned him as a perverter of youth, and the public also was against him because they were, of course, addicted to that Victorian point of view and regarded him as a dangerous influence. So he suffered very much but remained in isolation. He said that even the slightest compromise, with form let us say, would in the end lead to his renouncing the substance of psychoanalysis and was a dangerous thing to undertake. What Jung did was actually selling out to philistinism, so that Freud regarded as a cardinal sin. It was no longer Freudian, and he wrote it in the papers and magazines for psychoanalysis, that Jung was on a very dangerous road, and if he continued so, he will have to be run out of the party, he will no longer be a psychoanalyst. Now Jung, of course, was insulted by that and thought of leaving the psychoanalytic movement on his own account, not waiting until Freud got around to it. And that was the moment when I was in the sanatorium; there was great tension between Freud and Jung. I didn't know this, of course, being a private man, not a specialist in psychoanalysis. But the way it affected me is the following.

Freud, at this juncture, came to Switzerland. As it happened, Jung was out of town when Freud came, on some business of his own which had nothing to do with psychoanalysis, and was not there to meet him. Freud hadn't announced himself in advance, and so there was this anomaly—Freud had been in Zurich and Jung had not welcomed him. There was clearly a tension between them for everybody to see. Well, Freud came to the sanatorium, to the beautiful garden and fine view, and that is when I met him. I had played with some psychoanalytic ideas and had a project of writing a psychoanalytic investigation—of course not medical, a literary psychoanalysis so to speak, for there was a magazine, *Imago*, edited by Hans Sachs, who later became a practical psychoanalyst. If successful, I could give it to be printed there, *Imago*. Well, I conferred with Freud; I asked for an audience with him, and he came and visited me in my room. We had quite an interesting discussion about my possible work, and from then on I was known to Freud and met him later again; and that was for me, of course, a great event, having met Freud and talked to him.

[Tape interrupted]

EPSTEIN: I met Millikan in Chicago. I think we stopped on that part.

MRS. EPSTEIN: Yes, you were just waiting to meet Millikan.

EPSTEIN: Well, he came after three or four days. He was a very nice and likable fellow, as you know, but this interruption of my trip was quite unnecessary, because all he asked is whether I was ready to start the lectures in Pasadena. I was, and I had telegraphed him so, and what I intended to lecture on there the first year. I told him I thought we would give a course on partial differential equations in mathematical physics because that is a necessary preparation for other theoretical courses. The students should get that mathematic stuff because they need it all along. And he said, "That seems to be a thing to do," and that was all. He took me to his house—he still lived there. In the first years, he came to Pasadena only for a few months in the year and the rest of the time he was in Chicago. And Mrs. Millikan was there, of course, and of the children, Clark was there. Clark had been a freshman in Chicago, but his father advised him to change to Yale. So he became, at Yale, a freshman again because transferring as an advanced student is

difficult. I didn't see him again until he graduated from Yale and came to Pasadena.

Millikan was on the point of moving completely to Pasadena. His substitute in Pasadena was [Earnest] Watson. Watson had been with him for several years, and he was in charge of building the Norman Bridge laboratory, which was nearing completion when I came but was opened only a half a year later. I arrived on the 26th of September, I think, and it was the hottest day of the year, a real scorcher. But Watson took me around in his car to several possible rooms which I could rent, which were all unsatisfactory. I finally took the old rooms of Watson; this was on Madison Avenue, in back of the Pasadena Theatre, which was a nice place to live. A few days later, [Ira] Bowen arrived with Millikan's car. That is, Millikan had his Chicago car, and instead of sending it by freight, he let Bowen and two other students who wanted to take the course under him in Pasadena [drive it] to Pasadena.

[Tape interrupted]

EPSTEIN: This relates more to social and personal activities than to science. So that's why I omitted it the first time. My social life in Munich had several different parts. One was through the scientists. When I came to Munich, which was in February or March of 1910, I met Sommerfeld and his men. And I lived in a room where I did not have any meals, only my breakfast. And therefore I went with Debye and Koch down to the city to have dinner—dinner in Munich is at twelve o'clock—in the restaurant of a brewery reputed for its good cooking; and it was really pretty good. It was rather crowded, that was the drawback there. We had dinner together, which was a pretty short affair, because we had only a meat course, possibly salad and vegetables, but nothing else. And then we went all together to the *Stammtisch* in the Hofgarten. That was a very remarkable institution. The Hofgarten was literally "courtyard," and it was a yard of the king's palace. On the outer side they had just a solid front, as buildings have in general, two stories high, and they were pretty old buildings, maybe one hundred years old, which is not very old for those parts. And on the inner side, there was a series of arcades, enclosing and opening on the garden. In the arcades there were paintings by once famous artists, mural paintings of views of Italy mostly. Under each painting in an arcade was a verse, and it is said that these verses were all created by King Ludwig I, who was deposed after a long reign in the general revolution in 1848. Now, I don't know if it was true or not, but the paintings were

quite valuable presumably and belonged to the individual houses into which this wing of the palace was now subdivided. It no longer belonged to the king but was sold to private owners, mainly to cafe owners. Each of the buildings was a cafe, and we had our *Stammtisch* in one of them, which was called at that time the Cafe Lutz.

Fig. 4. Paul Epstein in Munich, April 1917.

We came there at one and stayed there till two. This *Stammtisch* was, according to tradition, originally founded by Ioffe and Koch. Ioffe had been an assistant of Röntgen's in the institute, and Koch was assistant already at the time Ioffe came. And they simply met there every day for their dessert and coffee. It became an institution.

When Sommerfeld came to Munich—he was appointed in 1907, I think, as professor of theoretical physics—he was innocent of physics. Actually, he was a mathematician, and he wanted to learn something about physics. So he said to Ioffe, "I want to sit in your office everyday and see how physicists work." Now, Ioffe saw that as a method without much sense, because they just work with their hands. So he said, "If you attend our *Stammtisch*, then the conversation there can lead you to know about physics. So Sommerfeld became a member of the *Stammtisch* and brought Debye with him. Sommerfeld was a slow thinker, as the Germans are, and Debye was very fast and clever. So Debye understood the problem with the physics and mathematics in a moment and explained it to Sommerfeld. So he was very useful to Sommerfeld, and he was a good member of the *Stammtisch* because of his general knowledge of mathematics and physics.

When I came, I also became a member of the *Stammtisch*, and I was just as regular as Koch and Debye. In later times of stress and war, I kept the whole organization going. There were, of course, other people. Laue was a member. The time wasn't quite convenient for him,

so he came off and on. Then there was a very regular member; it was the young mathematician [Artur] Rosenthal. And there was a man who had nothing to do with mathematics and physics, but who was an anatomist and physician, and a brilliant mountain climber.

So this *Stammtisch* prospered and became so well known that it was an institution. People from out of town, physicists and mathematicians, did not go to the university to meet people but went to the Cafe Lutz to our *Stammtisch*. Of course, in winter we met in the cafe, in the summer, in the Hofgarten. There were tables and chairs around the trees, and it was very pleasant to sit in the shade. They had excellent ices and other frozen things. Simply attending the *Stammtisch* every day, you met all sorts of people from all over Germany because they came there. For instance, [Richard] Courant I met there first, and then [Hermann] Weyl, and many others. So that *Stammtisch* was also an approach to the society in Munich because I became very intimate with its members.

Another approach I had to Munich society was my cousin Alexander Eliasberg, who lived there and tried to be a writer. He finally hit upon translation—translation from Russian to German and German into Russian. There he was really successful; he had plenty of work and made a little money in this way. He was married then and lived not far from where I lived. Now, he was a great gossip, and he knew everybody, practically, in the art colony—some well and some not so well—and through him I had an approach to the art people. His wife was an artist herself. She was a pretty talented artist, though a scatterbrained woman; but she had a good eye and hand. Now, I met the artists, of which you are interested. And whom I met first is very hard to say.

MRS. EPSTEIN: Klee? Kandinsky?

EPSTEIN: [Paul] Klee, yes. I think I met Klee through Sasha, Alexander Eliasberg, who knew him from old times. He was a native of Bern, Switzerland, and had come to Munich to study art—Munich had a great reputation as a center of art, deserved or not, but there it was. And he became the pupil of a very fashionable man—that is, a man of great reputation at the time—Franz Stuck was his name. Stuck was a very talented man; he had a brilliant technique. Some of his paintings were thought to be outstanding, and in my opinion, some of his sculptures were outstanding. But he was not of the highest artistic integrity; he was a compromiser. He did not

have a definite program of artistic ideals that he tried to pursue, but he did what the public wanted and thought it right to do so. For a few years he was the rage all over Germany; he was the leading young painter. But he had two great faults. In the first place, his taste was not impeccable. He did such things, for instance, as persons in action. Now, that is a mistake always because they cannot stay in action. You can paint them as well as a photograph, so accurately, but it still won't be an artistic painting, you know; it has something wrong in it. There were several of his paintings in the modern art gallery of Munich. But his fame didn't last. The paintings are hung somewhere in the storage room, and the name Stuck is hardly remembered.

Now, Klee was, in spirit, just the opposite of Stuck. He had theories, an artistic program, which he had worked out for himself, and he was absolutely uncompromising and incorruptible. And when Stuck told him that you must make sacrifices to the public, you must give the public what it wants, otherwise you won't have sales, they parted ways. He went away from Stuck. But by that time he had married and married a very fine woman. She was a pianist—no great shakes as a pianist, but a good teacher who had plenty of pupils on that score and was really now the breadwinner of the family. So that was the situation when I became acquainted with Klee.

When my wife came back, which was a few months later, in the summer, they met, of course. Mina was a professional; she had a fabulous technique on the piano and was a concert artist. But that Klee woman, the wife, was not in that class at all; she was of a very much lower artistic capability. But she made the money, and it didn't come easy to her either. I remember how she often complained to me of being very tired. Sasha, Alexander Eliasberg, recommended to her cola tablets. They are not seen here much, but they contain caffeine in a particular form, and they act like coffee, waking you up. And she said that saved her life. Now, she was also an ambitious woman in her way. Munich was not a musical city. While in Moscow there were literally dozens of first-rate pianists, and at least a half a dozen first-rate violinists, in Munich there wasn't a single outstanding pianist, and no outstanding violinist at all. So that to have lessons from an authority was impossible in Munich, and she traveled once a month to Stuttgart to have a music lesson from a famous man. Stuttgart is four or five hours by train. It is quite an undertaking to go there and back, but she did it. Once in a while, she gave public recitals, for advertisement only, so that the parents of her pupils would see that she was really a pianist. The first recital which I attended she gave with a local violinist, a second-rate violinist, but not bad.

While she was working with her pupils, Klee, her husband, attended to the domestic affairs—what the wife usually does. And that is when I knew him first. I usually came there together with the wife of Sasha, Alexander Eliasberg, who was a close friend of Klee and an artist herself. We dropped in on Klee and talked to him. One marvelous thing Klee did to entertain his little son—he had a son of six or seven years and no children's maid, of course—he made little statuettes out of gypsum. He stirred up the gypsum with water and when it was still plastic and not hard, which takes only a few minutes, he shaped the statuette and it was really a complete work of art. Wonderful talent, he had such clever fingers. In a minute, there was a man with an expression of face and everything that is necessary.

Well, when Mina came, she, of course, met the Klees. She wasn't particularly interested in the wife, whatever her name was—I forget—but Klee himself was a violinist of outstanding merit. He was perhaps the best violinist in Munich, but he gave no public appearances. He said that it was hard enough to conquer the indifference of the public, and if they heard that he also gave concerts on the violin, they would set him down as a musician, not an artist at all. But Mina tried to have chamber music in our apartment when she could get the people to play, and Klee was often a member of this quartet or trio. It was mostly a trio because she played the piano. There was a pretty indifferent cellist, which she found somewhere. In that way, I came to know Klee pretty well. He had not yet found himself as an artist. He was too theoretical in his thinking and did some etchings of a symbolic kind. In the book about him, some of his early etchings are reproduced. That is all that I knew of Klee in Munich at that time.

Now, this had nothing to do with my acquaintance with [Franz] Marc and [Wassily] Kandinsky, which was quite separate. I think that I got to Marc through Laue. You see, Marc had an older brother who was privatdocent for medieval Greek. There was a professor of later, classical, medieval Greek in Munich, and Marc was a main assistant and manager of the colloquium he had there, a Greek colloquium.

Laue was, at that time, a young man yet unmarried, and he was a boating enthusiast. He had a very beautiful boat of mahogany, polished and with plenty of gilt, and kept it on the Starnberger See, which is not far from Munich—it's half an hour by train. But there was very rarely wind on the Starnberger See, mostly we were becalmed, or had to wait for gusts, so that the progress on the boat was very, very slow. And he invited people to sailing parties; that is, he took them on the boat from one point where he kept it to another and back again—if they had the

patience. At one of these parties I met a young man named Davidson, who was a member of that Greek seminar. As he was my neighbor, I came to know him pretty well, and he introduced me to the elder Marc, or maybe Laue introduced me, I can't remember. Anyway, I met the elder brother, who was married already and had an establishment. I think he was Karl Marc. Through Karl Marc, I met his brother the artist, who was Franz Marc. And I became a member of their bowling club also.

I forgot to tell you that in addition to the *Stammtisch*, the physicists had another organization, namely a colloquium. Sommerfeld had already a colloquium which he had taken over from old times. He had a nice lecture room there, not very large, in which he gave his lectures to these special groups. The big lectures—the freshman lectures and so on—were given elsewhere because there was no room for hundreds of students there. It could take about forty men, but not more. The Sommerfeld colloquium met once a month, but Röntgen had his own colloquium independently. When Debye came to study the setup, he told Sommerfeld that one colloquium a month is not enough and that he will found another colloquium for young members of the staff; and he did, and that met every week, every Tuesday. The hours were different from what we were accustomed to in Moscow. After the colloquium, we usually went to a restaurant to have supper. Sommerfeld also became a member of Debye's colloquium there, because he saw an opportunity to learn some physics. And after supper, we bowled. There was a bowling alley in that restaurant, a very good one. We were quite independent there, in that we bought a keg of beer holding about nine or ten liters, and we drew our own beer. We bowled and drank beer.

[Tape interrupted]

EPSTEIN: Duprel [name unverified but identified later as Röntgen's assistant] was very good at bowling and knew a lot of variations to the game. It was nine-pin bowling, not the ten-pin as here. I became a pretty good bowler then—had my specialties.

Now, those Greek people, the Marc seminar, had their colloquium on another day of the week and also went bowling. They had not a steady place, but changed from bowling alley to bowling alley, and none was really as good as that we had. I don't know why they didn't use that, but ours was a pretty difficult one. You had to be a good bowler to start there even. I did

not directly join their bowling games, but I often was a guest there, and so was Franz Marc, the brother of Karl Marc. Karl Marc was the head of that colloquium. I think that was the place I met Franz Marc first, at the bowling alley. He was not married yet and I saw both brothers pretty often. I remember once Marc showed me a place which was the original farm of his great-grandfather, who first settled in Munich. And he said that they were actually Americans. This great-grandfather of his was an envoy to the court of Bavaria, a diplomat who came on a mission to Munich as a representative of the American government—it was not yet a government, I think. When his mission ended, he liked Munich so well that he decided to remain there, and bought that farm and settled down. So that they were men of American extraction. In those years, I saw him pretty often, the artist. But a few years later, he married and lived in the Isar Valley, not far from Munich, and it was not so convenient to reach him. So from then on, I saw little of him.

[Tape interrupted]

EPSTEIN: I told you about Klee and Marc. Now, as to Kandinsky. I did not know him well; I had just met him a few times. He was also drinking coffee often in the Hofgarten when he lived in Munich. He had become a married man with a very rich wife. But he got tired of her, apparently, and they separated. Well, she took the money away, or he had some money, too; I don't know. Anyway, he didn't stay single for long; he teamed up with a woman who was also a painter, an artist of sorts [Gabriele Münter]. And whether they lived in a wild wedlock or had the legal connection, I don't know. I think they were not married, at least when I met him. Somebody introduced us, possibly it was Sasha—that is, Alexander Eliasberg—in the Hofgarten Cafe.

So the situation remained until I received an invitation to attend the foundation ceremonies of the group of artists called the *Blaue Reiter*—the Blue Horsemen. There were not many of them; it was Marc, Kandinsky, the wife of Kandinsky, and two other Russians, all progressive. Well, it was really a sale of pictures. They wanted to collect some money to start the group going, the *Blaue Reiter*. It was all in somebody's apartment, and it was poorly prepared. There were no money bags there, no rich people to bid and buy the pictures. In fact, all they had was myself, and a man called Ritzler [?], who was the director of a picture gallery.

He was an historian of art. And he was there, ready to bid, but he hadn't brought much money. The Russians also invited the secretary of the Russian legation, who was a nephew of the prime minister of Russia, but he was not interested in modern art and didn't bid. So that the bidding was mainly between me and Ritzler. Ritzler hadn't much money. I didn't have either, but more than Ritzler had. So that when the auction started, I got away with two of the best pictures, which I considered the most interesting. I bought them and a third picture, which was less outstanding but quite nice, for a ridiculous, low sum. I think the whole thing cost me three hundred marks or something like that.

That was, of course, a disappointment to them because if Ritzler had bought one, they would have a Kandinsky or Marc picture in a public gallery, and that was much better than to have that picture in my study. Anyway, the frame of the Kandinsky picture was not quite appropriate, it was some dark color that deadened it. And Marc just got out white oil paint and painted the frame over there and then, and that immensely improved the looks of the picture. I had them hanging in Munich, first in my rooms, and later in the apartment which I rented for a number of years, and enjoyed them very much. I had, already, some pretty good pictures, which I had brought from Russia—bought in Moscow, by Russian artists—so that I was outfitted pretty well as to possession of art. Unfortunately, when I moved away from Munich, all these pictures were stored in a warehouse which burned down, so that the pictures were lost. It is very regrettable because I judged that this Kandinsky and Marc would be worth $10,000 each today.

I also made the acquaintance of [Alexei von] Jawlensky, who was a Russian artist. I don't know how long he had been in Munich, but we occasionally met in this same Hofgarten, though in a different cafe from Lutz's. I never got to know him well, but I knew him to some extent. He was living in sin with a woman—a Russian, too, and an artist—called [Marianne] Werefkin. Quite ugly. The reason was that this Werefkin received a pension from her father, who had been an official of some sort. Russian pension law is that after the death of the official, the children are entitled to receive pensions—the daughters until their marriage, the sons until their majority age. So that as long as this Werefkin remained unmarried, she received the pension. That was an important item in the budget of the Jawlenskys, so they didn't marry. That's, incidentally, a very common occurrence in Russia, this non-marrying because of pensions.

The other Russian member of the group I do not remember by name, but he was pretty

good. He had pictures of Paris, since he had lived in Spain and in France before. They were good pictures, though maybe not as good as Jawlensky or Marc. The German was also a good artist, and of all the men there, he was the only one with some money behind him. The others lived from hand to mouth, just what they could earn, which was pretty little. Klee was not a member of the group from the start. I don't even know whether he was acquainted with any of them. But he became a member later, or perhaps a member of the other organization into which this *Blaue Reiter* developed eventually. Anyway, you'll find the *Blaue Reiter* mentioned by historians of art everywhere.

MRS. EPSTEIN: They had a quite good collection in the Pasadena Museum. Did you know Galka Scheyer, who collected these?

EPSTEIN: Oh, yes. I knew her.

MRS. EPSTEIN: Was she about at that time?

EPSTEIN: No. I don't know if she ever was in Munich. She collected them in San Francisco, or New York; I don't know. Yes, she had a good collection.

MRS. EPSTEIN: Jawlensky has beautiful portraits or pictures of heads of women. Those are the ones which she has in the Pasadena Museum.

EPSTEIN: That is then some of my contacts with artists, but not the only ones. I also met a man called Melchior Palyi, a Hungarian. He was a teacher in the school of business administration—they called it there an academy of trade. Palyi was a man of initiative and very active. Together, Palyi and myself founded an interdepartmental seminar, like the seminar which I had later here. We met in the lecture room of the school of business administration—not every week, but once in two weeks maybe—and the lectures were provided by Palyi and myself. It was an interesting undertaking. Palyi had with him his mother and sister, his father remained in Hungary. His father was a newspaper man. The sister was Flora Palyi, that girl whose pictures we have hanging in several places. I got friendly with them all; the mother liked me very much, Mrs.

Palyi. I think the mother would have liked me to marry this Flora, and Flora was not adverse to it either. But I was married then; I had no legal right to marry again, so that was out of the question. But they were interesting people and I saw a good deal of them—both the mother and the daughter and, of course, Melchior. So that Palyi was a third artist, that Flora Palyi, and she was indeed a fairly good artist.

Among other people, he brought a learned Hungarian historian of the name of Palagi, who gave us a lecture in this interdepartmental seminar. A very long lecture he had; he couldn't say anything shortly. Also, we had a psychoanalytic lecture by the only practicing psychoanalyst in Munich, which was a certain Dr. Zeiss. Later, when I had these depressions and heard about psychoanalysis, I went to him as a patient.

Now, in addition to this *Stammtisch* of the physicists, I joined other *Stammtisches*. There was a group of philosophers and other young men, whom I met through Alexander Eliasberg, that met periodically. But I wasn't much impressed by the philosophers. Most interesting among them were two, one was Dr. Levin. He was actually in the army but had been relieved of duty temporarily because of poor health. The other was a young man called Löwenfeld. Dr. Löwenfeld was the son of one of the best psychiatrists in Munich. He lived not in his father's house but independently, and we met first at this *Stammtisch*. Later, when the philosophers became too tiresome for me, we founded a *Stammtisch* of our own in another cafe. This was Löwenfeld, Levin, myself, and Dr. Dreyfuss, who was on military duty, too, a medical officer. Now, what is interesting is the following. Dr. Levin, as it turned out, was a socialist. He was brought up in Russia, and his father still lived in Russia, but he was a German citizen and a student in Switzerland. When the war broke out, he was inducted into the German army. He was not only a socialist but a communist, though at the time "communist" just wasn't used, wasn't common. And later, after the war, the government of Bavaria was seized, for a short time, by the communists, and Levin was the head of that temporary government. By that time, however, we had ceased our acquaintance and I practically didn't know him—at least I didn't emphasize my former acquaintance with him.

Löwenfeld later married a girl called Blau; what her given name was, I don't know. They got divorced and then he married my second cousin, the daughter of Leopold Lurie of Vienna. However, they didn't get on well because he was not quite a normal man, that Löwenfeld.

[Tape interrupted]

EPSTEIN: Well, so I left Munich then in February, after a very long wait for the visa in Switzerland. They were very careful whom to let in, foreigners especially, because they felt they were overcrowded and not enough food for everybody at that time. But I can say it had just turned; that is, I had all I wanted, and milk and food. While in Munich, I practically was on hunger rations and was completely emaciated and thin. And in Zurich, I filled up again. And about Zurich I have spoken at length before. So that was essentially the story of Munich. If you want to know something more, then ask me a question.

[Tape interrupted]

MRS. EPSTEIN: Well, you were in Switzerland.

EPSTEIN: I finally settled matters with my marriage. That is, I got a divorce. The main reason why Mina didn't give me a divorce before was that she was greedy. She wanted a lot of money. But now I had no money. The money was nationalized, and that question settled itself automatically. As I found out, she was then in London. She had fled before the outbreak of the war and subsisted somehow. Well, she opened a boarding house in London. She hadn't much brains, but apparently she was capable of managing it. When I got her address and I wrote a letter and proposed to have a divorce, she agreed. Jewish divorce is, as you know, on mutual consent; there is no other ground. And the rabbi of the place where the husband lives has to write the letter of divorce. I went to the rabbi and explained things to him, and he said, "All right, I shall do it." And he then wrote his letter, sent it to the London rabbi who got in touch with Mina and got her agreement. The Jewish divorce was now settled. That, of course, had no validity for the Russian courts. In the old times, there was a special, so-called state rabbi, who was actually not a rabbi at all but a manager of vital statistics for the Jews. And he just endorsed it and then it was finished. But now with the Bolsheviks, who abolished religion in Russia, the only thing that could be done, and was done, was that Mina went to the Russian legation—there was a communist legation in London, where in Zurich there wasn't one yet—and registered herself as divorced. And that was the end of the Russians. So there was a formal divorce then.

But it made little difference for the time being, because I had no intention to marry anyway. So that was one finished matter in Zurich.

I told you how I got from Zurich as an assistant to Lorentz, yes? And stayed in Leiden, for a time, until Millikan brought me to America? And there is where I stopped last time. That is, I arrived in Pasadena and met Watson, Bowen, and others. These were my future listeners, the students.

MRS. EPSTEIN: You mean Bowen was a student?

EPSTEIN: Bowen was a student, yes; he was a graduate student. They were all graduate students and enlisted in my course, and a few of the local men who had graduated from Caltech also. And for good measure, some of the instructors also listened in. Anyway, it was a small audience, but sufficient and appreciative. I had maybe ten listeners, and I had to start lecturing immediateiy. The California Institute was a comparatively small place.

Perhaps it is appropriate to say something of the history of the California Institute, how it came into being, and of the form in which I found it.

[Tape interrupted]

EPSTEIN: The plans for Caltech came from George Ellery Hale. George Ellery Hale was an astronomer who found himself isolated and wanted an institution of higher learning out here. The nearest was the University of California. The Los Angeles division wasn't much, had no great attractions, and couldn't be regarded as an institution of higher learning in this sense. But there was, in Pasadena, the Throop high school, founded by Mr. Throop, who was still alive and kicking [Amos G. Throop died in 1894], and the plan of Hale was to develop Throop into an institution of higher learning. So he got a charter from the appropriate authorities in Washington for an institute of technology. He decided to call it the Throop Institute of Technology. As president, they chose a man called [James A. B.] Scherer, who was actually a preacher, and not much else. Some of the professors were from very old times already; they had belonged to Throop high school—[Clinton] Judy, for instance. Judy was considered for its first president, but he somehow didn't give it prestige, and so they took Scherer. Then there was [Royal W.]

Sorenson, who was early, and [Harry Clark] Van Buskirk, a mathematician. I don't know whether [Robert L.] Daugherty was there or not, but [Frederic W.] Hinrichs was. As the trustees, they got local rich men. In the first place, [Harry] Chandler, who was the son of Otis, the editor of the *Los Angeles Times*, and an important man in Los Angeles himself; he soon stepped in Otis's shoes. Then they had Norman Bridge, a friend of [Edward L.] Doheny, who had scads of money. And as chairman of the trustees, they got Arthur Fleming.

To actually do the development, Hale and Scherer got [Arthur Amos] Noyes. Noyes had been acting president of MIT, and it was supposed—and it was the case—that he knew all about an institute of technology and how to run it. Noyes became a close friend of Hale's. And they pursued a somewhat strange policy; namely, they were telling to the world that the Institute was rolling in money. They thought that that was an advantage, and everyone believed them. The truth is that they had very, very few commitments. That is, the definitely promised money was Fleming's own.

Fleming had a lumber business and owned some forests near Yosemite reservation and produced quality woods for furniture and other such things. There was a lot of sugar pine on his lands, and there was an income of about $100,000 a year, which was handed over to Caltech. That was definite money that they had. Then they had only promises. Norman Bridge promised to provide for the Institute in his will—at least a million or two, it was expected—and in the meantime, he gave them sums irregularly. For instance, he gave them the money for building the Norman Bridge building, and also a fund for the library, the library of Norman Bridge. And that's all they had. So that there was a discrepancy. Everybody thought it was a very rich institution, but really, it was quite inadequately funded.

That characterized Fleming all through. He had made his money himself, was a very successful man, but was a muddlehead actually. In his own business, he also pursued two policies which were mutually contradictory and excluded one another, namely, on one hand, he invested heavily in an improved plant for treating the wood that was near Fresno somewhere, and on the other hand, he was a public spirited man, and he decided that such valuable forests and lumberlands should not be owned privately, that they should be a government reservation. He brought his very considerable connections and influence in motion in Washington to enlarge the Yosemite reservation and take in a new tract. Now, in this he was quite successful. It was accepted by the Secretary of the Interior, and that was the large Yosemite Valley reservation—

nobody knows, at present, the border between the old and the new; it is one thing. But that actually put his new plant out of business, because all the sugar pine in that tract that the government now owned couldn't be cut. So that there was a very well-equipped plant with nothing to do. And while he had had a considerable estate before that—the plant alone cost him a million and a half to two million—now his estate shrank to nothing. And the Institute income was wiped out with it. Instead of getting $100,000 a year, they found that they still had a mortgage on that property which he left them. So that, actually, they had not only no money, but they had a considerable debt of half a million maybe. Fortunately, Fleming died about that time. You met him, yes?

MRS. EPSTEIN: Oh, yes. I was at his house when Einstein came.

EPSTEIN: But he died soon afterwards. His daughter, Marjorie, was very well off herself. She had married a rich man, a lawyer, and she thought it right to pay that mortgage so that the Institute, at least, was free of that.

Fleming had his business, such as it was, right in the Throop building. He occupied the three rooms next to Millikan's office, which were quite richly outfitted, with fine rugs and good file cases and so on. His brother Clarence was working for him. There were several Fleming brothers, mostly successful and rich people, but Clarence was not one. So Fleming made provisions for Clarence and Clarence's daughter while he still lived, so that when he died, Clarence had no worries—at least was provided for. Also, the Norman Bridge Library was in Throop Hall, in one of the back rooms.

They started graduate instruction in 1913, I think—that is, they got a few professors, among them [Harry] Bateman. But the big advance was only after Noyes came in 1917. Noyes brought with him some young men instructors: [James H.] Ellis and [Roscoe G.] Dickinson. Now, the question was to replace Scherer, who was theoretically still president, though he went to Japan and lived there with somebody. Hale thought of Millikan. He had worked with Millikan during the war and found him a very good worker and a pleasant man with whom he could get along. So Millikan first came on a temporary basis; he spent a few months every year in Pasadena—I think that was from 1917 on. And then, finally, he made the big move here. He pulled up his tents in Chicago and went to live in Pasadena. That was in the fall of 1921, when I

came to Pasadena, too. So I came at the same time Millikan took over his duties, and he was now chief executive.

He didn't want the title "president" because, in fact, he was much more than a president. He went personally into every question and had power, which rarely a president has in other institutions.

I told you there were a few good men in Pasadena among the old instructors. And a few new ones came in that year together with me. Among them was [Graham A.] Laing, for instance. At the first meeting of the faculty and student body together that they had—which was in the open on the steps of Throop Hall—the new professors were introduced. Bateman was not there; he had been on a trip home to England and came back a few days later. But Laing and I were introduced as new members of the faculty. I also met Judy then, for the first time, and some old timers in the physics department. The head of the physics department was Professor [Lucien H.] Gilmore, and then there was [Walker T.] Whitney, a pupil of Millikan's from Chicago. Whitney was a local man; he owned some property in Claremont and some orange groves, which became very valuable later. For that reason, he went to the California Institute.

I came as professor of theoretical physics for a year only, on an experimental basis. Now, for this yearly visitor, [Millikan] had some endowment. I don't know where it came from exactly, but it was decided to make that a permanent feature, that is, every year to invite a distinguished physicist from outside—from Europe in the beginning. I knew I had a job for a year, but if, after that, I would remain in America or go back to Europe, I didn't know. And I was looking around. You see, here it is the policy not to tell people anything as long as possible. So I wrote, for instance, to Berkeley, whether they could take me on for the next year. And they answered that they shouldn't like to disrupt the faculty of Millikan's; a good neighbor policy didn't permit them to take me. With that, I went to Millikan, and he said that it was a permanent appointment. From this time on, I was on the faculty as professor of theoretical physics. I had no contract, no tenure, no nothing—just the word of Millikan.

But the guest professorship would go on the next year, when I was professor. The second man who came was—I don't remember whether it was [Hendrik A.] Lorentz [Lorentz came in 1921-1922, Epstein's first year at Caltech] or [Charles] Darwin—I think it was Lorentz the second year. It was, of course, a very great honor to have him here. He gave a course of lectures on some problems of modern physics. Lorentz spoke one hour, and I spoke the following hour

always. So it was a two-hour affair and pretty taxing to the listeners. A lot of listeners came—all the astronomy field. Lorentz's name, of course, was a drawing card. Hale Observatory had nothing to do with Caltech formally, but they were on friendly relations, and many of them came to our lectures.

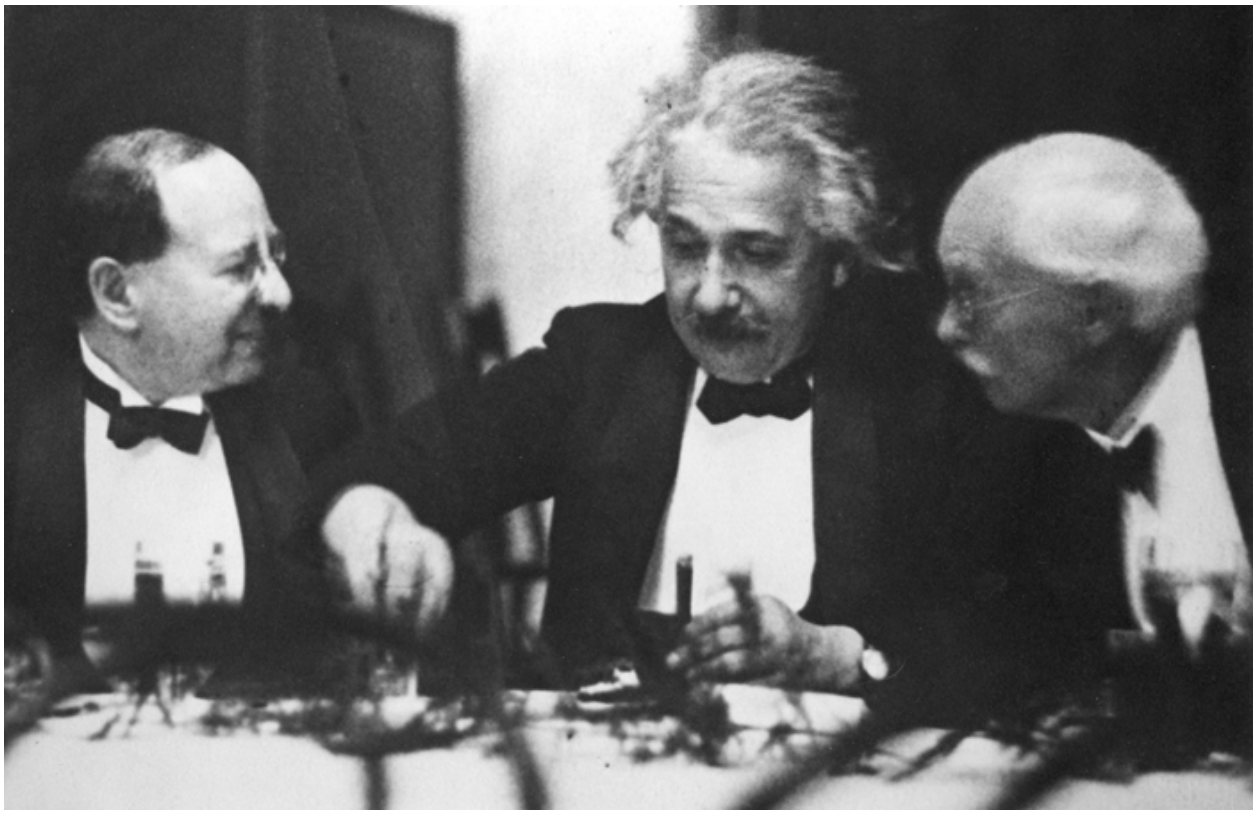

Fig. 5. In 1930 Millikan invited Albert Einstein to be a distinguished visiting professor at Caltech. Einstein arrived in time for the formal opening of the Athenaeum in January 1931, where he sat between his old acquaintance Paul Epstein and the astronomer Charles E. St. John.

We had, also, monthly research conferences jointly with the astronomers—that was already in operation when I came here. The first Friday of every month was a research conference—one time in Caltech and one time in the main observatory building on Santa Barbara Street. The members were the astronomers and the members of the physics institute. Now, it was very nice to have that, but it was entirely insufficient. We needed much more in the way of a colloquium, or research conference, or whatever you call it. The hours, to me, were also inconvenient. It was a last hour of teaching, from five to six, when everybody was tired out already. There was no time left for discussion; at six, most people had to go home. I was accustomed to having the colloquium in Russia and Germany where they could talk after the formal presentation. In the first place, they were two hours, not one hour, and in the second

place, we could talk long after the formal two hours. Here you couldn't. But Millikan said that it was not the American way; the wives want their husbands at home in the evening and not doing science. [He] suggested, since I insisted on two hours, that we have two sessions a week, two one-hour sessions. This was a difficult matter, because we had to find speakers for two times instead of one. In the beginning, Millikan was even the chairman of my two research conferences, so that I wasn't worried with that.

It was enough for me, with my poor English, to start lecturing almost the very day I arrived. I knew some English, as I told you—I had even been to America before—but it was not a practical knowledge. You must remember that I studied English intensely when I was in high school, which was many years before, so that much was completely forgotten. And in the second place, I never got to speak much. Even during my trip to America, it somehow always turned out that the persons I had to deal with spoke some other language. I understood when women spoke, because they spoke more distinctly, but not men. That didn't matter for lecturing. But what did matter is I didn't know the technical words. There are a lot of words used in science which are not of common usage and which I didn't learn in my time, and I had to find out all those words. So that this lecturing an hour a day in the first weeks was a rather heavy chore, because I had to do two hours preparation with a dictionary to find the words I needed, before I could start. But I got the hang of it in a few months and had no difficulty afterwards. Now, my lectures found approval from the start. The students found them interesting and helpful and clear, which they were, if I do say it myself. I am naturally a good lecturer. And I understand what you can tell people and what not, what they will understand and what they will not understand.

So that was behind that decision of Millikan's. Millikan knew all the time that he needed a permanent theoretical physicist. But he did not know if I was the man, whether I could lecture. But it turned out that I could, so for that reason they retained me.

In the beginning, I shared my office with Millikan in Throop Hall. He had the president's office, which DuBridge has still [Lee A. DuBridge, Millikan's successor]. It was a large room in which there was a second desk installed, and I sat at that desk. As I told you, I lived on Madison Avenue near Colorado Street and walked every morning from there down to the Institute, which was a good walk. It took me about twenty minutes to arrive and I came usually at half past eight or so. Millikan came a few minutes later. We had quite a peaceful and happy time together.

Very soon Millikan had his wife there. I would say family, but, as a matter of fact, Clark was in Yale; and his second son, Glenn, was away at school. Only the youngest, Max, was at home.

Millikan had Sunday mixers. That is, every Sunday he received people in the afternoon. In the first year, I went there pretty regularly. Most of his students came; also, some people of the town, and trustees. It was a place to meet the Pasadenans and become acquainted with them. Mrs. Millikan was also a gracious hostess, and even when the students bored her, she didn't show it particularly.

So, I lived there in that house on Madison. I rented a good room from an old woman called Mrs. Sandeman. She was eighty years old, but lived with her married daughter, Mrs. Peterson, and her grandson—Faraday Peterson was his name—a very nice boy. The name Sandeman should have a familiar ring to you for the following reason: there was a Sandeman sect in England, a branch of the Methodists. The great physicist Michael Faraday was a lay preacher of that sect, the Sandemanites, and was married to the sister of the founder of that sect. And that woman was a daughter of Sandeman, so that Faraday was her uncle. And therefore, her daughter named the little boy Faraday. So that I blundered there into some physical history. She told me about Michael Faraday, how she listened to his lectures and thought what a fine man he was. There are still Sandemanites in England. This woman had a son also, who didn't live in Pasadena but somewhere else in California. So that there is a Sandeman family still going here.

[Tape interrupted]

EPSTEIN: It was Hale and Scherer—the president whom Hale had appointed—who selected the first board of trustees. And the trustees looked good, but they were really a little soft in their brains. About Fleming I already spoke, how he actually squandered his money so that the Institute got nothing but debts. Then there was Norman Bridge, who also looked good on the face of it. Norman Bridge was a physician, had been a professor at the Rush School of Medicine—I have an idea it is in Chicago. He was a specialist for tuberculosis. Because he had himself a touch of tuberculosis, he was continuously in danger of getting it.

Well, he retired from Rush School—whether he retired for reasons of health or age, I don't know, but he retired—and came to Los Angeles to live. He had no wealth then, but was reasonably well off. He set up in practice for tuberculosis and had considerable success as a

doctor in Los Angeles. While in Los Angeles, he somehow struck a close friendship with Edward Doheny, the oil man, and engaged in speculation in oil stock. On the tips of Doheny, he made very great profits, and in a few years he amassed a fortune amounting to about seven million dollars. He was good as a trustee for the university for two reasons: In the first place, he was himself a man of science and knew what Hale wanted, what research was, and what the ideals of the Institute should be. In the second place, he had some money to give. In fact, he told everybody that at his death his will provided for the estate being divided into five equal parts for five local institutions, of which Caltech was one. By all estimates, Caltech was expecting one and a half million from that inheritance. In the meantime, he also gave Caltech lesser sums. For instance, he paid for the Norman Bridge building of physics. I do not know whether he only paid for the first half, which was the only one finished in his lifetime—and where my office was—or for the whole thing. Anyway, he gave there a pretty good amount of money. And he also handed over to the Institute a library fund of $50,000.

Now, so far so good. Only he had forgotten one thing; namely, that some ten years before—I don't know exactly when—he had had a quarrel with Throop and was very highly insensed with him. And at that time, he cut out the Throop Institute from his will. That is, he changed the will so that the fifth assigned the Throop Institute went to another institution and the Throop Institute was left with nothing. Now that had completely slipped his mind, and he told everybody that the Institute was one of the five and will get one-fifth of his inheritance. He had a very fine house on West Adams Street, not far from Main Street. It was one of the most desirable locations in town; all fine and elegant houses were there on West Adams.

When he actually died, it came out that the Institute was left with nothing, received not a penny from the estate. That was a great disappointment. He was a doddering old man who just didn't remember things. It didn't occur to him to look at the will once in a while and see if everything was in order. Mrs. Bridge, who survived him and who was provided for in her lifetime, pretty independently of the will, felt so badly about it that she tried to correct it to some extent. In her own will—she died a few years later—she set down the Institute for $300,000. So that indirectly the Institute received something.

Then there was "Harry" [Henry M.] Robinson, a trustee who was almost as bad as the other two, though he was considered a financial wizard. He was director of the Pacific First Bank, I think it was called. It is now Security First National.

MRS. EPSTEIN: He was president of the First National Bank, which merged with the Pacific Southwest.

EPSTEIN: Yes, he was some important man in there. I think he was a founder, too. Anyway, he was considered a very sound man with investments, and that turned out to be not the case. The investments which he made for the Institute invariably turned sour and lost money. He didn't hurt the Institute any because the Institute had nothing to invest; it was a meager time without any funds that could be invested. But he badly hurt the Huntington Library. He was also appointed a trustee at the Huntington Library after Huntington's death; and there he really did great damage and reduced their endowment very considerably, so that it was not the rich institution it once was.

There was also a trustee, [George S.] Patton, a lawyer, the father of General Patton. He was a vain man, a show-off, who liked to make the impression of a very learned and distinguished man. Apart from that, I don't know much about him—though I had dinner with him and the others several times at Fleming's.

Harry Chandler I already mentioned. He was a good trustee but he never gave the Institute any substantial sum of money, because he had other institutions to interest him.

Robinson did a great deal of entertaining. He had a fine house in Pasadena and received the trustees and members of the faculty, and so on. And Millikan encouraged me always to join the crowd, to be one of the mixers at the Robinsons', get accustomed to the trustees and other important people of Pasadena. But I didn't. In the first place, after having a few tastes of them, I found them very dull people and uninteresting to associate with. In the second place, I didn't see where I could get the time for it. I was giving a lecture course, and I had the language difficulties, which cost me hours every day. And I was doing research. It was a question of either I play around with Robinson's guests, or do my research, and so I did not join the Robinson crowd. But [Adriaan] van Maanen was one friend of Robinson's, who visited him very frequently. And van Maanen was liked as a companion. He was considered good company; he was a talker, and he was good with children. He liked children and played with them as if he was a child himself. Van Maanen discreetly tried to approach Robinson on the question of investment several times. He wanted to make profits himself. But here, Robinson

had some principles. He said that a private person not in business should not speculate; he should have very solid stock, which would go up and down and be contented with that—which is a very good idea.

There was around a Captain [Paul] Perigord. Captain Perigord was a Frenchman, an ex-priest. I do not know whether he was a Jesuit or some other denomination. After his consecration as a priest, he was sent to America by his ecclesiastical superior to learn English and to serve the order in America. In that capacity, he entered an American university—I think it was either Illinois or Wisconsin—and graduated from the university. At that moment, the war broke out, and he was drafted into the French army and served the whole war as chaplain of a regiment. He became disappointed with religion after the war—he was poor material for a priest; I wonder why they insisted on his being that, anyway. He was a vain man, pretty good looking, and he liked to show off, wore elegant blue uniforms. He somehow got onto the Caltech faculty as professor of history. I listened to a few of his lectures and found them excruciatingly dull, though he was an excellent speaker as far as the choice of words, and so on, is concerned. That's why I listened to the lectures, to learn English expressions.

Now, Robinson's was just the place for him. He wanted to marry a rich wife. He made there the acquaintance of a Miss McBridge, the daughter of Dr. McBridge, who was the physician of Hale and many other persons. So he played tennis with her, and courted her, and after a short time, maybe six weeks only, he proposed and married her.

At that time, he also worked on his doctor's thesis. He asked Laing to read over his thesis and see whether everything was okay. Laing did it, and what he said I don't know. Maybe he suggested a few changes, but, on the whole, the thesis was good enough. He submitted it then to Wisconsin and obtained the doctor's degree; and from then on, he was Dr. Perigord, no longer captain—captain was only a courtesy title, anyway. Being a doctor now, he had, of course, pretensions for a better position and got it in UCLA as professor of French civilization.

PAUL S. EPSTEIN

PART IV: RÖNTGEN, SOMMERFELD, AND OTHER GERMAN SCIENTISTS

EPSTEIN: Well, the first man I want to talk about is Röntgen. [Tape scrambled] He attended the high school in what the Germans called "Marselle," the French Marseilles. His high school record was not outstanding, because he was a very independent spirit. Many of his teachers didn't like him for that reason. One teacher there disliked him so much that when the time for final examinations came Röntgen did not get the certificate of maturity that entitles you to get into universities. Now he was greatly distressed, and his parents were also anxious, but somebody told him that the Zurich Polytechnic, the technical university, has an entrance examination, and those that pass the entrance examination can enter without the certificate of maturity. And that is what Röntgen did. He went to Zurich, passed the examination there and was entered a student at the polytechnic.

He was an independent spirit, and before long he found his way to the political exiles of 1848. You remember, it was about right for his years. Among his friends of the political exiles, he had a friendship with the daughter of the tavern keeper where they gathered. He got engaged to this girl, and before long she became Mrs. Röntgen. Now, when they finished this course in the polytechnic, he went as an assistant to Professor Kundt, a famous physicist. I am not quite sure whether Kundt was a professor at Zurich first and Röntgen became his assistant right there or they went together to Strasbourg. And Kundt was the professor and Röntgen was his main assistant. As such he has many, many merits to his credit. Kundt and Röntgen started the accurate

Fig. 6. Wilhelm Conrad Röntgen.

experiments school of experimentation. Before that, experiments were produced in a rather haphazard way, hit or miss, so to speak. From Röntgen on, it was a strict, logical, scientific activity. In particular, he investigated the properties of gases. He was greatly interested in the properties of gases and the properties of electric discharges. Kundt then went to Würzburg, which was a larger field than Strasbourg, and Röntgen went with him, but there was some red tape, so that Röntgen could not take the appointment. So he went back to Strasbourg and continued his activities. Kundt got the invitation to be professor in Berlin from Würzburg, which he of course accepted.

MRS. EPSTEIN: Kundt went to Berlin.

EPSTEIN: Yes. Würzburg was then the city where Röntgen worked on his specialities and eventually became world famous, namely, by discovering in 1895 the röntgen [i.e. X] rays. He worked on this great discovery for three years, investigating the property of the rays he had discovered in a very complete fashion. Then he received the invitation to come to Munich as a professor. Now, I am a little ahead of myself. The invitation to Munich came considerably later. He came to Munich maybe in 1898. Once in Munich, he started, in his fashion, to remodel the University of Munich. That is, what he wanted in the first place was a successor [to Ludwig Boltzmann]. He was the University professor and member of the Bavarian Academy of Sciences, and his laboratory was in the Academy building, a large, roomy building next to the Michelstrasse, not at all where the present or the later university was located. Boltzmann had been professor in Munich and a member of the Academy. He was a Viennese and did not particularly like it in Munich and had a sick wife there. Boltzmann had very peculiar habits; he kept in his laboratory building a cow to have good milk for his ailing wife. So the succession of Boltzmann was a prime concern for Röntgen. He wanted to get Lorentz, who was the most famous theoretical physicist, to take Boltzmann's place. But Lorentz, after talking over the proposition with his government and the University of Leiden, declined, because he already had everything he wanted and that was as much or more than the Munich Academy could offer. So he pointed out to Röntgen a young man named Sommerfeld who, according to Lorentz, was the coming man of whom great things could be expected. After a time, Röntgen decided if he couldn't have Lorentz, he would take Sommerfeld and started a campaign at the ministry in

Munich. Now the minister was completely satisfied with things as they were. You see, they hadn't really much money, and the salary to pay him was assigned to different matters. They were not very eager to have a contract by which they were obliged to pay Sommerfeld every year but, in the long run, they agreed to the importunities of Röntgen, and Sommerfeld was appointed in 1896 or '97. That turned out to be a very great event for the teaching of physics in Munich, and Röntgen used to say that bringing Sommerfeld to Munich was perhaps the greatest service he could render to physics in Munich. Sommerfeld first was also in the big, gloomy barn of the Bavarian Academy building, where his neighbor was another old Academician, Groth, the great crystallographer. He took over an old monthly meeting, the so-called Sohncke Colloquium. [Ludwig] Sohncke was the crystallographer, a predecessor of Groth, who founded this. Eventually, Sommerfeld was transferred to the new university building. Anyway, Sommerfeld felt that he was, by education, a mathematician and not a physicist at all and had to learn physics. And he brought with him his own assistant from Aachen, a young man of the name of Debye. Debye had a very quick mind and also trained in Aachen as a mathematician. He very soon got together with an assistant of Röntgen, Koch, and became a physicist. Sommerfeld himself had the same idea; he also got together with an assistant of Röntgen's.

I mentioned as his main assistant Koch; but there was still a more intimate assistant than Koch, and that was Ioffe. Ioffe was the main assistant to Röntgen; Koch was an underling at that time. Sommerfeld asked Ioffe whether he would permit him to sit a few hours every day in his office—that is, in Ioffe's office—in order to see how physicists work, what physics is about. Ioffe told him that half an hour made no great sense because what we work on would not be a clue really to what physics is; the work is very inconspicuous. It would be better to train at the *Stammtisch* which they had in the Hofgarten, the garden of the Royal Palace of Munich, with shady trees and so on. There was a cafe attached to it, in the Hofgarten, and there the physicists talk really about what the purpose is of what they are doing and not just the outside appearance, and that would be a way to learn physics. Sommerfeld did that, he joined the *Stammtisch* in the Hofgarten and was with them as long as Ioffe's appointment lasted. That is the origin of the famous *Stammtisch* in the Hofgarten, which later became a landmark for the whole of physics in Germany. The Sohncke Colloquium of course was continued. But when Ioffe went, then Debye took a hand and pointed out to Sommerfeld that one colloquium a month, the Sohncke Colloquium, is not enough for physics. And he, Debye, would start another colloquium for the

younger men in physics. And he did, he had a colloquium which assembled on Tuesday from five to seven. At seven, the members together went to a restaurant and had supper, and after supper they bowled at the bowling club. The bowling club was an immensely popular feature, so that those young men who did not listen to the scientific part, the talk of the colloquium, were eager members of the bowling club. Among them was Duprel, also an assistant of Röntgen's. Now the arrangement in the colloquium of Debye was not like the three speakers that we had in Moscow; they had only one speaker, the standard German way. That made it a little heavy and cumbersome, because Debye had to find a speaker to talk for two hours. It was not always easy, but it functioned.

In the meantime, Sommerfeld became quite popular and famous as a professor of physics. It is strange that the two names that I remember as the oldest were not German but foreign men. Andrus was Greek, who stayed a couple of years with Sommerfeld and learned everything, and the other was Grover, an American, who also stayed the same length of time and left when I came. On the other hand, one of the oldest Germans was Hopf who was just one year older than I. He was with Sommerfeld when I came, though he had finished his work under him and had written his thesis. The foreigners, after finishing their work, wrote reports or theses at home; therefore, Hopf was around the laboratory longer. There was another in the same category. That was Seeliger, the son of the astronomer [Hugo von Seeliger] in Munich, also a very early pupil of Sommerfeld, who had written his thesis by the time I had arrived.

MRS. EPSTEIN: Was Ewald there yet?

EPSTEIN: No, Ewald was not there—oh, it might have been Herschelmann [?], but I am not sure. Herschelmann was a German with Russian connections. His father had been a professor in Russia, and his uncle was General Governor of Moscow and a very big grafter there. Anyway, that was the situation, and as time went on Sommerfeld got more and more popular. In the seminar, in addition to Herschelmann, were now Lenz, who had his first couple of years in Göttingen, then Ewald, who had been in Cambridge, England. Sommerfeld also had a quiet assistant professor, namely, Laue. He was not yet von Laue, but plain Laue, and had his education with Hilbert in Göttingen. It was now a growing and big outfit.

Let's finish with Röntgen first. Röntgen then had under him the big institute, and he was

no longer in that barn of the Academy. When the new university was built, a separate wing was assigned to the laboratory of experimental physics under Röntgen. Sommerfeld had a theoretical physics department in the main wing. Röntgen then had great responsibilities, a large number of pupils to whom he taught the precise experimental methods which he himself had developed and established. He was still married to the same woman, but they had no children, and therefore they adopted a little girl who was the natural niece of Mrs. Röntgen. For that he had a villa in Murnau. Röntgen spent the whole week in Munich and from Friday to Monday morning in Murnau. That situation then continued with little change until the summer of 1914.

Röntgen was a strange phenomenon. He was liberal; that is, he always thought of himself as a liberal and embraced the liberal cause, but at the same time he had enormous influence and interest in university matters—a conservative in matters of the University of Munich. When the war broke out he was a pacifist, and liberalism always makes of pacificism before, so I think he was not free of the guilt of bringing on the war. [The sense of this sentence is not entirely clear.] That is, he falsified the history of Germany to some extent, of the other pacifists to some extent. But of course he would never have admitted that. Those public actions of the German professors who approved of the actions of the government in the occupied provinces when the English agitation, the foreign agitation—he was an opponent. There was a famous public letter of the German professors against the agitation of the foreigners against the German occupation forces. It was signed by all, but Röntgen was violently in disagreement and did not give his signature to them. He began to fail before long and pretty soon he was dead. That was some time in 1913, I guess. [Röntgen died in 1923.]

MRS. EPSTEIN: Before the war? The war started in 1914.

EPSTEIN: Before 1916 it was. 1916, yes, I made a mistake. [Break in continuity, but the subject is still Röntgen.]

EPSTEIN: 1853, I think, it must have been. It was several years after the revolution in Germany, but that is a thing that you can look up. We need the rough biography of Röntgen, that is one thing, and we shall run into the names of some persons I wish to discuss. The innkeeper [in Zurich] who catered to the ex-revolutionaries, his name and exact position and date I also don't

remember, but that is probably in the Röntgen biography, too, perhaps in the more detailed one. Now the other thing that needed correction, that is who was the professor in the Zurich Polytechnic, the professor of physics. I had the idea that [Wilhelm Eduard] Weber was, but whether that was right or not I do not know. Weber was a friend of [Carl Friedrich] Gauss, that was one thing. He was a liberal and one of the protest professors, that is, when the King of Hannover became king—that is, the nephew of Victoria who inherited Hannover. That would fit with ’48 well and ’53. Victoria got on her throne in 1838 and was under the tutelage of her brother-in-law until sometime later, and that may have been ’53 or so. Then she married Albert of Saxe-Coburg. So the question is when did she marry?

MRS. EPSTEIN: Should I look it up now?

EPSTEIN: Yes, if you have a handy . . . [Jump in the tape]. He did not have a doctor’s degree. Now, well, he was assistant to Kohlrausch, a professor in Strasbourg. . . .

MRS. EPSTEIN: Well, it doesn’t say anything about that.

EPSTEIN: Anyway, it is important work that was done, so those articles are very poor. His important work was done in Strasbourg. That is certain, yes, especially work on the properties of matter.

MRS. EPSTEIN: Well, it says something about Giessen.

EPSTEIN: Let me see; Giessen was an important German university. In Würzburg he made his discovery, and it isn’t told here who his assistant was in Würzburg?

MRS. EPSTEIN: It says he received the Rumford Medal in 1896 with Philipp Lenard.

EPSTEIN: No. No, that is later. He had an assistant called Reitznaur or some such name [possibly J. Hanauer], a lifelong friend and assistant. Some biographers said that the idea for the discovery came from Reitznaur. But that isn’t true because Reitznaur was a native of Basel in

Switzerland, and he was not in Würzburg at the time. He was absent. We must have a real biography of Röntgen, but even the biographies are very poor.

The other person who was present in Würzberg was his laboratory servitor, named Marstaller. There is then a question about what was due to Marstaller. Some go as far as to say that the idea of the discovery came from Marstaller, but that is nonsense. But there was another version. The explanation of the discovery was that wood—pine—was more transparent to the rays than anticipated. However, painted wood—wood with white lead paint on it—was suprisingly unpenetrating and stopped the rays. Now, here, Marstaller might have made a contribution and that Röntgen did not understand really what it was. But a fact is that he discovered this, Marstaller, and the photographs which Röntgen took on the leaden ones—striations which corresponded to the striations of the lead paint—so that there is a real contribution of his. Röntgen could not explain what the striations were, and Marstaller helped him in that respect. But since I have not the data the others asserted, I cannot say to what extent I can correct them.

MRS. EPSTEIN: All right, I'll get it Monday.

EPSTEIN: It is not a very important question anyway. Here is a point that is still, by these poorer biographies, unsolvable. Did you read that he moved from Würzburg to Munich in '79?

MRS. EPSTEIN: 1885 he moved to Würzburg, and it doesn't say anything about Munich.

[Tape garbled for a very long time]

EPSTEIN: [Sommerfeld was] the son of a physician. This is strange to those who knew him because these Germans have a very strong Baltic accent which immediately places them as Balts, as they are called in Germany. But Sommerfeld had not the slightest trace of accent. He was born in 1868. The University of Königsberg was a very remarkable place at that time. There were classmates of Sommerfeld of the same vintage, in part contemporaries, a little older, and a whole series of very eminent men. In the first place, David Hilbert and Hermann Minkowski. Also there was the later philosopher and phenomenologist, [Edmund] Husserl, who was in the

same grade school class as Hilbert. These men appeared again and again in Sommerfeld's biography, either as fellow mathematicians or as teachers and pupils. Though it will make this review cumbersome, I will say a few words characterizing all of them. David Hilbert was a slow thinker, the greatest mathematician in the world, but he was purely German; he had a slow reaction time. The same thing is true of Sommerfeld; he was also very slow thinking. That was very different from Minkowski, who was of the same age and vintage, but a precocious young man. Sommerfeld graduated under Lindemann, wrote his thesis; I was unable to ascertain either the subject of his thesis or graduation year. And completely out of my head is the first name of Lindemann, though later I visited his house and became well known to him, and he to me. [Lindemann's full name was Carl Louis Ferdinand.] Sommerfeld was a slow thinker, but he showed a great independence of spirit during his student years. There is a characteristic tale told about him. There appeared in Königsberg a showman who was presumed to be a thought reader. Sommerfeld was violently opposed to such presumptions. Now, on one occasion, he was in the audience and opposed several things the man said. This man took a potato from his pocket and, offering it to Sommerfeld, said, "You try that apple; it is very good." Sommerfeld, without a moment's hesitation, bit into the potato which shows that he was, though a leader of math, not very observant, and that remained a fact. Being not very quick, he graduated probably when he was twenty-two or twenty-three. Hilbert also about the same time, that would be 1870-1871, went to Göttingen on Lindemann's recommendation. Minkowski, on the other hand, was very precocious and fast. At nineteen years of age, as an undergraduate student before his graduation, he already was a very knowledgeable mathematican. And when the Paris Academy announced a prize essay, he wrote an essay and submitted it. It was on the theory of the Oxford mathematician, Smith, who also submitted an essay to the same committee. I think they shared the prize. In later years that was a source of anti-Semitic agitation. They said he stole the prize, that he stole things that were in Smith's prior papers. In the first place, he could not copy because the first and leading mathematicans of France were on the committee, and the papers were read very carefully. The other is that Smith certainly would have set up a great squawk if parts of the paper were actually copied from him. It was nothing but propaganda, this whole bit. I do not know when he ultimately graduated, neither do I know where he went. He had a brother, this Hermann Minkowski—August—who lived in Warsaw and was a partner of my uncle in some ventures. August was a rather successful banker. I knew his son pretty well, and

of course I knew his partner pretty well. So all these things are interwoven in my experience and memory. Husserl also graduated about the same time and went, I believe, to the University of Giessen, to study philosophy. [Epstein's recollections of Husserl are not quite accurate. Sommerfeld probably knew Husserl through his connections at Göttingen, although Sommerfeld had left Göttingen by the time Husserl was appointed there (1901).]

What happened to Sommerfeld is a matter of record. His teachers' recommendation must have been very good and the oral recommendations of Lindemann also, because he was soon appointed assistant to Felix Klein, who was the second best mathematician in Germany. Felix Klein was a man very different from Sommerfeld in temperament, because he was an extremely quick and clever thinker. But they got along very well and Sommerfeld, as assistant of Klein, wrote a three-volume book with him about the pendulum. Three volumes sounds very pompous, but the volumes are not very thick; they are of standard size but not many pages in them—two hundred fifty or so per volume, so I estimate. It is not correct to say that he wrote three volumes; the third was later written by a pupil of Sommerfeld under his supervision. The other famous work he did at that time was the mathematical theory of diffraction. That was a very remarkable paper, which attracted the attention of Poincaré in Paris, who had written on the same subject but to much less effect. Also, Sommerfeld made a number of personal friends. His friend David Hilbert soon came to Göttingen and then a number of others. Mathematicians, Max Abraham—though he was more interested in physics than mathematics—and Otto Blumenthal, who later went to Aachen. Anyway, Sommerfeld was one of the outstanding younger mathematicians and physicists, so that when an opening for a position appeared not long after, Felix Klein tapped him on the shoulder and said, "That's for you." It must be said that Felix Klein, with his enormous connections in Germany, appointed practically all the mathematicians in the German universities. Now it was the turn of Sommerfeld, and he got an appointment to the Academy of . . . [*Bergakademie* in Clausthal]. He had been a suitor to a girl, the daughter of the curator [*Kurator*] of Göttingen University. A curator is the representative of the ministry in Berlin, and in Göttingen it was a form of professor. She became Mrs. Sommerfeld. These were happy years because I think their first child was born, and Sommerfeld continued his work. Being a professor of mechanics and mathematics, he was interested in the problem of friction and worked on that. His work was so good that before long he was promoted, again through the influence of Klein, to the position of professor of mechanics and mathematics in Aachen. Aachen was one of the best

polytechnic schools in Germany, and it was an honorable position. He continued his work on friction and took up other work on mechanics, for instance the theory of turbulence, that turbulence is a behavior of the liquid that nobody understood. Sommerfeld had some theories about that, partially worked out. He had a second child and was quite satisfied with this. The influence of Klein continued in one respect; that is, Sommerfeld had his friend Lutz [? possibly Luntz] there, who called himself the oldest pupil of Sommerfeld. Klein wanted to appoint him [Lutz] in the usual manner, because he was the oldest and spent the longest time there in Göttingen. Suddenly Sommerfeld objected; he wrote a letter to Klein which was epoch-making, in that it was the end of the autocracy of Klein. That is, no longer did only Klein appoint the professorships. Sommerfeld had two objections . . . he knew him very well from Göttingen and thought he was uncooperative. In the polytechinc institute the professor has to always work with other professors, especially with mechanics professors. In the second place, he was too abstract a mathematican, the mechanics professors couldn't understand him. So, you see, Sommerfeld was now something of an influence in the whole of Germany, in the academic appointments in other places than Aachen. He had in Aachen a number of pupils of whom I know only one, namely, Debye. Debye was a Hollander [i.e., Dutchman] of pretty lowly circumstances; his father could contribute little money to him, and he had to eke it out himself. Such an appointment was, for him, valuable for that reason. He was not only a very able man but had a very quick understanding. Sommerfeld made a large number of tours of the neighborhood together with Debye, usually paying the expenses of all these outings. On the other hand, Debye was very useful to him in many ways. I don't know much about his other pupils in Aachen and cannot tell you. Now Sommerfeld started to aquire a very wide reputation in science, so that when an important position became vacant in Munich, Röntgen, who was professor there, was told by Lorentz that a good man for him would be Sommerfeld. Eventually, Röntgen succeeded in getting Sommerfeld appointed to that position, which was in 1907 of 1908. It was very characteristic of the things that were done by Röntgen, that he made the proposal to Sommerfeld to go to Munich; and Sommerfeld, of course, was much gratified and honored and accepted. He heard nothing about the details and the date of his coming for about half a year and then suddenly a telegram came inviting him to come as soon as possible, immediately.

ADDENDUM
TO THE PAUL S. EPSTEIN ORAL HISTORY
CONCERNING THE HALPERN FAMILY

2010

The Caltech Archives was contacted in the spring of 2010 by Mr. Alec Jeakins of Haresfield, Gloucestershire, England, with information on the Halpern family who are mentioned in the Paul S. Epstein oral history. Specifically, George Halpern was claimed by Epstein as a second cousin (see interview, p. 34).

Alec Jeakins and members of his parish, St. Peter's, Haresfield, chose to write tributes to the Royal Air Force (RAF) men buried in their cemetery during World War II. Jeakins wrote about Wolf Halpern, who was the son of George Halpern, Epstein's cousin.

Mr. Jeakins shared this information with the Archives in an e-mail of 16 May 2010:

> My interest is in the references [in the Paul S. Epstein oral history] to George Halpern (1878-1962), also known as Georg and Gad. His son Wolf is buried in my local churchyard following a flying accident while serving with the RAF in 1943.
>
> Page 34 "Hayman" is almost certainly Hans or H. G. Heymann who was a witness at George Halpern's wedding on 28 December 1906.
>
> Pages 36 and 37: George's girlfriend/wife was Emily Lampert; all the details given match the information I have located.

A copy of Alec Jeakins's full tribute to Wolf Halpern with background on his family is deposited in the Caltech Archives in the Paul S. Epstein Historical Files.