

MILDRED DRESSLEHAUS

June - October, 1977

Part II

Women in Science and Engineering

MC 86

Oral History Collection

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MIT ORAL HISTORY PROGRAM

Project on Women as Scientists and Engineers

Interview with Mildred Dresselhaus

by Shirlee Sherkow

Cambridge, Mass.

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Session 4

Transcribed by Beth Gould

Sherkow: Today is August nineteenth, 1976, and this is Shirlee Sherkow in Mildred Dresselhaus's office. I believe this is the fourth session. Last time we had been back-tracking and trying to answer some unanswered questions. We had gotten to the point of your being a graduate student at the University of Chicago in physics. I wanted to know if you ever felt at this point, or at any other point, that you had to make a choice between marriage and a career.

Dresselhaus: Well, not really, because I had always assumed up to this point that my career was secondary to marriage. I didn't take my studies very seriously. Now, that's not a very good way of putting it. I took my studies seriously on a microscopic level; that is, my day-to-day work was as serious as that of any other student. My aspirations and thoughts of using my studies in a career were very feeble and limited at that

period. And that remained to be the case for, perhaps, another ten years.

Sherkow: What were your thoughts on a career?

Dresselhaus: Well, that my work, the career aspect of my work, would fit in as best it could with my personal goals. But work wouldn't be the primary focus. Certainly in my twenties, my thoughts were not that my career was the most important thing in my life.

Sherkow: What was the most important?

Dresselhaus: I always had thought in terms of having a marriage and family and children. These were things that were very much in the limelight in post-World War II society.

Sherkow: In 1956, you got a graduate fellowship from the Bell Telephone Labs.

Dresselhaus: Oh, I had a lot of fellowships all along; that was just one of many. It was kind of a prestigious one because they only awarded five or so nationally, and I got one of them. But I had had many others that don't show up on my resume. What I am trying to say is that it wasn't especially unique, but it was a well-paying fellowship, and there were very few awarded. The same year I got that one, I got the GE Fellowship, of which also there were about five or six nationally. But I chose that one.

Sherkow: The Bell Telephone one.

Dresselhaus: I couldn't accept both of them, so I chose the Bell Fellowship.

Sherkow: How did you get this fellowship?

Dresselhaus: I just applied.

Sherkow: Did certain people make you aware of the existence of the fellowship?

Dresselhaus: There were a few prestigious and well-known fellowships; I think all graduate students know about the existence of NSF Fellowships, and today they have the Hertz Fellowships. There are certain very well-publicized, well-known fellowships that students just know about. The Bell Fellowship was something I knew about; the year I applied was the year that seemed like the right one for me to apply. So I applied, and I was awarded a fellowship. I didn't, of course, expect to get one when I applied, but you apply for things in the hope that you might be successful.

Sherkow: Now, you accepted this one because it gave the most money?

Dresselhaus: Yes, that's basically [it]. But it was kind of a nice fellowship. Those fellowships gave you an "in" to the companies, and Bell Labs and GE both had very fine research laboratories at that time. So having the fellowship gave me a link to the company; it had that additional advantage. And it gave me some independence in that I had a

good source of income. But that really wasn't such a big thing because graduate students are always supported one way or another, then as now, and whether I had that fellowship or some other source of support was not particularly relevant.

Sherkow: Did you need the funds to go to school?

Dresselhaus: Oh, yes, graduate students always need funds, don't they?  
(Laughs)

Sherkow: (Laughs) I have read that you and fourteen other men got this Bell Telephone Lab Fellowship.

Dresselhaus: Oh, it was fourteen; I thought it was only five. Okay, fourteen. (Laughs)

Sherkow: You and fourteen other men, right. And this was the first time that it was awarded, in '56.

Dresselhaus: Is that right? I thought it had been awarded many times before. See, I'm learning all about it from you.

Sherkow: That was from your Radcliffe file; they had information in there on this particular award.

Dresselhaus: Oh, I see.

Sherkow: But, in any event, how did you feel about being the only woman?

Dresselhaus: Oh, I don't think I knew that I was the only woman. These are questions that I didn't ask, particularly. In applying for a fellowship like the Bell or the GE, any of those sorts of things, I always thought that being a woman was an advantage because it gave you much more visibility. And I used to think that the people on these awarding committees would find it "cute" to award it to a woman.

Sherkow: You were the only woman that got the award.

Dresselhaus: Well, there weren't that many applicants, probably.

Sherkow: How did you use the funds?

Dresselhaus: Just to go to school. As a matter of fact, that award allowed me to finish up my degree. I had the Bell Fellowship, and it paid a little more than I needed, so I saved some money and it turned out that these savings helped me out the final year of my thesis. You never know when you're going to finish a PhD thesis. I thought I would be finished before the end of the year, so when I applied for fellowships for the following year, 1957, I told them that I would probably finish my thesis before the end of the year. So they wrote me back a nice little letter saying that I wasn't eligible to apply. I was just too honest. I found out afterwards that one should never tell award committees such things because they know, as well as you do, that one never knows when one will finish a PhD thesis. See, I applied for a post-doc, instead of a pre-doc. And I was awarded a post-doctoral NSF Fellowship. But I hadn't yet finished my thesis, so I had to wait until I finished my thesis

to accept it. For that interim period, then, the Bell Fellowship savings helped me out to tide me over until completing my degree.

Sherkow: You mentioned that it was one of the more prestigious fellowships.

Dresselhaus: Well, I guess they only awarded fifteen, you said.

Sherkow: How did you feel about that?

Dresselhaus: On, it didn't really matter.

Sherkow: Did it have any effect on your own self-confidence?

Dresselhaus: By that time, I knew pretty well that I could make it, at least, at school. No, I thought I could make it pretty well, in general. The graduate study at the University of Chicago was very demanding and the survival rate was not very high, academically, among graduate students. But if you got through that system, that in itself gave you the self-confidence required for going on. I don't think awards or fellowships or anything else were particularly meaningful in comparison to the peer competition. Many people at the University of Chicago at that time were really pretty much superstar types.

Sherkow: The students?

Dresselhaus: The students, yes. During World War II, there were a lot of students who had accumulated and had not yet started graduate school; they had delayed graduate study--often both undergraduate and graduate



study because of the war. During that period, many of them had technical jobs in the services, working on war-type projects. And when they got back to school, they had an awful lot of background and a great deal of motivation. The students who came to the University of Chicago were, by and large, people who either had extensive experience in the Radiation Lab here at MIT during World War II, or on the Manhattan Project, working on the atomic bomb. So they were well-versed in technology and different things; these were really a great bunch of students, and the competition was exceedingly keen.

Sherkow: How did you feel about this great deal of competition?

Dresselhaus: Oh, well, in the beginning, I didn't know if I could make it. But after I had passed the exams and did well there in comparison with that peer group, I had confidence that I could make it most anywhere; that was good training. Good training for everything that came afterwards. It was very, very competitive; extremely competitive.

Sherkow: Now, there were a number of women there, too, in addition to yourself.

Dresselhaus: Right. Among the students or faculty, or how do you mean?

Sherkow: Well, both, I was thinking--

Dresselhaus: Yes, there was one other girl in my year who went through the system; Caroline Littlejohn, who is now Caroline L. Herzenberg, and is on the faculty at Illinois Tech; this school is also in Chicago. She

was an undergraduate here at MIT, and she did pretty well at Chicago, too. Two years ahead of me was Nina Byers, and I was more friendly with her than I was with Carolyn Littlejohn, for--I'm not sure why, but that's the way it was. And then there were some other girls. There was Shulamith Eckstein, who came about two years after me, who's done very well and is now a professor at the Technion in Israel. I knew all these people, and the girls at Chicago did well, by and large.

They had some women faculty; there's Margaret Burbidge, who was in the Astronomy Department; Maria Meyer was in physics; and Leona Marshall was also in physics. They were all quite senior people and very well-known already at that time. Maria Meyer is somebody who got a Nobel prize shortly after. Margaret Burbidge has also received many awards.

Sherkow: I read that at the time you felt that they had very good positions, and you only found out later that that wasn't the case.

Dresselhaus: That's true, I wasn't really aware of the exact appointments that they had, but they all seemed to be working well and doing good science, and having a great time. To be more specific, Maria Meyer, the one that got the Nobel prize a few years later--and not very much later, in fact, from the time I was there--she had a visiting-type appointment; I think they called her "Adjunct Professor" or something. Because of nepotism rules, she and her husband couldn't both be on the faculty, so he had the job and she held a position not on the regular academic ladder. They had some kind of phony appointment for her, but I don't know

that her colleagues treated her differently from a full professor. And Leona Marshall also had a similar-type arrangement, as did Margaret Burbidge. All of them had sort of phony appointments because their husbands, in all cases, were on the faculty.

Sherkow: But you weren't aware of that while you were a student?

Dresselhaus: Well, I wasn't too aware of it, and it didn't bother me, because the main thing--and I thought they felt the same way--was to have an opportunity to do work and work in a really good place, which they all three had. They didn't have the same recognition that the guys had. But I never thought that the lack of public recognition was anything that bothered them as people. I found out later that that wasn't the case; they thought they should have had better official positions, better support, not have been just their husbands' wives.

Sherkow: At the University of Chicago, you volunteered to be a teaching assistant.

Dresselhaus: When I first came there, I was a real teaching assistant, and I got paid to do it. But after my official appointment was over, I did a bit of volunteer teaching. Now, whether I got paid for it or not, I don't even remember now. But I like teaching, and so I kept doing it, whether or not I had to.

Sherkow: What did you teach?

Dresselhaus: I was teaching the elementary course, first year course.

But the first year course at Chicago was not really all that elementary; the only course that was taught to undergraduates was that first year course. From there, after you've had that one-year course, you were essentially in the Graduate School. At Chicago they didn't have any intermediate level courses like they do at most other universities. So that was really a very fast-moving, intensive course, and it was great, great fun teaching. The kids we had in the course were really super; very, very bright kids.

Sherkow: Did you devote a lot of time to preparing for this course?

Dresselhaus: No--Well, the first time you did it, it took some time. I did it maybe three times, or maybe even four times; I did it at least three times, so I got to be much better at it, and it didn't take too much time. I was well-liked by the students, which made me feel pretty good. I had a good time teaching that course; that was nice.

Sherkow: Were most of the students men?

Dresselhaus: Oh, yes. Of course. Naturally.

Sherkow: Why, "of course?"

Dresselhaus: The students who would take a course like that would be students who were serious in going either into physics or chemistry, or maybe mathematics. But these were not students who were going into medicine or arbitrary people that were just taking a physics course. These were people that were really serious about physics, more or less

professionally; thus, the clientele in this course would pretty much mirror the distribution among [the] sexes in the profession.

Sherkow: What were some of the short-term effects of this teaching?

Dresselhaus: What do you mean by "short-term effects?"

Sherkow: I read that you felt very good about this particular teaching job.

Dresselhaus: Yes, I liked the teaching. For one thing, it's always a challenge to teach because you learn the material better, and you develop insight into elementary ideas. Teaching elementary physics, maybe elementary anything, is quite challenging because the ideas that you have to teach are really not so elementary, but you have to present them in a form that's understandable and also, at the same time, correct to a person that doesn't have a great deal of background. To do that in a correct way and an interesting way is not a trivial matter. It's quite a challenging thing. So I liked teaching and it did help me understand many things. It was a good educational experience in terms of physics. It was also a good educational experience in terms of learning teaching methods. Teaching is not only knowing the material, but it's knowing how to present it and how to interest people and to stimulate them. I believe that amateur psychiatry (laughs) or psychology is involved in teaching. Then you do develop a lot of personal friendships with the students; they come around and see you after class and socially.

Sherkow: Did you think that perhaps in the future you might be teaching again?

Dresselhaus: Well, maybe in a sort of way, but I didn't imagine I would be teaching in the way it turned out later. I did this teaching because I liked it a lot, and it was a lot of fun doing it. The first year I did it because it was a job, but afterwards I did it because I liked it a lot. I was pretty good at it, and one likes to do things that one is good at.

Sherkow: I also read that you felt that you got along very well with men students, and this really helped your ego when students would come to you and not go to the other men teaching assistants.

Dresselhaus: Yes, well, that's right. That was very nice--a nice thing.

Sherkow: Were you the only woman who was teaching this elementary course?

Dresselhaus: I don't really remember. Probably. I expect. But now that I look back at it, I don't remember--Nina Byers was a teaching assistant at one time; I doubt that we ever taught at the same time and in the same course, but I think she was a teaching assistant at one point. I'm not certain about this; the facts may be different than my recollection.

Sherkow: You also mentioned in the same article that I read that this teaching experience turned out to be valuable later on.

Dresselhaus: Oh, yes. It did turn out to be very valuable in terms of learning how to teach. One's career evolves. My first teaching experience in a group situation was this teaching assistant job I had at Chicago.

The next time I had a major teaching job was when I was a post-doc at Cornell, and that never would have happened without the teaching assistant job at Chicago. And my job at MIT would never have happened if I hadn't done the teaching at Cornell. So these are all interrelated.

Sherkow: Do you mean if you hadn't had the experience?

Dresselhaus: Yes, that's what I'm trying to say. Later on--now I'm moving ahead into another period--when I was at Cornell, there was a need for somebody to teach an electromagnetic theory course because the guy that was scheduled to teach it resigned from Cornell the first week in September; there was just nobody available to come in and take over that course. So they were desperate to find somebody that could and would teach a junior course--that is, for third-year students--a course in EM theory. I came out of the woodwork and volunteered to teach it. There was a certain amount of prejudice against my teaching it. For one thing, I was a post-doc, and post-docs normally don't teach, although they do so occasionally. But the other thing is that they had never in the department--or maybe in the various physical science departments--had any women teachers taking over a course; it had never happened before. There was a certain amount of hesitation that the students wouldn't take me seriously, and they wouldn't do any homework for me. That was the big thing. But the Physics Department was sufficiently desperate, and I had had a good teaching record; I already had quite a bit of experience, and I had been good at teaching. I assured the people at Cornell that students at Chicago came to my classes rather than other people's

sections, not because I didn't give them any work, but because I gave the students more work (laughs). So they were willing, on the basis of concrete evidence, to give me a chance. So they did give me a chance to teach the EM theory course, and I think I did a good job. I was well-liked by the students; the students seemed happy with the course.

Sherkow: Did this change their ideas about women faculty?

Dresselhaus: I think it had some influence. I wouldn't say that they offered me a job on the basis of this, because they didn't. And I wouldn't say that they hired any women faculty members right away, but many, many years later they did. They still talk about me and my [course]. When I go to visit Cornell, there are many people who remember me and remember me as a post-doc. So I did have some kind of influence on them, but some if it didn't rub off immediately, some of it evolved in time.

Sherkow: Did you do that for two years?

Dresselhaus: No, I had that course for only one semester. And that was, in fact, the very last semester I was there.

Sherkow: I want to jump a little backwards to your thesis topic. You talked about the topic in terms of your supervisor; he didn't feel that women should be doing graduate work in physics, and he sufficiently discouraged you. I didn't want to get into that again. But we haven't really talked about what you did and how you felt about the research that you did do.



Dresselhaus: I got into this problem pretty much on my own. At the University of Chicago at that time, they operated under a system that I call the Fermi System; I don't know if this is the common name for it, but that's what I call it. The idea was that the PhD thesis was original research whereby the student designed the thesis topic, developed it, did the work, and presented the thesis. The supervisor only came in to help when needed. It turned out in my case that my supervisor--my nominal supervisor--the guy that was locally responsible for me, didn't know anything about my topic. So he wasn't much help. But the topic was inspired by the visit of a visiting professor, Brian Pippard, who was there the first year that I was working on research, and I got into this project by talking to him. He had done some work on high-frequency studies of superconductors and he had done, in fact, some high frequency work in a magnetic field. I picked up that idea. He suggested to me that it would be interesting to do such experiments at lower frequencies than he had tried. So that's how I got to do my experiment at thirty cm wavelength, which was a very funny frequency range for microwave experiments, because there was very little in the way of equipment. But graduate students at that time built almost all their own equipment, so that was what I did, too.

Sherkow: You built--

Dresselhaus: We all did; we all built our own equipment, so I was just like everybody else. I built a microwave apparatus to operate at 30 cm and then had that working in conjunction with a low-temperature system

where I put some superconductors in a magnetic field, and I measured the surface impedance; that is, the high-frequency response. After a couple of years of hard work on this project I found some unusual effects. Now, Brian Pippard left after my first year of research and at that point I was just in the beginning stages of building the apparatus. I didn't really get any results until well into the second year, and by that time, he was long since gone and I was pretty much all by myself on this project. In fact, there were hardly any people at the University of Chicago at that time working on superconductivity; I think I could well have been pretty close to the only one. Maybe there was somebody else; still, I was pretty much by myself.

But there were about ten other graduate students in our research group, all working for the same Professor Lawson; he was our thesis advisor, Andy Lawson. Everybody in the group worked on a different topic. Very different, I mean, just totally different; every one had an unrelated topic. Most of the topics Lawson knew very little about. So we didn't get much direct help from him. But we got a lot of help from each other, and we learned a lot by talking to each other. Actually, there was one guy who was working on a topic that somewhat close to mine. He was also doing surface impedance measurements, but at a somewhat higher frequency than me and he was working on normal metals, but he was also doing a microwave experiment. That student was George Smith, who later became famous as the co-inventor of charge-couple devices; he's a well-known person today. But we were both graduate students then, and we had a lot of interaction. I was one year ahead of him, but he was a

very smart guy and he was very resourceful in the laboratory. I think he gave me a lot of help. Maybe I gave him help, also--I don't know. But I do remember that it was nice having him around; he was useful--a useful friend. I got along well with the graduate students. We all helped each other; the only way to get through the system was to help each other. We talked about our thesis topics, and we learned about thesis topics of the other students. That education was also very valuable.

Sherkow: You mentioned that you got unusual and unexpected results.

Dresselhaus: Yes, I did.

Sherkow: What were they?

Dresselhaus: In a nutshell, it's like this. When you apply a magnetic field to a superconductor, it goes into the normal state, eventually, after you apply enough magnetic field above the critical magnetic field to make it normal; then it behaves like any other normal metal. What I found was that as far as the high-frequency resistance and reactance of the sample was concerned, instead of behaving more like a normal material when you applied a field, the material acted as if it was going more superconducting. That is, the surface impedance went down, rather than up, with small applied fields. I was studying this effect under many conditions, including the effect of temperature, the effect of magnetic field strength, the effect of different orientations in magnetic field, the effect of different superconducting species, and I found the conditions under which the anomalous effect was large and the conditions under which the

effect was smaller. That was kind of the gist of the thesis.

This magnetic field effect was an unexpected effect, and it therefore aroused some curiosity among people. This experiment was done at an interesting time historically. My results came out during the same year as the so-called BCS Theory of superconductivity, which is the microscopic theory of superconductivity. My experiment was done at just the right time. It was an experiment that couldn't be understood easily in terms of the BCS Theory, so that made it even more interesting. And so it was that people who were involved in the formulation of the theory and understanding of it, were interested in my experiment.

Sherkow: And consequently interested in you?

Dresselhaus: Yes, that's right. I gave quite a few seminars as a graduate student, which is not the usual thing for a graduate student. Usually graduate students stay at their own places, but I gave talks in a number of places outside of Chicago; I was invited down to talk about my results. Of course, I didn't understand my results very well (laughs), but I talked about them as best I could. One of the disadvantages I faced was that I did this work by myself, and I didn't have experts around to talk to; the best experts were elsewhere, so it was nice to travel around and talk about my research.

Sherkow: What effects did this have on your career later on?

Dresselhaus: Doing a good thesis is always a good steppingstone toward

developing any career. One thing leads to another and having done one good thing, it made me an attractive job candidate; so when I got my PhD eventually, there were a number of places that would have been happy to hire me.

Sherkow: I did read that you were offered many different opportunities.

Dresselhaus: Yes.

Sherkow: What were they?

Dresselhaus: I don't really remember them all, and I didn't follow them up in great detail. With regard to universities, there were a number interested in me; I'm not even sure I can remember which ones they were. But I'd say the major schools that were doing superconductivity at the time would have been happy to have me come as a post-doc, junior faculty, or whatever--the lowest position, the lowest post-doctoral position; there were also industrial jobs, and I again could have had my pick there. But I had an NSF post-doctoral Fellowship that I had acquired when I was a graduate student. Waiting for me to finish my thesis was this post-doctoral fellowship, and with this fellowship I could pretty much go anyplace I wanted. So I had my own resources; that made it very attractive for places to offer me a job.

Sherkow: Did the other women that were at the school have similar lucrative opportunities?

Dresselhaus: I don't really know what they had. At that time, it was

easy to get a job; it was easy for people to get a job.

Sherkow: For men and women?

Dresselhaus: It was not as easy for women to get jobs as for men, but because there were so many jobs available relative to the number of trained people, there were also enough good jobs for the women that were left over after the men had their pickings, so to speak. Today, I would say there's no overt discrimination, or, less discrimination. If there's a job available today, they consider both men and women applicants for jobs. However, the number of jobs, the total number of jobs that are available is a small number, so that even though there's more relative opportunity for women, there's less absolute opportunity, because the total number of opportunities is much smaller.

Sherkow: Getting back to the University of Chicago, I was wondering how you felt about the Buddy System with professors, and the effect that that can have on one's job opportunities.

Dresselhaus: I was saying that I didn't really get involved with that, because I had enough of my own resources that I didn't have to worry about the Buddy System. So the Buddy System didn't really apply. If you're well-trained, you've done a significant thesis and you have something to offer an employer, you can be your own agent; you then don't have to worry about the Buddy System. I didn't worry so much about the Buddy System at any point, because I was lucky; I always had something cooking on my own.

Sherkow: What about the other students at the University of Chicago?

Dresselhaus: As I was saying, the probability of completing your degree at the University of Chicago in physics at that time was not large; the graduating class was small compared to the incoming class. So consequently the people that survived were people who were way above the national average or even high average of people, so we were very much in demand for employment. If you could get through the system, you pretty much were assured of a good position afterwards. We all got good jobs; everybody got good jobs.

Sherkow: Was there a similar number of women as men that dropped out?

Dresselhaus: I don't know. You'd have to do some statistical study of that. The number of women that we had was so small, and I'd say that many of them finished; so maybe they did better than the men did. But I think that there were some women who came and dropped out at a very early stage; they didn't even try to compete.

Sherkow: More so than men?

Dresselhaus: I'd say you'd have to go back and do a study of the numbers. The numbers are very small, so I don't know how it all shook down in the end. But quite a few women did get degrees from the University of Chicago. I don't know what the numbers are, if it's five or ten during a ten-year period; three percent of the profession is female, and I would say that women had more than three percent of PhD's during the time I was there.

Even though the numbers are small, I think the numbers were larger at Chicago than they were in the total profession.

Sherkow: How would you rate yourself, vis-a-vis other students at the University of Chicago at the time that you were there?

Dresselhaus: I was in the top group. There were people there that were brighter than me; there were people there who, I think, did better things; and there were people there that have since done better things that I've done, but I was in the top group. I was what would be called a strong student. I didn't have any trouble getting through the system.

Sherkow: In 1958, then, you got your PhD, and in the same year you married Gene Dresselhaus. First of all, how did you meet him?

Dresselhaus: He became a junior faculty member at Chicago right after he got his PhD. I met him when he spent a year at Chicago. He left Chicago in 1956.

Sherkow: While you were working on your degree, you met him?

Dresselhaus: Yes. He left in '56, and I remained at Chicago for two more years.

--[Interview interrupted]--

Sherkow: We were discussing when and how you met your husband. So for two years, you were at the University of Chicago, and he was elsewhere.

Dresselhaus: Yes.



Sherkow: Were you engaged before he left?

Dresselhaus: No.

Sherkow: Did you continue to see each other?

Dresselhaus: Oh, occasionally. I was working pretty hard on my thesis, but we saw each other from time to time.

Sherkow: Then once you got your degree, what happened exactly?

Dresselhaus: I had this fellowship, which I could use any place, and he was at Cornell, so I just took my fellowship to Cornell. It was simple. So we got married, I worked at Cornell, and I settled right there at Ithica.

Sherkow: What did you do your two years at Cornell?

Dresselhaus: Not much. I started out trying to set up the same kind of experiment that I had been doing at the University of Chicago, but I really didn't do a whole lot more with it. I spent the most fruitful time at Cornell, trying to interpret the experiment that I had done for my thesis. I kind of got my thesis out of my system at that point. Later, on my next job, after the two years at Cornell, I started working in a totally different field.

Sherkow: How did your husband feel about your having a career and a family?

Dresselhaus: Yes, well, he was encouraging about it, and that's why it all happened. He encouraged me a lot to keep going with my work. He always liked working with me.

Sherkow: Were you working together?

Dresselhaus: Yes. We were working on the interpretation of my experiment during that period at Cornell. My first child was born while I was a post-doc at Cornell. So we were busy both with house and home and working on this project. I didn't get a lot more done than just working on the interpretation of the experiment, writing up some papers related to my thesis work, getting them all in print. That was mostly what I did during that period at Cornell. These two years were not especially productive, professionally.

Sherkow: Did either one of you consider going elsewhere? You just went where he was. Did you consider going somewhere else--or your husband?

Dresselhaus: What do you mean by somewhere else? I didn't understand the question.

Sherkow: Did your husband consider leaving Cornell?

Dresselhaus: Yes, we did leave, in 1960.

Sherkow: Right, but I meant at the point when you were married.

Dresselhaus: No. He had a job there, and I had a post-doc that I could use there, so it was worked out very well. But after two years, my NSF Fellowship ran out, so I didn't have a job at Cornell at that point. Thus,

I could either have settled down and become a housewife and forgotten about my career, or we would have to move. In Ithaca, if you don't work at Cornell, you don't work at all; there isn't a lot of industry around Ithaca. So that's why we left Cornell, because my fellowship ran out and my husband thought that I should keep working.

Sherkow: Did you mention the nepotism rules?

Dresselhaus: That was part of it. I could say that there were nepotism rules so that the university couldn't hire both of us, but then maybe the university didn't want to hire both of us. Nepotism rules made it impossible for the two of us to work at the same place, but I had never been offered a job at Cornell, either.

[BEGIN TAPE ONE, SIDE TWO]

Sherkow: We were in the middle of discussing why you left Cornell.

Dresselhaus: There were other reasons, too. I think my husband, who by that time had been there for four years, was a little tired of it. Ithaca was quite an isolated place. The weather during that period had been particularly snowy and bad. In the wintertime there was one period during which we were snowed in for about a month and couldn't get out of Ithaca--driving around Ithaca or getting out of Ithaca by public transportation was really pretty tough; the airlines were a disaster. So, all in all, living in Ithaca wasn't all that appealing. It was a really nice place in the summertime, but the wintertime wasn't

all that great. So he was ready to leave Ithaca just for personal reasons; he also got tired of seeing all the same people every place he went. Ithaca was a small town, and you feel pretty much of a small-town atmosphere when living there.

Sherkow: How did you feel about leaving?

Dresselhaus: Cornell?

Sherkow: Yes.

Dresselhaus: It was okay leaving. It was nice being there; we liked it there, but at that time it was easy to get a job, it was easy to go somewhere else. So if we couldn't both have the kind of jobs we wanted in Ithaca, we would look and see what we could do elsewhere. So when we went to the annual American Physical Society meeting, we talked to a couple of people in the halls about looking for jobs--you know, just in a very cursory off-hand way, not too seriously. And right on the spot word got out that we were looking around for another place to work, and we had all kinds of offers. It was just like that. People were giving us offers to come and join them at their laboratories. The person who was most enthusiastic and came through with something concrete in a big hurry was Ben Lax, here at MIT, and this is how he hired both of us.

He was really enthusiastic to get us, to get both of us. He wanted to hire both of us, and the fact that we were married really didn't matter to him. Ben has been really good about women. See, he's the one who gave Laura Roth her chance, and she came to work for him

several years before I did. She'd already been working with him for a couple of years, and she was terrific, and he was happy to have her. In some ways, Laura greatly contributed to Ben's career. She's really smart, and she can do very complicated calculations correctly; she is one of those people who really does things carefully and correctly. She was very, very useful to his research group. So he got used to working with women, and he liked Laura; I would say that he couldn't do without her, she was his left hand or right hand. He was thus quite happy to take on another woman; he wasn't prejudiced that way. I had a good record, so he was glad to get me, too. As a matter of fact, he used to pride himself on saying that he had, "The two," as he called us, "best young women physicists in the country." He used to say that to visitors; he used to brag about it.

Sherkow: Was this a rarity?

Dresselhaus: Why, well--yes. He said he had The two best ones in the country--so it was a rarity. That's what he used to say. You know, I'm not implying that this was true. But Lax was quite proud of himself, and he liked us both as people, too.

Sherkow: You mentioned that you and your husband went to an American Physical Society meeting and had gotten a lot of job offers.

Dresselhaus: Yes. Well, all physicists go to the American Physical Society meetings, for the big meetings; it's the thing to do, and there you talk to people in the halls about everything. You see all your old

friends, and they ask you how you're doing, and you might be saying, "Well, we are getting tired of Cornell. Do you know of a job somewhere?" So they say, "Yes, sure. Why don't you come to our place?" That's the kind of job offer I am talking about; it's not a firm offer. It isn't that we applied for any jobs. I've never applied for a job after receiving my PhD; jobs just sort of happened for me. This was an off-hand conversation, and then, next, Ben Lax wanted our resumes, and three days later, we had a job offer. Within one week of the time we were down for the Physical Society meeting, we were working for Ben Lax.

Sherkow: Was he the only person that came through with a firm offer?

Dresselhaus: Oh, well, no--I guess not. The people at IBM were anxious to have us, and we went down there to see their lab. They really wanted to have us. Oh, different places, there were a lot of places. Gene sometimes reminds me that GE (General Electric Company) was interested in both of us, but they had a nepotism rule, so they could only hire one of us; either one, but not both. Gene and I were talking about GE recently, and he was laughing about this nepotism rule; how funny it is to look back on that now. Now nepotism rules are kind of humorous.

Sherkow: It wasn't so humorous then?

Dresselhaus: Well, we kind of liked GE because my husband had been a consultant for them and we knew a lot of the people there. But there were a lot of other good labs, and our feelings weren't hurt when they didn't offer both of us jobs--they didn't want us; we didn't want them. We

remained good friends with GE; there wasn't anything acrimonious about this incident. Besides, living in Boston had certain advantages over living in Schenectady.

Sherkow: I wanted to just jump back a little bit, to while you were at Cornell. Did you do any teaching there?

Dresselhaus: Yes, well I was telling you about the course that I taught in EM theory. That was the only teaching I did while I was there; I taught one course.

Sherkow: Two years.

Dresselhaus: No, no. I taught that course the last year I was there.

Sherkow: Oh, right. That was the only course that you taught?

Dresselhaus: Yes. I believe so. I think I taught that in the fall semester, and it seems to me that I didn't teach anything that spring semester, Maybe I did; I can't really remember.

Sherkow: You mentioned that you had your first child then. How did having a family and also working on your research work out, the both of them?

Dresselhaus: Well, it didn't work out so well in the beginning. It worked out much better later on, because I had to get into the swing of things; I had to develop a working system. Being a post-doc is tough on anybody. The hardest period in one's career is usually right after

you get your PhD.

Sherkow: Why is that?

Dresselhaus: It's sort of getting adjusted to a new situation, a new place, and you have to perform well. I find the same thing among my own research students; we call it breaking the umbilical cord. This adjustment comes after you start working on your own, really on your own. As a post-doc, I didn't have all my graduate student buddies; we used to help each other when we were graduate students. My adjustment was even more difficult. I was also setting up house, being pregnant, and everything else. It all added up so that I wasn't being productive that year. I think I did better during my second year than I did in my first year. Oh, during the second year, of course, we had babysitting problems. I had the wife of a graduate student doing my babysitting for me.

Sherkow: What were your responsibilities towards the children and the domestic affairs, and your husband's responsibilities?

Dresselhaus: Oh, we've always shared them. We don't have exactly a division of labor; we both do what has to be done. We still work it that way--we don't ask too many questions and keep track of how much each one does.

Sherkow: The feeling that I'm getting from what you're saying is that maybe more of the responsibilities were on your shoulders--

Dresselhaus: Well, no.



Sherkow: While you had the first child.

Dresselhaus: Not necessarily. It was kind of new for both of us. I wouldn't say that I was an abused wife; I wasn't. We pretty much worked it out well for both of us.

Sherkow: You were both working full-time?

Dresselhaus: Yes.

Sherkow: Did you have a housekeeper, or somebody who lived-in?

Dresselhaus: No, no, no. Actually the only time in my life that I had good household help, really in the sense of having someone come and clean my house, was when I was in Ithaca. I had a really good cleaning lady who came once a week. She was fantastic, but never since have I had anybody like that. She was a widow, and had a baby the same age as mine, and welcomed the job. She was super-dedicated, really, really good; she made life easy. I think I just wasn't very efficient during that year; I just wasn't with it. It also wasn't one of my good years as far as research was concerned. I really turned over a new leaf when I moved here to Lincoln Lab; I got much better at everything.

Sherkow: Did your husband have any problems with maintaining his career and also having a family?

Dresselhaus: Oh, I don't--Well, you can ask him that. I would say that he did all right. We both did all right. Research is something that goes better some years than others, and when you start out in a program, it

sometimes starts out slowly; that's what I'm trying to say. For most people, when they go somewhere for a post-doc, there's usually a professor or somebody they work for, thus post-docs get into a new situation and learn new things. But the way it was in my case, is that I worked for myself and I didn't come to a laboratory that was all set up; I had to do everything on my own. So it was slow, and I didn't get a whole lot done in these two years.

Sherkow: You mentioned that you published some papers.

Dresselhaus: Well, you always publish papers; that's part of being a professional physicist. I wouldn't say I published a lot of papers during that period. My publication rate has increased a good deal since those meager years. I'm saying that when you're starting up, that's an investment time--it's kind of laying the foundation. I had to go through that period. It was a good, useful period, and then I went on into something else.

Sherkow: So you and your husband left Cornell for a number of different reasons, and you came to Lincoln Lab. Could you elaborate on why you chose coming here?

Dresselhaus: Lincoln Lab at that time was really, really a good place; it was a very good place. Still, it was hard for us to make a decision. I remember the time that we made this decision; we had our choice narrowed down to IBM and Lincoln Lab. I don't remember in detail all the other places we considered, but there were others. But those two

were the ones between which the decision was made, because we thought they were both outstanding opportunities. It was hard for us to make this decision; I remember how we made up a score sheet, and we put down a whole list of conditions--I don't remember what the conditions were--and then we rated them. We gave each condition a weight that was most important because it set up our priority list, so to speak. Then we rated each place on the basis of this priority list; Lincoln Lab came out slightly ahead, so we went there.

Sherkow: Were you only considering places where both you and your husband could work?

Dresselhaus: Yes. As a matter of fact, we were mostly considering places where we could also work together. Both of those places were happy to have us both come and work together, if we liked, which sounded pretty good to us.

Sherkow: Are you and your husband both in the same field?

Dresselhaus: Yes.

Sherkow: I was under the impression that there was a difference--

Dresselhaus: No.

Sherkow: --in your fields. So what did you do while you were at Lincoln Lab? I know you were there for seven years.

Dresselhaus: Yes, I did a lot of different things. I got into the optical field at that time, magneto optics, high magnetic fields, energy

bands, and all kinds of things like that. I sort of switched fields when I moved to Lincoln Lab. When I came there, I was still interested in superconductivity, but there was nobody at Lincoln Lab doing superconductivity, and the Lincoln Lab management was not especially interested in that field, so I looked around at a number of other areas where they had strong programs. I selected a few of these, and I have worked in those and related things ever since. But then, again, I still switch; I work in a broad enough field that I do a lot of hopping around from one project to another. It all started at that point in my career, when I got into a number of new areas, myself. I'd say that it all really started when I was a graduate student, because in Lawson's research group of ten or so graduate students, all in the same research group, the variety of topics was so enormous that if you became familiar with half of them, you would certainly have a very broad spectrum of areas to work in.

Sherkow: Were you and your husband working on the same research problems together?

Dresselhaus: On some problems we worked together, and on others we worked separately; on some we worked alone, on others we worked with other people--all different kinds of combinations and permutations. The years we were both at Lincoln were a lot like that. Then there was a period of time when I was down on campus for almost ten years; I was down here on campus, and he was at Lincoln. During this period, we did relatively few things together. Just recently, during the last few months, he's moved down to the Magnet Lab. So now we're in the same

place again, and we're back to our old mode, the way we used to be when we were at Lincoln, doing a lot of problems together.

Sherkow: How do you feel about that?

Dresselhaus: I think that the years that we worked together out at Lincoln were really my best research years. I think I also did well when I was down here on campus working by myself and with the students. I think that they were very productive years. But I think I'm enjoying myself more since the summer, when my husband came back, and we're going back to our old mode of doing research. Not only do I like it, I think my research program at MIT has also improved a lot because of it. The thing is that, talking to a pro--having him around and talking to him a couple of hours a day, and him talking to me--just gives us so many ideas that it's kind of different than talking to the students; the students don't have quite the same level of insight. It's just great having somebody to sound off ideas, great for both of us; so I think there's a new great era coming up. Maybe all professors ought to have a shadow that they can go talk to.

Sherkow: While you were at Lincoln, weren't you in a group, a research group?

Dresselhaus: Yes, you're always in some kind of group, but the actors in the group change with the problem. At any given time, you're working on a number of problems, and the various people who are working with you on the various problems change from problem to problem.

Sherkow: You had done a lot of teaching prior to coming to Lincoln Lab--

Dresselhaus: Yes.

Sherkow: Was that a consideration at all, that you wanted to teach?

Dresselhaus: Lincoln Lab doesn't have teaching.

Sherkow: I know, but was that a consideration while you were trying to decide with your husband where you would go after Cornell?

Dresselhaus: We decided that we wanted jobs that didn't have teaching. We were mostly looking at non-teaching jobs at that point. The reason, partly, was that at that time we had one small child, I was pregnant with the second one, and it looked too tough to try to do both teaching and research. It seemed easier to focus on one thing. Looking back at it, I certainly made the correct decision; that was certainly right at the time, for me; I don't say that this is a universal principle. Just focusing on one thing allowed me to do it much better than I could have done two things; I would probably have done two things badly, and I guess I did one thing pretty well. I had somewhat more flexibility, because I didn't have to meet classes at a fixed time every day; I could arrange my situation with our children a little bit better. Of course, working at a place like Lincoln Lab, you have fixed hours, and the official party line is fairly rigid; that gave me a lot of trouble because they were not very well-g geared for professional women. Laura Roth and I both had trouble. We both had children. Our child-bearing years spanned

each other. She had two children, and they were born nine months out of phase with mine. Every nine months, one of us had a child; it was like the cows.

Sherkow: Could you mention exactly when you had your children?

Dresselhaus: The first one was born at Cornell on Labor Day. The second one was born a few months after I got to Lincoln Lab; we arrived at Lincoln in the summer of 1960, and January, 1961, the second one was born. I had the third one in January of '63; and the fourth one, July, '64; that was it. The fourth one was the biggest problem because he had a lot of health problems as a baby, and that gave us food for thought; raising kids wasn't all that simple.

Sherkow: What was wrong with him?

Dresselhaus: I don't know . . . he had all kinds of allergic problems that kept him awake at night; he couldn't sleep. Having a baby that's up all night for months on end drives you nuts.

Sherkow: Did that affect your work at all?

Dresselhaus: Yes. I didn't get too much sleep the first year of his life. I was always tired; it was tough. But, actually, catnapping and waking up used to give me great ideas.

Sherkow: At work?

Dresselhaus: No. It gave me great work ideas when I was home. The kind of work I do, you do twenty-four hours a day, you know; you can't really

get it out of your mind, it's always with you, so ideas come at random, at arbitrary times and places. And during those years, I really had a lot of good ideas; those were good years that way. The kids used to break up my work day a lot, and breaking up the work day used to help me get new ideas.

Sherkow: Were you at home?

Dresselhaus: I was sort of rattling around, shuttling around. No, I was in the lab; I had to be eight hours a day at the lab, because I had a full-time job. I was going home during the day, and going out to the lab, and driving around, and knocking myself out. There were a lot of things going on.

--[Interview interrupted]--

Sherkow: We were discussing working at Lincoln Lab, and having children, and how you managed the whole thing.

Dresselhaus: How we managed, yes (laughs).

Sherkow: (Laughs) You were working full-time, and your husband was working full-time.

Dresselhaus: Yes. You want to know how we managed. In the beginning, when we had a small number of children, like one, and even when we had two,--the very beginning--we used Harvard wives for babysitting. The Harvard Wives was an organization that babysitters would sign up with. So we had a succession of Harvard Wives as babysitters; we'd bring our



kids over, the one or two that we had at the time. We brought our children to their houses, and they would babysit for us. We'd go off to work in the morning, and then at the end of the day we'd come back and pick them up. We had the most phenomenal, sensational babysitters; we really had fantastic babysitters. They did a lot for me. I really liked them; they were great people. They were just struggling to try to get their husbands through graduate school, and this is what they were doing to supplement their income. But they were really great people who have since done a lot of things. There was one in particular that I had a lot of influence on. She saw me doing my thing, and she decided at that point to do the same thing. And so she got herself a professional job when she quit working for me. She got herself a babysitter for her own children, and she went to work.

Sherkow: You mean getting a PhD in physics?

Dresselhaus: No, no, no, no, no. She was a live translator for the United Nations; that was her training, and she was fluent in four languages other than English. So right after working for me, she went to work for the Harvard Law School. There she was working for one of the international law professors who needed somebody who could do manuscripts, and typing, and whatever, in any language that came along. The interesting thing that she did that year was working for a delegation of law experts from the Soviet Union; she didn't know Russian at the time, but she did know many other languages. They gave her the job of looking after these Russian visitors, so she had to learn Russian; in this way, Harvard sent her to school. She would study

Russian during the day. She did all their correspondence, and manuscripts, and whatever, in Russian, in addition to everything else she had to do for her own professor. She had a great time. Well, anyway, we met a lot of great people through our babysitters.

But after awhile, we decided the hassle of managing with these wonderful, but transient babysitters was a little bit too much hassle. We met somebody quite by chance who was looking for a babysitting job. She has been with us ever since, for fifteen years; she has been fantastic. Now, the best thing about our present arrangement is that she comes to our house. She's been with us so long that she has kind of raised all our children.

Sherkow: Does she live with you?

Dresselhaus: No, no. She has five children of her own. She lives very close by; she lives up the street from us; she lives close by, and she is one of the big attractions of this area for us. It's great having this nice babysitting arrangement. We still have her with us after fifteen years.

Sherkow: Did you ever take any time off while you were pregnant?

Dresselhaus: No. No. Most of the time, I was feeling pretty good, and my job was interesting. My job wasn't really hard, physically, work; it doesn't need to be. So there wasn't any reason that I couldn't do the work associated with my job all the time I was pregnant. I was sufficiently interested in my work that I couldn't put it down at all, so I even took

my briefcase to the hospital with me when I had babies. Yes, really, I did. The thing was that after the first child, we didn't have that much help at home, and there were the other kids. I was always anxious to get right back home to them. And so it was that my children were all born very fast; fast in the sense that I left the hospital the next day with all of them. I didn't take much time off for being pregnant or having them. I came right back and went back to work. As a matter of fact, people never noticed when I had a baby. Maybe it was because I didn't miss any time from the work, and they didn't notice. Right after you have a baby, it's not all so clear that you've had it yet, because it takes a few days to get back in shape; so people just didn't notice it. When people would ask me, "When are you going to have your baby?", I said, "I already had it." (Laughs)

Sherkow: (Laughs)

Dresselhaus: "Don't I look different?"

Sherkow: It would seem to me that you would. In what ways did your husband help in raising a family and domestic affairs?

Dresselhaus: All ways, all ways. Especially when the children were small, he spent an awful lot of time babysitting for them, and changing diapers, and taking them out for walks, and all things that have to be done. He was right there. He always helped with shopping, and whatever had to be done around the house. He's always been good, and still is.

Sherkow: Did he commute back and forth, too? During the day you

mentioned that you went home to feed the babies.

Dresselhaus: Oh, well, I used to do a lot of commuting, because I nursed all my children, so I would have to run back home during the day to nurse them. With the four kids, there was always a lot of traveling involved with that; that's why I was the one that was on the road.

Sherkow: I see.

Dresselhaus: That wasn't anything he could do for me. But aside from that, we pretty much shared the work. He worked it into his schedule. I hear people talking about all the sacrifices that one must make for children. We never looked upon these as being sacrifices. We like our kids, and we like to work for them. It's just part of raising kids. Part of the joys of raising kids is the clean-ups, and whatever else has to be done.

Sherkow: When did both you and your husband have time to spend with your family? I mean, it does seem like there might be a time problem.

Dresselhaus: We had a babysitter who was there from nine-to-five, nine-to-six. Then there's the evening; we would get home, and then we'd be homewith the children. Then there was the morning of getting up and getting everything organized, and then we'd be off to work. We saw the kids when we were home, and when we weren't home, they had a babysitter.

Sherkow: Did the babysitter also do the housekeeping jobs?

Dresselhaus: Not too much. I don't know what your impression of having

four kids in five years is like, but it was an awful lot of work just babysitting. At least when the children were small, keeping track of four kids--four screaming kids--a whole day, is a big job. And then coming home and having five of your own, you can't expect anything more than just taking care of our four. She's always done a fantastic job of taking care of them. She does everything she can, and it's just humanly impossible to do a lot of work around the house with that much babysitting.

Sherkow: So you and your husband shared that?

Dresselhaus: Oh, well, we're not such great housekeepers; we do what one has to do, but we are not pedantic about housework; we put things in perspective. You do what you have to do, and we don't worry about being the most immaculate people in town. I mean, I don't get a blue ribbon for housekeeping. I don't mean our house isn't fine. I'm not trying to say that there's anything wrong with the way we do housekeeping, but we don't make a fetish out of being immaculate and having everything spic and span. If you're willing to relax about that, you can make out just fine.

Sherkow: Were you living in Arlington the whole time?

Dresselhaus: Yes, we've been living in the house that we have now since 1960. When we first moved here, we were looking around for a place, and we were looking at houses among other places. We saw this house for sale, and the people weren't anxious to show us around. It was, I think, the second or third house we looked at. The people who were showing us this house liked their privacy, and they just showed us a couple of places

in the house; pretty nice neighborhood, conveniently located. Then we moved in, we found out what a wonderful house we had bought, and what a nice location it was. With most people, when they do things, after they look into them in detail, they turn out worse, but in our case many times it's happened that we went into something as stumbling bunnies, and it all turned out great. So we really have liked our house, and there's not been any reason to move; I imagine we'll stay in this house for a long time to come, unless we decide to leave the area, or something. It's a perfectly fine house.

Sherkow: What are your feelings about part-time work while raising a family?

Dresselhaus: It's okay. I don't have any preconceived notions about full-time versus part-time work. I think you do things as they are comfortable for you, and what works out well for your own situation. The profession I'm in, it's hard to do on a part-time basis, so it would be hard to be a part-time worker; I've been able to manage a full-time career with my other commitments. If I couldn't manage it, I'd do part-time work, and it wouldn't bother me. I don't have any preconceived notions that one is better than the other. Of course, on a part-time basis, I don't think you could be doing the job that I'm doing today because I can't even do the job I'm supposed to be doing here at MIT on a full-time basis; it takes more than forty hours a week to do this job. But there are other satisfying jobs.

Sherkow: I just read that in the field of physics, there seems to be some disagreement as to the advisability of working part-time or full-time. Some people say, "Well, you really can't do a good job."

Dresselhaus: It's very hard to do it much effective part-time. I have some friends that have been part-time for a number of years while their children were small, and they managed fine; they moved back to full-time after their kids got a little older, and they've had just fine careers after that, careers that have been not very different from the main-line type careers. They worked enough during the part-time period that it was about two-thirds time. But there are other people who haven't been able to do that. So it's not a question that I think has a black and white answer.

Sherkow: The feelings seem to be rather strong.

Dresselhaus: It depends on what and what. If you are on the university track, and you have a faculty position, I don't know if you can do that on a part-time basis, just because it's such a fragmented job, and you have such a large responsibility. But take my Lincoln job, for example; that's a good research job. I can see how I could have done that on fewer hours per week than I did. I wouldn't have done as much as I did, but I could have worked on one fewer problem at a time, or two problems fewer at a time. It would have been still enough to make a contribution. Then when the kids got older, I could have worked more hours; it depends on what you want to do. My present job, you can't do on a part-time basis; that even applies to a junior faculty position. What I'm trying to say is

that part-time work may be possible for some jobs; within physics, there are many jobs.

Sherkow: Why didn't you choose to work part-time?  
link

Dresselhaus: I didn't choose one way or another. I had a job that was full-time, and I was doing fine handling that with my other commitments; so I did it. There were times when I wasn't strictly full-time, and there were times that I was super-time. There were periods of time when I had babysitting problems; there were a couple of times when my babysitter was in the hospital for an operation. That happened a few times during the time that she's been with us. During that period, it was just very hard for me to manage with the family, and to do everything. At that time we had very poor help, I was very overworked, and I couldn't do it all; so there was a period of a month or two here and there that I was working less time. Then, when things straightened out, I worked more. It was all made up, in time; it averaged out. We all go through better periods and worse periods.

Sherkow: You apparently were working in a situation where that was possible.

Dresselhaus: It's always possible. That's what I'm trying to say. You always make it work out. You can only do what's humanly possible. That's true for all people, and in every job situation; there are variations, variations on the theme.

Sherkow: Helen Astin has written a book called The Woman Doctorate in



America, and in that book she's brought up the idea of the possibility of establishing new tax laws, allowing any professional woman or a working woman to deduct expenses that she incurs by employing domestic assistance. What do you think of that idea?

Dresselhaus: Oh, yes. Oh, gee, I'm so much with her. I've been talking about that for fifteen years or more. When I started out at the very beginning, it used to cost me money to work; it was an economically negative thing for me to work--and I had a pretty good salary. But when I figured out the expenses, the additional expenses of the household because I was not there during the day, the cost of babysitters, the social security you have to pay for the babysitter, all these things, it turned out to be totally uneconomical for me to work, in the beginning, when I was first starting out. But I worked because I liked it. Later on, my salary got bigger relative to the babysitters, and it became a little more economical. But I think the way the laws are now, they discourage women from trying challenging work. The laws have changed with time, and they get better every year. That is, you can deduct household help up to a certain point, but I now make too much money, so none of these laws have ever helped me. But I just think the whole thing is unfair and it hurts my feelings. I just feel very hurt by it.

Sherkow: So you would be in favor of her idea?

Dresselhaus: Oh, I think I'm a strong supporter. I'm willing to work for it; go talk on a soap box for it. I mean, I have really strong feelings about that, and I think a lot of professional women have strong

feelings about it; the tax laws are a slap in the face to women. Those years when my children were small, and I was really, really working awfully long hours and very, very hard, from an economical point of view, I was making zero wages. It just didn't seem fair.

Sherkow: Well, we're coming to an end.

Dresselhaus: Why don't we quit for today?

Sherkow: That's a good place to stop.

--END OF SESSION--

MIT ORAL HISTORY PROGRAM

Project on Women as Scientists and Engineers

Interview with Mildred Dresselhaus

by Shirlee Sherkow

Cambridge, Massachusetts

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Session 5

transcribed by Janet Billane

Sherkow: Today is September 13th, and I'm here with Mildred Dresselhaus in her MIT office. Last time, we concluded with the discussion of Lincoln Lab and your seven years there. One of the things that you didn't talk about was the encouragement and support that you received there. Could you elaborate on that?

Dresselhaus: Yes. I have little recollection about what I said about the Lincoln Lab experience because our last talk occurred quite a few days ago. Let me say that Lincoln was professionally a really important part of my career for a number of reasons. For one thing, it was an exciting place to be doing research because they had an excellent staff. Encouragement was received just by interacting with so many smart people, doing such exciting things. It was a forefront place in the solid state

field internationally. I was in a good research group, a small group of people, my close associates. Everybody got encouragement just from talking to each other. It was just an exciting place and an exciting time. I think it was an exciting time in the field. The early 1960's were the heyday for solid state physics. Great discoveries were made right and left. I think it's always good to be in a field that's moving rapidly.

Now you ask me about individuals. The management at Lincoln Lab was very good. The person in charge of the whole solid state division, for at least the early years I was at Lincoln, was Ben Lax. Ben is a person that I think has a very, very good feeling for research and research management. He does a lot to make his people feel wanted and successful and excited about what they're doing. He has a good way to play down the paper work and the administrative things that go with the job and to focus on the essentials. He's always been very, very good that way. I think that when times got bad later on in the late '60s and '70s, I was no longer working for him; he was not my supervisor. But I think that he made a big effort as a person to keep up that approach to research, to emphasize the important aspects and to play down the paper shuffling. I'd say that many other places in those periods didn't understand the value of research the way he did. So I think it was a combination of the research field, what was happening internationally, and that Lincoln was a good place and attracted very good people. And we were all there at that time. We were young and active. It was just an exciting time that was reinforced by the good management.

Sherkow: Who else was in your research group?

Dresselhaus: In my local research group, there was a colleague, John Mavroides, with whom I worked for most of the time I was at Lincoln. We were kind of co-colleagues. We had a technician, Don Kolesar. Then I worked a lot with Gene Dresselhaus. That was more or less the research group. Gene was a theorist. I had the most interaction with Gene, more than Mavroides or Kolesar. I mean it wasn't that we all formed a group, but those were my close collaborators. I collaborated and interacted with a lot of other people at Lincoln Lab. Those weren't my only colleagues but those were the everyday people with whom I worked all the time.

Sherkow: You haven't really specifically talked about the work that you've done there.

Dresselhaus: When I first came, the very first few months, I was still thinking about superconductivity. But that was a field in which there was almost nothing going on at Lincoln; it wasn't one of the areas that they had as their main focus. There was a group working in superconductivity at Lincoln, as a matter of fact. There was some work, but it was in another part of the building; for some reason or other, I didn't get attached to this group. I used to talk to them quite a bit in those early days. They were doing tunneling experiments. We had a lot of personal interaction, but we didn't ever publish any papers together. I used to see them quite frequently. When I first came to Lincoln, I was looking around for different problems. I was looking at

problems in magnetic fields because my thesis work had been properties of superconductors in magnetic fields. There was a lot of interest in magnetic fields at Lincoln Lab at the time. They had a number of good magnet facilities. There was talk and interaction with the National Magnet Lab; it wasn't, however, called the National Magnet Lab at the time. It was just a facility down on campus in the basement of Building 4. It was a very small operation at that time. But the group I was attached to, the larger group, not these few people that I discussed, but the division or group of about fifteen professionals that were around me, were active in magnetic fields and did have some interaction with the people on campus.

Early on, during the very first few months I was at Lincoln, we started working on bismuth, which is a semimetal. I got into this project because I had background from the University of Chicago in semimetals. But it was just like general background knowledge. However, the project at Lincoln Lab, when it got started, seemed to be subcritical in size in terms of personnel. I just fell into joining that project because they needed the manpower. I don't remember if I was specially invited in.

There was some work that was ongoing when I first arrived at Lincoln, in cyclotron resonance in bismuth. The idea at that time was whether one could do interband transitions in bismuth, to do optical transitions between bands, as had been done in semiconductors. I got started on that project. To be able to use higher magnetic fields in order to make the experiment work better, we came down to the magnet

lab here at MIT in the basement of Building 4. That's how my association with the campus started.

I think I would come down one or two days a week. And magnet time was any time over a twenty-four hour period. Magnet time was allocated in eight-hour shifts, starting from eight to four, then four to midnight, and midnight to eight am. Those were the three different times for magnet runs and one got a distribution of times. It seemed that I always got the midnight shift. At least that's what I remember. We called it the "graveyard shift," the twelve midnight to eight in the morning shift. But I'm sure that I wasn't discriminated against. It's just that at that period in my career it was very hard to work during those hours.

We got a lot of exciting results with bismuth; clearly, that was a very good project. But I quit working on bismuth after a year or so, even though the project was still going on. I quit because I had some personal conflicts with one of the people who was working on the project. It wasn't that I had problems with him, but he had problems with me. He didn't seem to want to work with me. So I moved on to something else. At that time, we thought of applying the same thing that we had done with bismuth to graphite. It turned out that I came back to bismuth later in my career, and I have since revisited bismuth many times. It's become an area in which I have made a lot of contributions over a long period of time. But I worked in that field for maybe a year or so, shortly after I came to Lincoln. And then I changed areas.

The graphite project is something that I took up at that time with John Mavroides, and Don Kolesar was our assistant. That's a project that I've sort of stayed with forever. I'm still working on graphite. We've done many, many different things in that field, but somehow I keep coming back with new ideas of things to do in that field. The very first experiments started in about 1963, and concerned the study of interband transitions in graphite. One thing led to another, and we just did many different things with graphite. The graphite work involved high magnetic fields. The high fields involved coming down to the magnet lab. So I spent quite a bit of time down here on campus while still at Lincoln.

Sherkow: Did the other members of the group also come down here?

Dresselhaus: Yes, yes. We all used to come down. Then somewhere along in there, I started developing contacts with graduate students. That also happened around that time. Concerning the work on graphite, it seemed that we made predictions on the basis of our interband transition work about the graphite Fermi surface. It seemed that it would be nice to have a student do some work studying the Fermi surface. It happened at that time that R. A. Smith had a student who was doing some work with arsenic and Fermi surface measurements, called De Hass-van Alphen measurements. So I interested him to do some work on the graphite problem. That turned out to be a major part of his thesis, and we then published a number of papers together. That was really the first student that I had completing a thesis. That thesis was finished in about 1965. I was only an unofficial sponsor. I don't think that I was the person that



signed that thesis, but I was a main supervisor.

Sherkow: Were you the only member of this group who was involved with the work of this student?

Dresselhaus: In a research group, you interact with members in different capacities. So when we were doing the interband work, then I had the team with Mavroides and we worked together. But those colleagues had other projects that they worked on also. And I had other projects that I worked on. So we didn't work together everyday, all the time. They weren't involved with the students at all; that was only my project. But I was working on that project with somebody at the Magnet Labs, [Simon] Sy Foner and Professor Smith, R. A. Smith. Now, Professor R. A. Smith was more the nominal supervisor. Foner was the guy that supervised the setting up of the De Hass-van Alphen equipment. That set-up was all done before I ever came on the scene. I only got into this project because they had this equipment, and were doing some experiments with the equipment. I wanted them to try to do another experiment with the same equipment. That's how I got into the act; then my suggestions turned out to be the major part of his thesis.

Sherkow: I was concerned with the division of labor and how decisions were made.

Dresselhaus: We were really a very congenial group. That's the main part of it--we were very congenial. I had a problem for the student to do, and he had equipment, and he was looking for more things to do with his equipment. So I didn't supervise the instrumentation part; that was

already finished before I ever got involved with the problem. But I was the one person that knew a lot about the physics of graphite. I had a big influence on what was the experiment to do next, and what does it mean.

And this was how it happened that I was down on campus talking to the student a couple of days a week. We spent a lot of time working together. But it was kind of an unofficial fun-type relation. I didn't get any official recognition for this, I don't suppose. But when the papers were published, though, we were the co-authors because we all did different parts of it. There was a part I was expert on, and there was a part that Sam--(Sam Williamson was the student)--a part that he was expert on. And Sy was there; he was a big help with the equipment. He was important in the initial stages of the thesis, and I was important in the later stages of the thesis. And we complimented each other in this way. We're all still great friends.

Sherkow: Did part of the decision-making involve what each person was best at doing?

Dresselhaus: Yes. There was not any real decision-making. I don't know that we looked at it that way. It was sort of obvious what had to be done. The person that was expert in that particular area gave the advice. As I said, we were a very congenial bunch. I can't think of it as anybody making decisions. But I guess somebody made decisions. Decision-making was a little different at that time. Later on, after I became a professor at the Institute, and I supervised graduate students, the chain of command was much more clear. But when I was a sort of

a research-type person here on campus, supervising graduate students, there wasn't a clear line of command. But it worked out very well. I think where it worked out better in some ways is that I had a lot more time to spend with the individual graduate students. Later on, when I had an official position at the Institute and was the official supervisor, I had many more students at a given time and also a lot more responsibility in other areas. So the amount of time that could be spent with any one student was less than with this [thesis] student. I mean, we did really great things in that thesis. That was a good thesis. The main paper we wrote is a paper that's referred to many times, even today.

Sherkow: There were independent discoveries involved in this paper?

Dresselhaus: All theses are independent discoveries. They were all new things. Yes. We discovered some major things, new things that went into this thesis. That's right. We made a quantum change, a big change in the graphite field with that thesis.

I had some other students while I was at Lincoln. I had Paul Schroeder, who did an interband laser experiment in graphite. I guess he started a little after Sam but roughly at that same general time. He was officially [Ali] Javan's student. Javan wanted to do something with magnetic fields and lasers, so I suggested this problem, and we co-supervised the student. Javan supervised the laser part, and I supervised the graphite part. It was a congenial working relation. As a matter of fact, Javan did an awful lot to help me with that because

he had money. I didn't have any money to support the project. At the time, I never thought about the financial aspect of research. But now that I'm more wise, I realize how much help he gave.

Sherkow: I just wanted to go back to one thing that you had mentioned. You had talked about being involved in this bismuth experiment, and you stopped working on that and went to the graphite because one man didn't get along with you in one way or another. Could you just say what exactly it was? You don't have to mention his name.

Dresselhaus: I never did really understand what was the situation. He had a difficult personality. He just felt that he didn't want to work with me.

Sherkow: Was it because you were a woman at all?

Dresselhaus: I think that that could have been related to it. But I never understood the exact details, and rather than get upset about it, I just decided not to make a big issue of it.

Sherkow: Did he not get along with other people?

Dresselhaus: Yes. He also had trouble getting along with other people. He left Lincoln Lab shortly thereafter. I now feel, looking back in hindsight, that the project suffered because I left it. I think the project would have gone better if there hadn't been this personality clash. There was a part of the project to which I could have made a bigger contribution. But when he left MIT, which was very shortly after this

incident, I picked up and did much more work with bismuth. But while he was there I didn't try to compete with him. While he was doing it, that was his thing. I had many other things to do; I wasn't without work. At various times in my career, there have been people who have found it hard to work with me; it hasn't happened very frequently because I think I'm pretty congenial. But there have been some people, and I've not tried to work with them if I wasn't wanted.

Sherkow: Were the rest of your colleagues in this research group behind you in terms of this problem with this one individual?

Dresselhaus: Yes. But, work has to go on, and if people clash, you find some other arrangements. Nobody made a big issue of it. I had too many things to do, and if he wasn't happy having me, I was happy doing something else. I don't know all the details of what was in his little mind; that was his problem.

Sherkow: One of the people that you worked with was Laura Roth.

Dresselhaus: Yes and no. I only worked with her in the sense of talking to her. We never published any papers together. But we worked in the same large group, not in the same small group. We had many conversations. We were good friends. But we never did research on exactly the same project. That was just coincidence. It could have worked the other way.

Sherkow: In some of the things that have been written about you, you've indicated that you did have a problem--and Laura Roth had the same problem--

of getting to work a little bit late, not at nine am.

Dresselhaus: Yes. That was a big irritating thing about Lincoln Lab for me at the time. I guess, through no fault of their own, they felt contractual obligations to have a certain time schedule for people. The official work hours were, I guess, eight-thirty to five and then an hour or a half hour for lunch. You can figure how that works out for eight hours on the job. In reality, the way it worked out for us is that we had plenty of good opportunities for babysitting after five pm. But the early hours in the morning were the hard ones, just getting ready. People taking care of kids usually aren't able to start work much more before nine o'clock. There's transportation, and whatever. So it was just extremely difficult to have a babysitter start at eight o'clock. The best we could do most of the time was have somebody start at nine or eight-forty-five, which sounds like pretty early in the morning. You have to get the babysitter there or the children to the babysitter before you can go off to work. So it's like making arrangements before the day starts and getting everything ready for the day. So just to be on the job with small children at nine o'clock requires getting up at six and doing a tremendous amount of work around the house.

Neither Laura nor I seemed to manage getting there at nine o'clock; we used to be there at nine-thirty because we used to get our babysitters between a quarter to nine and nine o'clock, which is pretty good when you think about it. It wasn't all that bad. But the lab didn't like it. We used to stay late, however. We used to always work at home at night. All the years I was at Lincoln, I always did work at night.

We never left before five-thirty, almost never. That was our regular work time. So even on the lot, we were there the requisite time but shifted by a half hour; they didn't like that.

Sherkow: Who do you mean by "they?"

Dresselhaus: At Lincoln there were some people who checked the time. It wasn't somebody at Lax's level, but they have administrative-assistant types who do such work. They are not so much technical people, but they're other people. They check you in when you come in. At Lincoln they had a little counter that counted people coming in the front door. Lincoln had all kinds of ways of accounting for people; I'm not quibbling with that. I think that maybe an organization has to run with some kind of time schedule for people, accounting for time. But I think there has to be some flexibility, and they didn't have much flexibility.

We both were given a hard time by the administrators because we were unable to conform to the regulations. I think, also, we didn't make enough effort to try to conform to the regulations. It just seemed too difficult, and it didn't seem worth our while to do it. So neither of us did it. And, therefore, we were always hassled by [it]. But then we used to get upset about it at the same time.

Sherkow: Are you saying that if you would have tried harder, that perhaps you could have gotten there a little closer to nine?

Dresselhaus: I guess. I guess. One can always do things. But neither of us seemed to be able to manage it. On the other hand, we were both

pretty upset about it. I know we were. I was. It was a constant irritation.

Sherkow: Does that mean that you and your husband didn't go to work together?

Dresselhaus: Yes, we did. So he had the same problem, consequently.

Sherkow: So he always got there about nine-thirty?

Dresselhaus: Yes. He got there with me. Yes. We used to go together. Right. He was part of the reason why I didn't make more effort because he looked upon it as a matter of principle. He didn't think that they should hassle me about this.

Sherkow: Were you being hassled and not him?

Dresselhaus: Well, they didn't hassle him, really, because he was just taking me to work. (Laughs) I guess that was it.

Sherkow: That doesn't seem fair, somehow. Now in 1967 to '68, you came to MIT in the electrical engineering department as a visiting professor. You did mention that this problem of getting to work late was one of the reasons why you left Lincoln Lab.

Dresselhaus: I was just getting tired of it. After you're at a place for awhile, sometimes you feel you need a change. I was feeling that I'd like to do something a little different than I had been doing.

Sherkow: Did you actively seek jobs elsewhere?



Dresselhaus: Oh no, no. I never looked for a job.

Sherkow: Were you considering other things?

Dresselhaus: How it all happened was, I think, we were having lunch in the cafeteria. We must have had some campus people at lunch with us. We had some friends--George Pratt, who was in the EE (Electrical Engineering Department)--he also came down to campus from Lincoln. He overlapped with me at Lincoln for the first couple of years I was there, maybe the first two or three years. Then he got a job in the Electrical Engineering Department. We remained friends. I used to come down and give a lecture for him in his course now and then. He used to follow my work. When I was down on campus, I spent quite a bit of time with the students I had. I guess that's been mentioned, that I had some graduate students on campus. I was supervising them here and then also using the magnet lab facilities. Thus, I spent quite a bit of my time on campus. So I used to talk to some of the people, in a casual sort of way. Now and then I would complain about the Lincoln situation. By that time, Lincoln was not as good a place as it had been when I first arrived.

Sherkow: Why was that?

Dresselhaus: A number of people had left. In particular, Lax had left. He left about '64 or '65. I don't know exactly when, but he left about halfway through my stay at Lincoln. And after he left, the place really went downhill. A lot of other people left, and the whole climate and atmosphere of the place changed; it just became a place of less excitement. Maybe the field also changed. There was less money in research in the

late '60s. Everything changed. The whole atmosphere at Lincoln became just a little less exciting.

George Pratt was always looking for colleagues down here. He had heard about this Rockefeller Mauze chair. And he said, "Well, golly, they have this chair available. Hell's bells! There's money from the Institute. Why don't we try to get somebody visiting the Electrical Engineering Department?" So he asked me if I would like to come down. This was just very folksy, low-key conversation; he wanted to know how I would like to come down and do some more teaching. By that time, I had taught for him in his course a few times. I figured that I could make some contribution to the department as a visitor. So he said, "Well, if we can get her for nothing, why not?" So he asked me if I'd like to come. I said, "Sure. If you offer me a job, I'll come and spend a year here." So he made some inquiries, and it turned out that the Institute had all this money for a visiting woman faculty member. And there were essentially no applicants.

Sherkow: Was that because it wasn't publicized?

Dresselhaus: I think it was partly because it wasn't publicized. I think it was a case of there being essentially no competition for it. So he made up a case for me--I got my curriculum vita and made up a case and presented it. After awhile, I got a letter that I had been appointed. It was pretty simple and straightforward. There wasn't much to-do about it. So that's how I came down to MIT.

Sherkow: What exactly is this Abby Rockefeller Mauze Chair?

Dresselhaus: Mrs. Mauze, who is the older sister of the five brothers of the Rockefeller family, was a great philanthropist. She was interested in furthering opportunities for women; she was interested in this for a long time. She was way before her time. She thought it would be a good idea to give some opportunity for women scholars to do things at a major university. Somehow she got the idea, I imagine in consultation with some other people, that it would be a good idea to support women scholars in non-traditional fields and in technical areas. She gave a million dollars, approximately, to MIT to establish a fund for the support of women scholars. Now, MIT had very few women scholars on the faculty. Her idea was that this chair would bring visiting women scholars here, and they could take advantage of the opportunities of the Institute.

I was the first Abby Rockefeller Mauze professor that came to MIT for any length of time. There was somebody who came before me, actually from England, whose name just escapes me, who was a crystallographer and a very distinguished and famous woman. She had visited here for a few weeks--for a very short period of time, the year before. I never met her while she was here. I didn't have any connection with her. One thing about this chair is that there hasn't been a whole lot of connection between different holders. One has to make a real effort to find out who the holders are. We have since had visiting Abby Rockefeller Mauze professors and I didn't even get to meet them. I don't get to hear that they're here or have been appointed, except through Tech Talk. So that's essentially the way this thing was with her, and I didn't meet her when she was here.

So when I got this visiting appointment, I didn't know what the boundary conditions on it were. I didn't know what the expectations were, so I made up my own. I knew one important thing was to get involved in a major research program. But I was already involved in an on-campus research program because of the contacts mentioned before. During my year as a visiting professor, I offered a course because there seemed to be some need for more courses in the solid state area, so I gave a graduate course.

Then I looked around and got in touch with Emily Wick, who was dean of students, and tried to talk to her about what I could do on some other fronts. It seems to me that since the Mauze fund was donated for women scholars, these women ought to do something for younger women scholars. So I contacted Emily Wick, and we spent a lot of time talking about what we could do for younger women scholars. One thing we did was to have a little coffee hour up in the [Margaret] Cheney Room, that met once every couple of weeks. That was the first thing of its sort, and it provided interaction between women faculty and women students. As for the coffee hour, I didn't really know too much about how to proceed with setting one up. Some students find it very useful to see a faculty member and talk over career vs. family, and related things. That was part of what I saw as my job under this visiting appointment. I think other people that have had that chair since have also followed some of the format established during those early years.

Sherkow: Is part of this chair an obligation to be involved in special work for women?

Dresselhaus: There is no formal obligation to do anything. With the appointment, there was no statement about what my duties were. I was just here for a year to do whatever I wanted to do. It seemed to me I would do something that would be useful to the Institute and useful to myself. The research area was just a continuation of what I had been doing, except more focused on the component that was on campus. And the teaching part--I saw a need. I'm one of these people, when I see that there's work to be done, I get in there and do it. I don't ask too many questions. So there seemed to be a need in that area. There seemed to be a need also to do interfacing with women students around MIT. So I got into all of those three things, and it turned out, in retrospect, that those were certainly the right things to do.

I must say that I wasn't all so great at all of these things because I had no previous experience in the counseling. That was the very first. I only did that for a period of time. I moved on to another service function later on, in working on admissions. So the way I operated is I would give some time for public service around MIT. I always give some time for public service. I picked the thing that I feel there's a need for, and I can make a unique contribution to.

Sherkow: I don't exactly understand why you made the switch from physics researcher to professor in electrical engineering.

Dresselhaus: That wasn't a real switch, even though the title sounds like a real switch. My position at Lincoln Lab was research. I was a staff member of a research group. Working in solid state physics, you do what

has to be done. It's sort of a jack-of-all-trades from plumber to electrician. You do what needs to be done. George Pratt was down at MIT in the Electrical Engineering Department, and he was the guy who went through the trouble to invite me to talk on a particular subject; he was my official host. Being a member of Electrical Engineering, it would be normal for him to put through a visiting appointment in his department. So that's how I came to Electrical Engineering, because George Pratt supported me.

Now why didn't I go to the Physics Department? That would have been another possibility, but the person that was in the Physics Department, who would have been my natural sponsor, was Ben Lax. And at that time, Ben Lax had all kinds of troubles in the Physics Department. He had a lot of enemies there. It didn't seem like it would be right for me to come into a hot-bed of controversy. So I thought it would be better for me to go into a place where I would have a welcome, and where there wouldn't be any fighting or politics. So that's how I wound up in the Electrical Engineering Department. Also at that time there was very little work in experimental solid state physics in the Physics Department. There was more activity in that area in EE, and also more teaching in solid state physics. So in a sense, it was quite natural for me to join the Electrical Engineering Department. In retrospect, it was certainly the right move to make.

Sherkow: Are you saying that you weren't obligated to be involved in research work that you weren't familiar with? It was still solid state physics.

Dresselhaus: Over a short time scale, I never change my research field so very much. I just take on new things, and move in new directions, and whatever. The only time I made a radical change in my research direction was when I came to Lincoln Lab and changed from superconductivity to optical properties and energy bands. After that, with all my research work, one thing has evolved into another; there's been a constant change. I'm always changing my research. With every student, I move in a little different direction. You take on some new kind of project, move into some new area, but there's been some continuity and some connection between all the things I've done since. The only time I've made a real break was in 1960, when I first came to MIT.

Sherkow: So you were carrying on the research that you've been doing at Lincoln Lab, even though you were in the Electrical Engineering Department?

Dresselhaus: Yes. At MIT--maybe this sounds very strange to you--but there's a lot of overlap of interests between departments. The kinds of research that I do are on the borderline between the Physics and Electrical Engineering Departments, and I could fit into either one. Now, we have several people that could fit in either department; George Pratt is another person. There are about five or six people in the department that are in this borderline area, so I have company. It's not that I'm all alone.

Sherkow: Did you want to stop now?

Dresselhaus: Yes. I think it would be a good time.

MIT ORAL HISTORY PROGRAM

Project on Women as Scientists and Engineers

Interview with Mildred Dresselhaus

by Shirlee Sherkow

Cambridge, Massachusetts

September 20, 1976

Session 6

transcribed by Janet Billane

Sherkow: Today is September 20th. This is the sixth session with Mildred Dresselhaus at her MIT office. Last time we were talking about the Abby Rockefeller Mauzé Chair, when you were a visiting professor in the Electrical Engineering Department and how that evolved. We didn't exactly finish with that. One of the things that we did discuss was your research and how you didn't feel that you changed research work in moving from the Lincoln Lab to the Electrical Engineering Department. But you didn't specifically say what kinds of research you would be doing in the Electrical Engineering Department.

Dresselhaus: Yes. It's hard to remember the specific projects that I was doing in 1967. At that time the project with Sam Williamson, who was my first graduate student, was over. I guess he went off for a post-doctoral fellowship abroad. He's had a number of jobs in the meantime, and now he's a professor at NYU and is doing very well indeed. However, I had two other



graduate students with whom I was working at that time. They were in the midst of their theses when I came down to campus. They both started at about the same time. One of them was Paul Schroeder, and he was working on magneto-reflectivity in graphite. The idea of that experiment was to do a laser magnetoreflexion experiment instead of using a tunable global source. We thought that we could get more information by using a laser source and working with polarized radiation. The advantage of a laser source was that we could get much more power at a given frequency and also could get more power at lower photon energies. This would allow us to do right and left circularly polarized studies much more conveniently than with conventional sources. For the graphite experiment, right and left circular polarization were the natural modes of polarization for doing the experiment. So his thesis was about that, and I can elaborate more on that if you want.

The other thesis student that I had was Martin Maltz, who was doing a similar-type experiment, except not with lasers but with conventional tunable sources in bismuth and arsenic. The problem in bismuth was supposed to be just a warm-up problem. It was a problem that I gave him to become familiar with doing magneto-optics. The real thesis was supposed to be on arsenic. It turned out that the work that we did on bismuth was quite significant. That formed a major chapter of his thesis, and we wrote several publications on bismuth that are quite valuable even today.

Now, I suppose you want to have a run-through of the various projects that I was working on. Those projects were in process before I became a visiting professor, and obviously they were suitable projects to continue with. Paul Schroeder was a student who was getting a PhD in

physics, but he had done his undergraduate work in electrical engineering. So he was kind of a hybrid between the two departments. Marty Maltz was a graduate student in electrical engineering. So those were the two graduate students. And around that time, a third student joined the group, Frank Missell, who was a graduate student in physics.

Sherkow: Did you pick up all these graduate students at Lincoln Lab before you came to the campus?

Dresselhaus: No, no. no. They were all on campus. They just got to know me and asked to work on a project. Frank Missell started working on a project because Paul Schroeder needed some help, not in the sense that he needed help with his thesis. But there was a lot of manual-type work associated with his thesis, and being in the lab by himself and in the room by himself was a little inconvenient. It seemed that if he had a helper who was working on a related project and who could share in some of the manual work, then both students would do much better. So Frank was recruited to work in conjunction with Paul, but his thesis topic was quite different. It was using the same basic system, but he was to study the optical Shubnikov-de Haas effect. So the thesis was on the observation of this effect in antimony and finding out the characteristics of this effect. He also did some theoretical work associated with this effect. So even though the topic sounds very different from what Paul Schroeder was doing, they used a lot of the same equipment. The problem was designed in that way. So the supervision of graduate students was something that had started before the appointment and continued through it and after it. So there was no need to change things.

As for my personal research, at the time I was working on energy bands and phonons spectra of the semiconductors silicon and germanium. I was working on that problem with Gene Dresselhaus. We continued working on that until it all was published. That was in large part what I was doing that year. It was very convenient that I had these ongoing projects. When you come to a new place and you have to drum up new projects, it's quite difficult getting all your teaching--  
--(Interview interrupted)-- . . . I was fortunate in having an ongoing program in my personal research and in student supervision. I was fortunate to have had a head-start in setting up a lab. It wasn't a big operation, but I had something set up already.

When I came on campus, then, I got a little money from the Materials Center. That was also a big help, that there was a Materials Center here that could provide a donation to my research program. When you first come to a new job and a new place, you normally don't have any outside research support. So I had a small number of dollars from the Materials Center. Then I had some support for the students who were continuing. Some of that money came from (Ali) Javan. Some came from George Pratt. So I had friends who helped me out here. That gave me a few years to build up my own support and improve the laboratory, and all of that. So I could put more effort into some other aspects of getting started at a new place. That is, I put in quite a bit of effort in setting up a course, which was quite successful, a graduate course in solid state physics. Then I had some programs for women students that I mentioned also in our previous session. If I hadn't been partly

established on a research program, I would have had to start that completely from scratch. Then I probably wouldn't have been able to manage all these different things at once.

Sherkow: Getting back to these courses that you helped set up, how did this evolve, and what was the reaction of your colleagues? You independently set up two courses that year.

Dresselhaus: The courses had been taught before. We had some numbers in the catalogue for courses in solid state physics. I think at that time there wasn't really sufficient staff to teach all of them. George Pratt was teaching them. I guess he was the main person teaching them, but he had just recently become very interested and active in the quantum electronics field. He wanted to give more emphasis to a new course that he developed in quantum electronics. So he was happy to get somebody who would take over the solid state course, and then he could bow out of that.

My course was a course on the books; it already existed. But when I took it over, I changed it entirely. I only came to MIT for one year initially, and I gave a one-year, two-semester sequence in solid state physics. A lot of what I gave, we still offer in some form or another. It's evolved and changed a lot over the years, but there's something that's recognizable from that element when I started it. The students did need some teaching in that field. We had a following of the electrical engineering students and the physics students. In more recent times, we've made these courses all a joint course between physics and

electrical engineering. That's been very good, I think, from everybody's point of view, from the students receiving the courses and also from the faculty in sharing the teaching load and making the course more interdisciplinary.

Sherkow: What were your colleagues' reactions to your setting up these two courses?

Dresselhaus: They were happy. There was a need at that time for courses in this area. When I first came to the Institute in the Electrical Engineering Department, there was a lot of applied work. What needed help was the teaching of the basic solid state courses because these courses weren't being done in the Physics Department. That was an area of the Physics Department that was not much emphasized at that time. So there were inadequate courses available in the physics of solids. I helped in setting up courses in those areas. With time, this part of the Electrical Engineering Department changed radically, and the people in the applied area left, one by one. So, although when I came there was a preponderance of people in the applied area, the Electrical Engineering Department now looks totally different.

Sherkow: The people have left now?

Dresselhaus: It had to do with erosion. Yes; the applied people have, just one by one, left. There were at one time twice as many of those, as [there were] basic types. Now there's more basic types than applied types. Over a period of ten years, a department can change very radically.

Sherkow: Is that one reason why you decided to come here from Lincoln Lab? You saw a need for applied physics courses?

Dresselhaus: It wasn't that I decided to come, but that they decided to hire me. I think they hired me because there was a need for somebody in this area. The department was a little understaffed in this area, and when I came I found a hole and filled it. After my initial appointment was over, I remained in that same general area. The courses that I've been teaching over the years have largely evolved around the area of that initial first year. I do teach different things, but it's a lot around that general area.

Sherkow: You indicated when you accepted this visiting professor position that you wanted to get away from Lincoln Lab, that you had had some problems there with getting there on time. You made a point of saying that there weren't any restrictions. In fact, there wasn't really any indication at all that this is what you should do, as a visiting professor; you said it was completely open. You could do whatever you wanted.

Dresselhaus: Yes. I think that's true of a visiting appointment--there are few responsibilities that are specified. That seemed like a nice thing. I'd done very little teaching in the past. I was welcoming that opportunity. I had some students with whom I had been working, and this appointment gave me a little more time to work with them. I liked the people down on campus. I knew a lot of people, and I liked them. I developed new contacts and started working on new sets of problems with them.

Sherkow: What I'm trying to understand is who identified the need for somebody to be working in solid state physics and to be teaching courses. Was that you?

Dresselhaus: It wasn't really so simple and obvious. When I had my Abby Rockefeller Mauzé visiting appointment, it was obvious that I was going to be teaching in my field of expertise. When I came down, it was obvious that they could use somebody teaching a course in this area. As I was saying, we were somewhat understaffed in this area, so there was a place to be filled. There's not really much more to say. It was obvious to me, and it was obvious to my colleagues, and they welcomed me. It was a very happy relation that I had with the various people here.

Sherkow: You indicated that you got research money from the Materials Center--

Dresselhaus: --MaterialsCenter. Many people in this building work on joint projects. The Materials Center has a laboratory structure. And at that time, research money was still plentiful. The Director of the Materials Center had a certain kitty of seed funds available for projects that he thought were of interest to the Center. Part of his program was to provide support for new people coming to MIT. This seed program emphasized their first year, before they could get their own support. So he provided me with some money that paid expenses for the research project during the first year I was here. The Abby Rockefeller Mauzé Chair just paid my salary. It didn't have much in the way of research funds.

Sherkow: What are the politics of receiving research money when you've just come in and you're new?

Dresselhaus: I don't know what the politics are. When I came down for this appointment, my colleagues here, who were more wise in these areas of funding research, procured this seed money for me. They talked to the Director of the Center on my behalf. I also knew the Director very well. Research support was just arranged as a natural course of events. As a matter of fact, we like to do things like that for all incoming faculty members. The difficulty that's happened in recent years is that research money is so scarce that it's very difficult to procure any.

Sherkow: Why is research money so scarce today and ten years ago it wasn't?

Dresselhaus: There was a period of many years, from the 1950s up until the mid-'60s when the research budget was increasing every year; the total national research budget was increasing by a very considerable amount each year. Starting about 1967-68, that expansion was curbed, and for several years running the total research budget was either static or somewhat decreased. But inflation was also present during all that period. Thus the general cost of research went up very considerably. So because of these considerations, research dollars at every university, including MIT, became more and more scarce from the time I arrived until now. All the time, it's been scarce.

I came to MIT at just the right time. I came at a time when there was still some research money that was available from the plush past. But in very short order after I came, it became very, very difficult to become established. Shortly after I came, I got into the swing of such



things as applying for grants. I got into the system just at the very last moment. One year later, it would have been much more difficult to get in.

Sherkow: What exactly do you mean by "you just got into MIT in the nick of time?"

Dresselhaus: My arrival at MIT was at a very good period of time. The total funding was going down every year, but there were some opportunities still for new starts in the grant system. In the federal grant system, the various funding agencies give support preferentially to <sup>those</sup> who are already in the program. Because their contributions have already been evaluated, the ongoing projects have an advantage. The agencies also have made an investment in the research, and they like to see it through to satisfactory completion. Everytime they start a new research project, they take on a new commitment. They feel responsibility to honor the commitment up to the point of getting results. So getting a new start on a research problem is always more difficult than getting funding for continuing research. When times are tight and there's very little money available for research, it's the new starts that become very difficult. The years that I got into the academic system were perhaps the last time that there was any money for new starts. After that, new starts became more and more difficult. I was already into the system when things got tough. Since then I have had to make a lot of new starts on different projects. But later I was already into the system. I got so that I knew my way around the funding agencies. The very first time you get into

sponsored research, it's much more difficult.

Sherkow: You indicated that you had friends here, and they got this grant for you from the Materials Center; they arranged it.

Dresselhaus: Yes, they arranged it. That was part of my coming here--my colleagues had to help me get some support to get started.

Sherkow: Who were these individuals?

Dresselhaus: George Pratt, I guess, and the department head.

Sherkow: Who was that?

Dresselhaus: [Louis] Smullin. He was the department head at the time.

Sherkow: Had you known these individuals from when you were working at Lincoln?

Dresselhaus: No. Smullin, I didn't know. I met him for the first time when I came here. But George Pratt I knew from Lincoln Lab. He was the one that figured out how to invite me to MIT. He saw the announcement for the Abby Rockefeller Mauzé Chair and thought he had a candidate. When he saw the announcement, he thought, "My gosh, I know somebody that can help us out. Why don't we get her?" Then he got in touch with the department head and said, "Well, there's this money at the Institute. You don't have to pay anything for a visiting professor under this program because it comes free to each department. The expense is just charged to the total Institute." So that's how it all happened.

Sherkow: Had you known George Pratt from working with him?

Dresselhaus: Yes, from Lincoln Lab. I knew him for a long time back.

Sherkow: But he was working in Electrical Engineering.

Dresselhaus: Yes. He had been at Lincoln Lab previously.

Sherkow: Part of the time that you were there?

Dresselhaus: Yes. When I came to Lincoln Lab in 1960, he was there. Then he got an appointment down on campus in the Electrical Engineering Department and he transferred. But I used to see him, from time to time; he used to come out to Lincoln. He was a consultant at Lincoln for several years after leaving MIT, so I would see him in that capacity. Then I would see him down on campus when I came visiting. Also, we had a lot of mutual ties. He invited me to give lectures when he was out of town. I lectured in his course from time to time. I was one of his regular guest lecturers. Everybody has guest lecturers in a course. The only way we manage to keep abreast of what's happening in the world is to do some traveling in connection with our jobs. When we're not on campus, and we have a lecture to give for a class, we've got to find somebody else to do it. So every professor has a few guest lecturers that they call on to help out when they're not around. I was such for George Pratt. Also, Marty Maltz was a student who started doing a thesis with George Pratt. Then somehow, he seemed to prefer to work on some of my projects. George was just supporting him as one of his graduate students.

He was working on one of my projects. It was the most amazing thing, now that I look back at it. I never thought about it in those terms at that time. But in the early years, George did a tremendous lot for me to get me started.

Sherkow: That's what it soundslike.

Dresselhaus: I think all my friends did. I've often said about my career--and I think it's true of everybody's career--that there are always some people who come out of the woodwork at the appropriate time, and they do an awful lot for you in furthering your career.

Sherkow: You had, briefly, last time talked about some of the work that you had done for women. You had a public service interest yourself. You felt that it went along with the chair. You did not go into great detail about the discussion group that you had for women students.

Dresselhaus: There's not a lot of detail to go into in a way, because I didn't know anything about counseling, and what I did was really outside my element. But it turned out to be useful, nevertheless. What it was is as follows: the women students have a room here--the (Margaret) Cheney Room. We just had afternoon tea and crumpets, a coffee hour, once every two weeks. I would decide on the topic, but the students would contribute something to what the topic would be. I would prepare a few ideas to talk about, like an agenda, a very loose kind of agenda. Then we would throw the discussion out to the students. There would be a lot of student interaction.

Sherkow: Were you addressing yourself to career problems for students?

Dresselhaus: Yes. Career problems, or any problems. Career and problems that they had as students, as well.

Sherkow: Was it open to undergraduates and graduates?

Dresselhaus: Yes. Right. It was open to all. The undergraduates were mostly immersed in their short-range problems of today. The graduate students were more concerned with the problems of women doing research. We talked about a lot of those problems. Then we talked something about careers.

I must say that a lot has changed in our social system during these ten years. Women are much more career-oriented now than they were at that time, although our women, of course, were much more career-oriented, (by far, more career-oriented) than the outside, average woman. Our women, of course, had a lot of dedication; otherwise they wouldn't have come here. But compared to today, I'd say that they had much less career-orientation at that time. They were pretty much wrapped up with the morés of the time, and for the most part were planning to be good housewives and fit their careers in as best they could.

Sherkow: What were some of the major problems that they were talking about?

Dresselhaus: The undergraduates had a lot of problems with the male students; that was a perennial topic. They were so outnumbered in the technical courses, and they felt very self-conscious. Many felt that they

weren't performing up to their potential because they felt so self-conscious. And the professors didn't know how to deal with them. That sort of thing bothered the undergraduates.

Sherkow: Did they feel they weren't treated correctly?

Dresselhaus: Yes. There was a lot of that, too. Then they had problems with boyfriends, problems that arise when you're in an institution with so many men around you. For many students there wasn't much separation between their work associates and their boyfriends; this created a lot of problems with the other people in their research group or in their classes.

Sherkow: I don't think I understand what you mean by that. They didn't have an outside life, outside of the Institute?

Dresselhaus: Often a lot of the men whom they met at school became boyfriends. There was a large overlap. Take the Radcliffe girls; ninety percent marry Harvard men.

Sherkow: What would be the problem involved in that?

Dresselhaus: The problem is that if you're in a research group as a graduate student or an undergraduate and one of the guys in the group is your boyfriend, it makes it hard to get along with the other guys in the group. There are personality relations that sometimes get in the way of business. Or, if the girl has a boyfriend who is the research associate of the group, he's sort of a little step above where the students

are, and he's the guy that has direct supervision over some of the students. In this situation he has difficulty treating the girl student the same way as he treats the boy students, because she is his girlfriend. So there were all kinds of problems like this, and the girls used to come around and talk about them.

Sherkow: So you decided to have this discussion group because you felt the need for women to talk about these things?

Dresselhaus: Yes. There was a need. Emily Wick had tremendous influence on all of this. She was the dean of students at the time. When I got this chair, I got to know her. I don't know if she made an appointment to meet me or I made an appointment to meet her. I don't remember how it all started but we became friends. At that time, she was doing practically everything that was being done for women students at MIT, and the women's programs were on her shoulders. She was carrying almost the whole load herself. When I got this chair, I figured I ought to do something, also. I consulted with her about what might be the best thing to do. She didn't really know what was the best thing to do, but we got into this idea--maybe it was my suggestion, maybe it was hers. I don't remember whose idea [it was]. We had a lot of ideas together. We worked together at the Institute for some years until she left in the early '70s. We did a lot of things together. We became real close friends. Between us we shared a lot of the responsibility. We also roped in other people to work, too. It became clear that with more than one person working, you can get a lot more than twice as much done. That's

how this all happened. We set up this format for the coffee hours. She helped me a lot with statistics. Particularly Dotty Bowe, who was her administrative assistant, helped a lot with the details of getting that seminar going.

Sherkow: Is that still going now?

Dresselhaus: Yes. In some format, it's still going on. It's not now going on in that format; some of the things that started then are still happening at the Institute.

Sherkow: How successful do you feel that that was?

Dresselhaus: I didn't think it was really great, because the things that I did later on in this direction I thought were much better. This first experience was especially valuable to me because I learned how to give women students the moral support they seemed to need. That was the first time I did anything along these lines, and as I said to you, it was really quite out of my element. I'd never done any counseling. I didn't have the background.

Sherkow: But you felt that it was useful?

Dresselhaus: As for myself, I questioned how useful it was. I didn't know how good it was. We had pretty good attendance, so I figured it wasn't completely a waste of time. People at MIT don't go to something that they don't have to, if it's not useful. But over the years, a number of the people who were there that first time told me that if they hadn't



attended that discussion group, they wouldn't have had the courage to go on. Whether it was half or a third of them, it was a sizable number that said that during that particular year, they had some really hard blows. Not that they discussed all their problems at the seminar, but they did discuss some aspects of some problems. Having me around, having the other women students around, and having the opportunity to talk about these things made a big difference to them, and sometimes made the difference between quitting or staying at MIT.

Sherkow: It sounds like it was important, then.

Dresselhaus: It was important to the individuals who attended. We had about fifteen people who were regulars. It wasn't a large number. But then we didn't have so many women students, either, at the time. So, put it this way: this program wasn't really the greatest thing, but for the students who came, it seemed to have been important. So that was that.

From there, Emily Wick got me involved in a number of other things. We were always thinking of what we could do around here that was important. From that seminar we identified a number of areas where students were having trouble and we tried to address them. Over the years, I've gotten much better at this. I think I put less time into these kinds of activities now than I did during that first year I came here, but I think we get more done because I know my way around. I know better how to pick the issues where we can make an impact.

Sherkow: Did you and Emily come up with some other ideas for ongoing projects?

Dresselhaus: Yes. The next big thing that we did was the admissions system. That was an area that started--not that first year when I was a visitor--but it started in seriousness the next year, when I was here permanently. The admissions work was a major thing. It had a big impact at the Institute. I would say, probably, we worked hard on that project for about two or three years; that was about the duration of that project.

Sherkow: Did you start in 1969, then?

Dresselhaus: Probably '68. I don't keep records of that sort of thing. In the Admissions Office, there should be some data on when I started. It all started when Emily got me to read the folders of the women applicants. Up to that time, she used to read each and every one of them herself. Then we started to split the load. But even splitting the load, we each would read two hundred or more applications. We were reading a very large number of applications. Then we had two staff people from the Admissions Office, who also read them. There were several readings on each. Many of them had three readings. No, I think they all had three readings, as a matter of fact.

From this we learned two things: we learned that faculty participation in reading admissions was very good for the education of faculty and also for giving guidance to the Admissions Office, and another thing we learned--we learned a lot about the needs of the women students coming here. If you just read what their aspirations are when they apply, you get some idea of what they're trying to accomplish here.

That part turned out to be really pretty useful.

We learned another thing from this exercise, that the admission criteria that we had been instructed to use were quite different from those used for the men. The space that was available to women students at MIT at the time was governed by the size of the dormitories. Mrs. McCormick donated the McCormick Hall, which happened just before I got here. But the new wing of McCormick Hall was in the process of being built and it opened the year I arrived. This made a lot more space available for women students; it doubled the amount of space that was available. Therefore, the number of beds that we had available for women to sleep in became so much larger that for the first time one could question the admission procedures for women. At that point, even with the new addition of beds for women, it became clear that it was harder for women to get into MIT than for men. They needed to have higher scores. They needed better recommendations, and so forth; we became aware that the cutoff criteria of the two groups wasn't the same.

We made a brief presentation to the Institute Admissions Committee about what we thought was the principle of admission, Emily and I. We then were asked to write a position paper. Then we were invited back to the Admissions Committee to make a longer presentation. It was all very short and sweet. We explained two things to the committee: first that the present system was unfair to women, and, second, that we thought we had developed a good system for evaluating the student applicants. We explained our system. Our system developed into this team effort that has been going on in the Admissions Office for a number of years afterwards.

This very last year it wasn't used because they'd had insufficient staff in the Admissions Office. But until last year, it had been used. I have a feeling that they may well go back to it because I think that a lot of faculty liked that system. It was a way of involving faculty in the decision process, which I think is a good thing.

The major impact of this presentation to the Institute Committee on Admissions was the decision that women no longer would be admitted independently of men, but all students would be admitted by all readers on an equal basis. That is, they wouldn't have a special admissions process for women students and another admissions process for men students, but they'd admit all students together and have equivalent criteria. It's very hard to say "equal" because women at that time were less into sports and more into dancing. There were different activities that women and men had in their profiles. With Women's Lib and all, that's all changed. Now we have all these women athletes applying to MIT, but they used not to be like that.

So our admissions work had a big impact on the admissions process at MIT. There were a lot of other things that we did in connection with admissions. We brought to the attention of people in the Admissions Office that the outside world doesn't recognize that MIT is co-ed. We emphasized the need to get that information out and to address the educational counselors that women exist at the Institute, so that when they go recruiting for new students, they go recruiting for all good students and not just for good men students, all good students. As a result of this, a booklet on women at MIT was prepared, and this, together with a small brochure, was later sent to talented women students, to women students with SAT scores above a certain amount. These efforts have been very

successful in increasing the number of women students at MIT.

Sherkow: Let me just turn this over.

BEGIN TAPE ONE, SIDE TWO

Dresselhaus: My work on the Admissions Committee started with this presentation. It was very well-received by the members of the Admissions Committee. They adopted some of the concepts that we were proposing. The two things that happened, was that women and men were from then on judged on an equal basis, an equivalent basis, as I explained. The review process was done for all students at the same time. The team project, with major faculty participation, was adopted. A fraction of the applicants, about a third to a half or so, were read every year in the team format. This increased the amount of faculty participation very considerably in the admissions process. What happened afterwards was that I was put on as a member of the Institute Admissions Committee after this original work. I served in that capacity for a number of years. But I think that when I was an actual member of the Admissions Committee, my contribution was nowhere as great as my contribution had been before I was appointed. My main contributions were toward changing the admissions process itself. As a result of all of this activity, the number of women students at MIT increased. This increase didn't only come from the work of the Admissions Committee, but a lot of other things were happening nationally and at MIT. The number of women students in engineering skyrocketed during that period. This was the period of large growth in the number of women applicants. The big increase in the number of women necessitated other projects at the Institute, and we got

into those projects also at the time.

Sherkow: You indicated that the Admissions Committee accepted some of your recommendations. One of them was that men and women be considered equivalently.

Dresselhaus: In a way, they came to that conclusion themselves. We just, more or less, pointed out the discrepancies. Once it was pointed out, it was a very short step for them to propose how they would combat this problem. There was no fight involved. I thought the changes were made in a very amicable and agreeable fashion. Everybody agreed that this was the direction to move.

Sherkow: You indicated one of the recommendations that they did accept was that men and women be evaluated at the same time. Now I didn't understand what the problem had been prior to that.

Dresselhaus: Prior to that the men were admitted by what I call the regular admissions process. The women filled out the same forms, but the people who read their forms were different people. The number of women that was admitted was put on a quota basis, which was related to the number of beds that they had in the dormitories for women, so the cutoff in applicant quality was different for men and women. Now if they evaluate all students at the same time and in the same way, then uniform cutoff criteria could be applied to both men and women. That is why a single admissions process for both men and women together worked to increase the number of women who were admitted.

Sherkow: You were involved in a number of other women's projects. But maybe we should go back to some of these additional women's group things that you did a little more chronologically. In 1968, you were offered a permanent job in Electrical Engineering. How did that come about? How did you feel about that offer?

Dresselhaus: Yes. That came about in a very natural way. I was here as a visitor, and I was involved in certain programs. The people that were here saw a need for somebody doing those things. I am talking here about my technical area. My appointment was made completely on technical considerations. I don't really think that these women's activities had any relevance to the decision to offer me a permanent appointment at MIT. I was just in an area where there was a need at the Institute. I was doing a fairly good job and demonstrated that I could do something useful; I showed that I could fill that need, and they hired me. The position that I was offered was better than the position I had at Lincoln, so there was no question about accepting it. It was convenient because we were living in the Boston area already; it didn't require a move. It was all very convenient. So that's how it all happened. Coming to MIT didn't require very much discussion or thinking. I had the opportunity, and I took it. I stepped into new shoes.

Sherkow: You indicated in Cosmopolitan that you really only took yourself seriously until you were a full-time professor at MIT.

Dresselhaus: Yes. My career evolved at a time when women in the profession were not taken seriously by colleagues, not with the same seriousness as men. I always considered my career as the second career in the family.

If my husband were offered a job at some location, I would go along with him and give up my job and find a job at the same place. That was the way I viewed the whole thing. I never considered my career as anything that was essential to my family operation. But when offered a job at MIT, I had an opportunity to have a good job, a job I liked, and so I did it. I never felt I was going any place, not during those years. It was just that I had an opportunity to do research in an area I liked and where I was doing well; that was it. It was very simple. I still viewed myself as a housewife. When there was a party--scientists often have parties together--the men go off in one place, and the women go off in another place. It was expected that I would go off with the women. It was that kind of thing. Of course, in the lab I was equal with everybody else; we all went out to lunch, and we went together and did this, that, and whatever happened during the work day; I was part of the group. Working with male colleagues wasn't a problem. But in social events, I was still a woman.

Sherkow: And you were with the women.

Dresselhaus: Yes. It was a sort of natural thing. I felt comfortable there, too. It was just the way it was. I was just a woman who had a job. Then there were the other women that had jobs, and others that didn't. But I wasn't really a career woman on a social level. My position at MIT was just a job that I had.

Sherkow: So you're talking about prior to 1968.



Dresselhaus: It evolved with time. I didn't really take myself so seriously when I came here, either. That made a lot of things easier for me in my relations to other people. I never worried about the tenure system and about promotion. I remember when I got my appointment at MIT, my permanent appointment, I didn't even realize that it was a tenure appointment for some months after I had the appointment. I wasn't that competitive with my colleagues or with other people. Just having a job doing what I wanted to do was all that I was interested in. I wasn't concerned about my salary or the benefits or all these other things. These aspects of recognition were not too important to me.

Sherkow: Why was that? Was it because your husband had a job?

Dresselhaus: Yes. My husband had a job. The view of people at that time--and it's no longer quite the same--was that the man was the main breadwinner in the family. A woman had a job if she wanted, but it was kind of a secondary thing.

With time, after I was a professor around her<sup>e</sup> for some time, I got a certain amount of respect from colleagues, from students, from parents, from staff at the Institute. The kind of respect that I got was the same as what the men got. I was just like everybody else here. Eventually, I saw my career as a thing in itself, rather than just something that I did for fun. That's what I meant in the Cosmopolitan article.

The fact that I was so relaxed about my job and not competitive about it made the whole thing very easy because I wasn't worried about what kind of job MIT would offer me and the details of this, that, and the other

thing, because it wasn't really relevant. It made the adjustment with colleagues easier. My colleagues weren't really used to having women around, but I wasn't viewed as one of these aggressive women; I was somebody they could get along with socially. They didn't feel me competing with them for their jobs because I didn't act that way. I didn't feel myself that I was competing with them. Now had I been very aggressive and competitive, my adjustment here at the Institute might have been more difficult. But not necessarily.

Sherkow: Aren't you saying that at some point, you did become more serious about your career?

Dresselhaus: Serious isn't the right word. Maybe I've used that word myself, but when you said it now, it sounded a little different from my viewpoint. I was always serious about what I did in terms of my standards for performance. The standards for my work didn't change. But I viewed my career as a thing of itself rather than just a job that I did for fun. It changed from a hobby to a career, in other words. So "serious" should be taken in that sense, but the work itself didn't change.

Sherkow: Did you continue on with the same kind of research that you were doing in that year that you were a visiting professor?

Dresselhaus: Yes. Research evolves, really. I had a lot of things going on in my program, and those things continued. Every year, I got to work with some new graduate students. When you're a permanent faculty member, more graduate students come to work with you. The new projects were somewhat different than the old ones, but they evolved from the old ones.

Research has a way of developing from what happened in the past. You do break new ground and get into new areas, but that evolves with time. I'd say that I've gone into a lot of different fields over the years I've been here. I've done a lot of different kinds of research. But everything has some kind of evolution that is identifiable with what happened in the past. Sometimes I got ideas in research from student projects that I would assign to my classes. One thing would lead to another. We'd be reading some articles, and I thought the articles were wrong, or the articles gave me some ideas about something important that could now be done. So that's how the research program evolved.

Sherkow: In 1972, you became the associate department head of electrical engineering. How did that come about?

Dresselhaus: That came about in the following way. I guess it was in 1970 that our department underwent a change of organization. Before 1970, we had approximately a hundred faculty members and one department head. It seemed like too much work for one person to keep track of all that was happening. This was the time when there were increasing administrative demands on the department head. With the shrinking budgets there was much more accountability that was demanded. There was just more work than one person could do. So the department got, in addition to the department head, two associates who had responsibility for different areas and different assignments within the total department heading structure.

The person that had the job before me was [Wilbur] Davenport, who is the present head. Davenport was offered the position of heading the Center

for Advanced Engineering Studies. That seemed like an attractive position for him, and I think one he was very well suited for. So he stepped down from the associate department chairman and went to do that, so this job was vacant. Smullin was going through his department list, trying to figure out whom he wanted to appoint. He was discussing the job with a number of people actually, and among the people with whom he discussed it was me. Apparently I was the only candidate who would accept this job. So I became associate department head. It was a very informal type thing. There wasn't any outside search committee, or anything like that. So that's how I became associate department head, and I was in that job for two years.

When the last administration went out, the two associates felt that we should resign and give the new department head a chance to select what people he wanted. I felt that I had served my time. I was anxious not to go back as the new associate department head. It's a job that once you do it for a couple of years, you learn the job. There's not that much in it to keep doing it forever. Doing the job takes a lot of time, and so you don't have time to do other things. I thought a lot of the other things were really more interesting to me and more important in the long run. However, the experience that I got was very valuable. I'm really happy that I had the opportunity to have that job. It was a very good job for me. At the same time, I was also happy that it was all over because of the administrative headaches; you work your tail off, and the next day it doesn't matter anyway. You solve somebody else's problem, but it still is somebody else's problem. You do very little of your own things when you're an administrator. You just run everybody else's stuff.

Sherkow: Why did you accept this position?

Dresselhaus: Oh, because I'd never run anything before. It was an opportunity to find out what it is to be an administrator. Oh, running our department is interesting. There is no getting around that; it was a lot of fun, a lot of challenge. We have all this talent and resources. It is a challenge to figure out a way to best utilize the talent and resources. There are a lot of interesting problems involved there. But it gets to be a lot of the same, after you've done it for awhile.

Sherkow: What was the reaction of your colleagues when you assumed this position?

Dresselhaus: In some areas, being a woman made it a lot easier for them to talk to me. I was pretty good on the rapport aspect of the job. My technical background wasn't exactly right for the job, but I made it do. That is, I don't have a degree in electrical engineering, and I wasn't one of the department's old standbys. It was only five years since I had come to the Institute when I took on the administrative job. Many of the people at MIT had been here together for many years. There was a <sup>a</sup>comraderie that I wasn't really part of. But nevertheless, I had good rapport. I don't think that there were any personality problems. When you have the title and the responsibility, I don't think sex makes a whole lot of difference. I made the decisions; that was it. Making decisions was my job.

Sherkow: Was the title--

Dresselhaus: The title is intimidating. When the department head calls a professor's office, you get fast response. It's very different than just another professor calling. When I call an office now, I don't get the same kind of responses I got then. You learn a lot of things about people's reactions when you have a job of authority.

Sherkow: You indicated that it was a lot easier for maybe some of the people in the department to talk to you once you got that title. Why do you think that would be so?

Dresselhaus: It was like talking to Mom. That was kind of the way it is. I'm pretty easy to talk to. I didn't jump on them. I was a good listener. They'd come in with their problems, and I'd listen to them and try to make them feel happy.

Sherkow: Do you feel that because you are a woman, maybe you were better suited for this job than somebody else?

Dresselhaus: Yes, I was good at that aspect of it. I thought that part was easy for me, easier for me than for a lot of the guys. That is, the professors felt more at ease in opening up to me. They felt less competitive with me, or something. For some reason or other, it was easier for them to talk to me than to a lot of other people. Yes, that was part of the job, coming to Mom and telling [her] what's wrong.

Sherkow: Again you indicated in Cosmopolitan that when you were offered

this position, you were afraid that you might not be able to do it.

Dresselhaus: Oh, yes. It was a rather high administrative position, in a way. It had a lot of responsibility, and there were a lot of people involved. It's not like a little group. It's a hundred faculty people in the department and eleven hundred students and a big research staff. There are just a lot of bodies in the department. It was a lot of responsibility, and I had never before had an administrative job at any level. It was like jumping a few steps ahead of where I had ever been before. There were two things. There was the lack of administrative experience, and the second thing was that I didn't have the proforma credentials. There were a lot of areas in the department that I knew relatively little about. I learned a lot while I was in the job because that's what the job was about, to learn new things.

Sherkow: How would you evaluate the two years that you worked in that capacity?

Dresselhaus: Oh, I guess I was adequate in the job. Administration isn't hard. You can learn how to do all of that. I think, in criticism, the one thing that I didn't do as well as I should have, is that I didn't put as much time into it as I might have. If I'd put in twice as much time, I would have done somewhat better. But I wouldn't have done twice as well. I tried to put in the amount of time that was necessary, but no extra time. In that sense, I was very different from most administrators around here. I kept up my full teaching load. I kept up our research program, graduate students, not quite as full a program as I had had, but I didn't cut back very much. So that part of my job still took

a very large part of my time. The administration had priority because when there was a crisis in the department, everything else had to fold. So I wouldn't say that the administration filled in the gaps. On the other hand, I didn't look for work. I did what work had to be done.

Now, if you want to do a job and be really creative in administration, you have to look for new areas, new projects. I did relatively little of that, by choice. There are two aspects. I was an associate head, not the department head. Being the department head you do differently because then you make the main policies. If you're associate head, you have to work with the other guys, and you're really carrying out their policies. You interact and you say what you think about the policies, but they're really not yours. The other guy has veto power over everything you say, in a sense. So I think the main thing is to carry out the responsibilities that are assigned to you, and when something is obvious, then you fill in. But beyond that, you mind your own business. That was my approach to the job. I'm saying that if I spent more time looking for work, perhaps I could have done more things, but that wasn't my style.

Sherkow: Do other administrators drop some of their courses?

Dresselhaus: Yes. They normally drop almost everything. But if you do that, then you become an administrator and it's very hard to go back into other things. I didn't really see myself as being an administrator forever and ever. I still don't see that. I do a lot of administration now. Once I did that job, I had a lot of other jobs come to me, mostly from the outside. I do run a lot of things now. I've demonstrated that



I can be an administrator so people have assigned main projects to me, and I do them. But I don't do them at the exclusion of my main activities at the Institute. I don't plan to change that. I think that when you change you get away from the technical areas. This is a matter of priorities. Of course, if you're president of MIT, or something like that, you have to give up your own things. There are some jobs that are too big and you just can't do your own things anymore. But at most levels, if you give up your main technical activities, I think you lose more than you gain. That's my viewpoint toward my total commitment. If you're sixty years old and close to retirement, and you go into administration, I think it's okay. But if you're forty, it's not a good move.

Sherkow: In the book, Women and Success, you indicated that you took this associate department job partially because it was an opportunity to do something for women at MIT.

Dresselhaus: Yes. That was a major factor. As a matter of fact, I don't think I would have ever accepted that job if I wasn't a woman. It was the first time that a job at that level had been offered to a woman at the Institute. I thought that somebody ought to do a job like this to show that we could do it, too. That was really the reason why I took this responsibility on.

Sherkow: Did you do any special work for women in this capacity?

Dresselhaus: Just a little bit, but it was an inspiration to a lot of

women at the Institute. I think it did a lot of good for women at the Institute. I think it did a lot of good for getting more women on the faculty in an indirect sort of way. It made women professors a lot more visible. I was at the faculty council. I mean there are a lot of things that you get into in the more upper levels of MIT when you are department heading than just being a regular professor. I had some opportunities to make some presentations to the faculty council and in different other places. I used to get invited to the different departments to make a presentation about what women faculty could do for their departments if they hired some. A lot of that came about as a result of my position. So I would say indirectly--I didn't use it as a way to particularly work for women because my job duties were working for the department, not working for women. But within the department, we tried to have some things done for women also.

Sherkow: You said there was an indirect effect in terms of having women faculty members at MIT. Has this happened as a consequence of your doing that?

Dresselhaus: I wouldn't claim all the credit for it. The number of women faculty members at the Institute has increased very much, and it has increased during the time period since I came here. In 1967 there were very few women faculty at MIT. I think there was probably less than ten, and now there's something like fifty. So the number has increased very radically over that period. But this did not happen only because of one thing; it's many things that have made that happen. When I took on this job, one of my motivations was to show that women could serve at all levels.

I felt that having been offered this administrative job, I really couldn't refuse it. However, I did refuse it for a month. It took me a month to make up my mind that I really could do it. But the main reason was more the symbolic value for the Institute than for myself. I really wasn't interested in the job personally. I felt also that once I took on the job, I had to execute it in a creditable fashion so that a similar job might be offered to some other woman at some future time. I think that that much of it was satisfactorily accomplished.

But as I explained, I didn't make an effort to do the job as well as I might have, at the expense of not doing other things. I did that as a matter of principle. I felt that there were too many administrators at MIT and elsewhere who were making administration their main thing. I think you get away from the troops when you do that.

Sherkow: The troops? You mean, the students and the researchers?

Dresselhaus: Yes. I mean everybody. All the people that you are over. All the people that report to you. I think that the gap gets too large if you just become an administrator. But if you spend a fraction of your time doing the same things that they do, there's more identity between [you and them]. You understand their problems better, and they understand your problems better.

Sherkow: I wanted to ask you about being a professor. I think you're the only woman professor in Electrical Engineering.

Dresselhaus: No. No, not anymore. There are several others in the department.

Sherkow: When you were first offered this job in '68, you were the only woman professor.

Dresselhaus: That's correct, yes.

Sherkow: How did you feel about that?

Dresselhaus: When I first came--as I was saying--I didn't take my career all that seriously at that time, and it was a great opportunity. I got along well with my colleagues. I'm telling you that I'm a soft touch. (Laughter) I'm pretty easy to get along with. There wasn't much problem. But I think that a lot of my colleagues got the message that women faculty do other functions besides normal assignments, and these other functions are with respect to women students and women's programs at the Institute. They were anxious, not from any pressure from my side, but from their own observations, to increase the number of women faculty. They have given preference to women applicants, where the women and men were equivalent. They have made several women faculty appointments since I came.

Sherkow: So what's the situation, then? What was the change?

Dresselhaus: We have two other women faculty members, Barbara Liskov and Liba Svobodova.

Sherkow: What rank are they?

Dresselhaus: Barbara is an associate professor, and Liba is assistant professor. Now Barbara came to MIT as an assistant and worked her way up.

Sherkow: So how do you feel about that situation, of not being the only woman?

Dresselhaus: Excuse me, we have got another woman assistant professor, Flora Chu. We have four now. Liba and Flora are quite new. They've [been] here for two years, and Barbara has been for about two years more than the others.

Sherkow: What's been your personal reaction to having other women on the faculty?

Dresselhaus: I don't see that much of them. I wish I had more time to interact with them and to organize them, and do more projects with the women students. But none of them are tenured faculty. It's not fair to ask non-tenured faculty members to get in there and put their time into helping women students. So in some ways I have to help the women faculty and support them and encourage them. I don't do as much of that as I should. I try, but time is limited. So we do what we can. But I'm certainly happy to have some other women faculty members. I think it's nice to have them around. For the most part, they're doing very well.

Sherkow: So you do meet with them and encourage them and suggest things?

Dresselhaus: Yes. I have this women's faculty luncheon that I started about three years ago. I guess this is the fourth year, starting up this year. We meet with all women at the Institute in faculty positions. What I decided is that I couldn't limit this interaction just to people in my own department. We have to have a support structure for the whole Institute because there aren't so many women faculty in any single department. Somebody's got to carry the ball. So that's another program that I started; that's a really good program. I like that program. I think it's very effective for those who come.

Sherkow: Why don't you talk about how that evolved?

Dresselhaus: That's pretty recent, actually. There came a time in the early '70s when the number of women faculty started increasing. It was a question of affirmative action and pressure by the women faculty members already here, and the fact that most of us women faculty that were here were doing quite well at the Institute. So we had respect from our male colleagues. I think everything worked in an amicable way. It was natural that the women wanted to increase the number of women faculty members.

But the problems came because of the level at which the women faculty members were coming; they were very junior, assistant professors, people the age of my children, more or less, really quite young and inexperienced and feeling insecure and not knowing their way around the Institute. The probability of getting tenure for any incoming faculty member, (male or female), is low. Our junior women faculty members didn't know the male faculty members. They didn't know the women in the other departments. It seemed that we ought to establish some kind of <sup>a</sup>comraderie.

The idea of this came about because when I came to the Institute, there were so few women faculty members, Emily Wick and me and a few others (laughs), we became friends. We used to do so many things together. It became obvious to us that since we were so small in number, to have an effect, we had to work together. We would marshall whatever other women were around to work with us. We had some other helpers, but Emily and I were the main organizers during that time. Sheila Widnall also worked closely with us, as did Judy Thompson. When more women came aboard, it

became clear that in order for them to have an impact in the Institute, they'd need some organization. The thing that got the women's faculty luncheons started was a fellowship that I got--a Carnegie Fellowship.

Sherkow: A Gilman Fellow of the Carnegie Foundation, '73-74.

Dresselhaus: That's right. Yes. I was a fellow for a year, and the fellowship paid a fraction of my salary. I thought that during the time paid by the fellowship, I would develop some things on behalf of women. It's like commissioning a work of art. It was like when the Rockefellers brought me here, I started kind of a new style of things. This little discussion group that I started in 1967 was the forerunner of the Women's Forum, which we haven't talked about, but will come to. It was the reincarnation of the discussion group that became the Women's Forum. Now, I didn't want to do the same thing as a Carnegie Fellow because that I had already done. So I had to think up some new things. Now I thought of two needs. The first one was something I implemented right away. I developed a course called, "What is engineering?"

--END OF SESSION--