INTERVIEWER: So to begin with the future, knowing your background in particle physics and solid-state physics, how close do you think we are to the end of the silicon era in computing and in sort of the kinds of materials that we associate with solid-state devices today versus what's possible in the next generation?

JACKSON: Well I think one probably can't think of some discrete end but rather a transition as people look at new technologies. For instance, as you know, a lot of people have done work with carbon nanotubes. That's been a big focus of nanotechnology here. And so people are finding out they can do amazing things with nanotube-- carbon nanotube arrays. And in fact, some of those can be designed in ways that they have certain kinds of properties that are semiconducting. We actually have people looking at that kind of thing, looking at creating interconnects.

You see, when you want to use, build chips, and then you want to make them into devices and so on, there has-- the big issue these days which relates to the speed with which these things operate you have to be able to have the right kind of interconnects. Traditionally people have used copper interconnects. But now the question is can you find other substitutes that can dissipate energy, can give you the speed that you need and so on. So I think there's a movement in that direction.

People are also looking at so-called optical interconnects. They in fact require completely different kinds of materials in order to have the optical and optoelectronic properties that you need. And so that, by definition, begins to move you away from purely silicon. And then it also depends on the kind of computation. So if you're really looking at electronic-based computation-- movement of electrons-- that's one thing. If you look at optical, so-called optical computing or even molecular computing that begins to take you into new arenas. So it's hard to make an absolute projection, but one is already beginning to see a movement in certain directions. And ultimately I think all of this will come together.

INTERVIEWER: It sounds like what you're saying is that it is almost less of a physics material science question and more of a sense of moving away from traditional architecture in computing and really embracing a much more diverse set of materials and resources to create different kinds of machines.

JACKSON: Well I think in fact what you're really talking about is both. I think people are definitely looking at different architectures even within silicon-based kinds of devices and the like. People are looking at distributed intelligences, looking at intelligence networks and computation in networks. And then there's the question of how all of that then gets brought back together. And so that is kind of its own thing, this issue of are there different kinds of architectures. Can you get almost three dimensionality? But then there's a separate avenue that has to do with new materials, new kinds of structures based on new materials, and moving into different kinds of computational physics than just that it's purely electronically based. So it's both a physics, a materials, and an architecture kind of thing, but they all play off of each other.

INTERVIEWER: If you are a postdoc today with offers from Penn, and University of Chicago and MIT and some others, what field would you want to study in? What's the exciting sort of frontier that would expect you if you were a young student today?

JACKSON: Well I think there are a lot of them. I happen to particularly be interested in biotechnology and the life sciences, particularly as it brings engineering and the physical and computational sciences together with basic biology. I think that's where a lot of very interesting work is both from a fundamental perspective with understanding biological systems, how they evolve, intra- and inter-cellular signaling and then the degree to the which one can model things at the cellular level up to the organic level. And then bringing ideas from physics into that, as well as studying the actual physics and chemistry of living systems.

INTERVIEWER: Do you think your strong religious background gives you a sense of the unity of the sort of biological architecture of organisms and the sort of physics of how those systems work?

JACKSON: I don't know that I'd say that the one drives the other in a direct sense. I think there's a harmony in the sense of accepting human beings as they are and trying to understand both things from an organic point of view but understanding that there are spiritual and other aspects that then in a classic sense people can't connect. And as you know, religion and belief-- religion really is about belief. And science is about hypothesis, experimentation, and proof. And I remember a long time ago, I learned faith is the substance of things long for the evidence of things not seen. So I think there are going to be those things that fall outside of the realm of what people can see in the here and now. But I've never felt that there was any conflict between the two, at least for me.

INTERVIEWER: So how is your Latin these days?

JACKSON: Probably relatively non-existent.

INTERVIEWER: Relatively non-existent?

JACKSON: But in the sense that Latin is always there because it is at the root of a lot of things in English. English is an interesting language in the sense that it really has roots in both Romance languages and Germanic languages. And that drives a lot of the structure, a lot of the syntax and grammar. And I retain a lot of that. I probably with a little bit of work could translate a few things--

INTERVIEWER: You could polish it up.

JACKSON: --in Latin. I could polish it up because I've studied it for a long time.

INTERVIEWER: You know, I see two themes in your life. One is a quest for the deep structure of things, whatever we're talking about language in Latin or biology in some of the things you talk about in high school, or your work in particle physics. Why this is instinct to find out what's going inside things? Where does it come from?

JACKSON: Who knows. I think all of us are born with a natural curiosity, but I think it just takes a certain form. I do relate it to the fact that I've always been very interested in mathematics and being able to cast things into a mathematical format and use that as a tool to make predictions to probe things further to create some order. And so I've always been interested in the world around me.

| mean, there are things one can understand at the level of the organism. But then there things that one can only understand by going to the cellular or the genetic level. That's in living systems. Likewise, there are things one can understand at a big systems level. But to really understand them, one has to get down to an atomic and subatomic nuclear and even subnuclear level. And then I think there's a beauty in being able to go from that to understanding how things build up from there. Sometimes in predictable ways, sometimes in chaotic ways, sometimes they can't be understood but they're still interesting. But I've always liked to probe deep and then go from that back to a level of understanding things at a macro kind of dimension.

INTERVIEWER: Have you ever joined an organization that you didn't end up leading?

JACKSON: That's an interesting question.

INTERVIEWER: I can't find one, I mean with the exception of MIT, but almost everything else.

JACKSON: As opposed to join? Maybe not. But I didn't join them to lead them necessarily. Although in becoming president here or becoming chairman of the NRC, I certainly joined them to lead them. That was the way. That was the entry. But that's an interesting question that I'd never thought about before.

INTERVIEWER: What is this quality of leadership do you think that comes, I think, very early on?

JACKSON: I think that leadership actually derives from a desire to do something, but to make things happen, but to realize that one can't do it on one's own. That by definition, one is working through other people, working through structures that bring people together, or they provide platforms for them to do what they what to do. And so it begins with the desire to make a difference, to get something done. And then looking at the fact that that plays out through people inherently, through organizations, through structure. But then it also relates to wanting to inspire people, to show people that there is a different way or that there are multiple pathways to achieve what they want. And those are the only reasons that I've ever taken leadership positions. Whether they happened after I joined an organization or whether they were the way into the organization as it were. Really to make a difference.

INTERVIEWER: In mathematical terms, leadership is the ability to get people from point a to point b.

JACKSON: I think it's the ability to inspire people to go from point a to point b. And then to figure out how to get people organized in a way where they can in fact get to where they want to go.

INTERVIEWER: So if I was to begin at the beginning of your life, I see a lazy, hot summer afternoon in Washington, D.C., and a young girl dreaming about science and biology. Am I wrong? Is that how you?

JACKSON: Well, it's interesting. I did start out with an inherent interest in living systems. And that's why I collected live bumblebees and did various experiments with them.

INTERVIEWER: Collected live bumblebees?

JACKSON: I did.

INTERVIEWER: How did you get the idea? What kinds of things--

JACKSON: It just occurred to me one day. I was in the backyard and I was watching them buzz around. And as the seasons changed, ones saw different kinds of things we called bees, meaning going from the bumblebee to the wasp to the yellow jacket.

INTERVIEWER: They're all bees to little kids.

JACKSON: Right, they're all bees to little kids. And then I saw them, the bees, flying into flowers and sucking the nectar and I wanted to have a closer look. So I got the mason jars and mayonnaise jars and punched holes in the tops. And I also thought it was a challenge to capture the bees without being stung and without harming the bees. So I did that. Sometimes I would actually close the petal with my hand to pluck it off and then drop the whole thing into the jar and close it up.

INTERVIEWER: So you'd trap the bee in its own flower?

JACKSON: Correct. INTERVIEWER: That is smart.

JACKSON: Yeah.

INTERVIEWER: Clever.

JACKSON: But then sometimes that. But I thought that was a bit crude, so I liked to do it that way.

INTERVIEWER: And what did you learn about bees by collecting them?

JACKSON: Well, a couple of things. One, that all creatures respond to their environments. One thing I learned was almost a metaphor for what I think happens to people and I've actually used it in a commencement address. And that is I used to collect the bees and then I would see how they behave as a function of how much light they got, how much they were in darkness, according to what they-- how they behaved according to what they were fed. And then I would mixed them up. I'd put the bees with the yellow jackets with the wasps and see what their behaviors were like. I always wanted to let them go before they died. I was never interested in the classic insect collection where one had the dead bees or whatever they are--

INTERVIEWER: Butterflies.

JACKSON: --and the pin stuck in them. To me you learned about them by how they lived and then-- but I would find that after I had them for a bit, you know it could be as little as a couple of days, if I opened the jars they wouldn't fly away. And so it says they became habituated to being in this environment. And to me that's been a metaphor for how people can be habituated to being stuck where they are depending upon what they see or what they think the boundaries are.

INTERVIEWER: Interesting. What were the boundaries for you back then?

JACKSON: Well, that's an interesting question in the following sense: on the one hand, there were actual boundaries that related to school segregation, that related to opportunities for a young African American girl. But on the other hand, because of how I was raised and the circumstances in my family and immediate neighborhood, I didn't feel they were necessarily boundaries. And certainly not ones that were intellectual and so on. And my parents believed very strongly in education and the power of education.

But I was never motivated-- and this is a hard one to explain-- I was never especially motivated by what kind of job I thought I would get as a consequence of education. I was never especially motivated by how much money I thought I would make as a consequence of education. But more what education would allow me to do and how much it would allow me to pursue my interests. And then along the way, of course, to live and have a career and so forth. And to be honest, when I went to MIT, I just went to study. And I knew I wanted to be a scientist. But I didn't know what that really meant. And as I was there I learned that to really do physics at a high level one really needed to have a PhD. But I can't say that I went to get a PhD when I started. But maybe I'm jumping ahead.

INTERVIEWER: Well, no that's fine. It sounds like that focus on simply what the learning could give you was liberating in some sense.

JACKSON: It was. But it was liberating but it also helped me get through a lot of challenges as I went along. But my father had a big influence on me. My mother did as well. My mother's influence had to do with perseverance, and being able to deal with adversity, deal with it quietly, but to push through it. My father had a lot of homilies and things that have remained in my mind. So one of them was, aim for the stars so that you can reach the treetops. And at any rate, you'll get off the ground. And his basic message was, if you don't aim high you won't go far. So you have to set your trajectory almost beyond where you really expect to go. And you might even get there. But you'll certainly go a lot further than if you aim low. And that's had a very big effect on me.

My father also taught me that the way you get your next best job is to do as well as you can in the one you're in. So, you know, I'm looking at you. And we all tend to look around a little bit even we're talking with people. But there's some people who are always looking over your shoulder at who's next, who's behind them, and searching the horizon. And my father's message was you stay focused on what you're doing. And not that you can't have ambition, but that ambition should be linked to trying to do something meaningful where you are.

INTERVIEWER: So as an educator it sounds like you may believe that young people inadvertently limit themselves by focusing on job career, MBAs, the orientation towards deliverables and outcomes in education could unwittingly hamper individuals reaching their dreams.

JACKSON: Well what I'd say to our students is we educate them for life fundamentally, for leadership, and impact. That will translate in concrete ways to be getting jobs, going to grad school, building their careers. But in the end, education is about what kind of life you want to live. If we try to target the students or point them at a job and that's how they think about things, then that doesn't have them have a perspective to look around and see what may be changing, what new challenges there may be.

Because in some ways, the key to success is to-- if you're on a given lily pad, to actually have a sense of knowing if that's going away. Or being able to then know that you want to move on. And to me, the most fulfilling career is that you're always looking at what's new. And that's even the case if one stays in research. One is looking at and being aware of what the important questions are. So it's a funny trade off, because of course when parents send their children to college they're looking for them to have good job prospects. But what they really want is for them to have good life prospects. And so there's an interesting balance that one has. And so to try to instill that in the young people is, I think, an important part of my role and our roles collectively as educators here.

INTERVIEWER: How did science-- I mean, you sort of say that you've always been looking for deep structure and that you were interested in how things work and how life systems worked. By the time got to high schools, how did your interests in science begin to manifest themselves and what were the external circumstances that caused you think about science maybe more seriously? Things that were going on in the world?

JACKSON: Well you know I'm a product of really two key seminal things that occurred. One was the 1954 Brown versus the Board of Education decision that desegregated the public schools, or at least started the desegregation of the public schools. And that happened pretty quickly in Washington, D.C. In fact, the year after that decision the schools were desegregated. Now with that--

INTERVIEWER: What grade were you?

JACKSON: --that was 1954-- I have to do the calculation. I think I was going into the third grade. And what that actually did was it put me into a school situation where the school did really have more resources. I had more competition. And in a funny way had more diversity of thought. Because I was exposed to people I really wasn't interacting with that much before. And so it made me more broadly aware of a number of things. As well, interestingly enough, a couple of my schoolmates were the children of academics and scientists. In one case a scientist, in one case a mathematician.

So that's what I meant about being more broadly exposed. So it began to open an aperture to let me really see pathways to what one would translate one's interest in science to in terms of becoming a professional scientist or mathematician. The second big event it was the Soviet launch of the Sputnik satellite. And the effect that had was to change curriculum in the public schools. Particularly in Washington, but in the nation. And there was a lot more interest and focus on math and science and identifying people with those interests and abilities.

INTERVIEWER: In fact, after Sputnik, there was a remarkable consensus at every level of society that science was something you were supposed to do?

JACKSON: That's right.

INTERVIEWER: How did that-- how did you perceive that as a young person just sort of looking out at the world?

JACKSON: Well I perceived it as something that the society valued, something that their would be investment in. And the curriculum changed in the schools. And there was a-- now it was a bit controversial-- there was a tracking system put into the Washington, D.C. schools and we were tested in the sixth grade. And it was-- it's a funny thing. Let me see if I can explain it. There was a test. And the first time it was given it was actually an IQ test. And some people felt it was to separate the people following on the desegregation of the public schools.

INTERVIEWER: So some people thought that the test was a resegregation? JACKSON: Well that that was perhaps an intent. And so I took that and I did very well. And so according to that, one was placed into one track or another. And I ended up in the so-called honors track. There were four: basic track, business track, college prep, and honors. And the honors was one that began an acceleration in the seventh grade and had a big focus in a lot of things like the classics, like Latin, and so on. And so I studied Latin for six years, five in formal courses and the sixth year doing readings with my Latin teacher in Latin.

So I took what you might consider a combination of today things that didn't have names, like AP courses, some college level courses, some things that had a flavor of an IB kind of program. And we had pretty small classes, particularly in math and science and Latin. Meaning, I think in the math class we didn't have more than ten students. And the science was a little larger. Although in the science, science was not as strong actually. I ended up teaching a lot of my high school physics class when I took it. And then-- but the Latin was extreme.

INTERVIEWER: Wait a minute, you ended up teaching your high school physics class?

JACKSON: Yes, well I had a teacher who either didn't know that much or didn't wish to teach that much. And so he in many, many days would ask me to teach the class.

INTERVIEWER: What grade was this?

JACKSON: I think was eleventh grade.

INTERVIEWER: Eleventh grade. I see. But just minor detail, I was teaching the physics in eleventh grade.

JACKSON: But I actually liked it. And I was probably not thinking as much then as I think today that that's not right. And that reflects some of my perspective today about the need to have discipline based teachers and so on, at least for certain subjects.

INTERVIEWER: Did you feel at that time in the honors track that you were chosen in some sense? That the community was invested in your success? That you were carrying the flag for something or someone? Or was it something more personal and about you?

JACKSON: Well I think it was both. I mean it was certainly personal in the sense that I enjoyed, it gave me a great opportunity to pursue things I liked. Probably as I got closer to graduating from high school, I began to think of it more as carrying the aspirations of a community and so on, particularly as it related to my particular high school. And also my family, that I felt I couldn't let them down and they had a lot of expectation.

INTERVIEWER: Aside from the physics teacher that you mentioned a moment ago, I want you to talk a little bit about the people that mentored you in those early grades. And in general, how do you think the lack of opportunity for African Americans affected the talent pool of the people who ended up teaching you? Do you think you unwittingly benefited from the kind of individuals whose opportunity was teaching and you ended up having close relationships with?

JACKSON: I sure did. I mean, I've in fact said that my Latin teacher could have been a Latin or classics scholar in college. My math teacher certainly could have been a math professor. In fact, she did some fairly advanced work in statistics and the like. I had an economics teacher in high school who could have been an economics professor. And so forth. So particularly in math, Latin, economics, even my English teacher, I think that all of these-- and they were women by the way, by and large. The one who didn't want to teach so much was a male. But the women were first rate.

But then I later found out that some of this was also deliberate on the part of the school system. And let me explain. When the schools were desegregated and they were going to kind of begin to mix the teaching staff, and they were bringing both African American students and teachers into schools that before then had been all white, apparently there was a very deliberate picking and scouring around for teachers that had certain characteristics. And so they were looking for teachers that had a high degree of education, themselves had been talented students, and so on. So this confluence of factors kind of all came together. The Brown decision which desegregated the public schools, that de facto brought these teachers to the middle school, the junior high school we called it in Washington, and especially the high school I attended. And the fact of the nation's interest in science and math and strengthening of curriculum because of that.

There was a so-called SMSG math approach, the School Mathematics Study Group approach to math, that really had to do with with problem solving and looking at more advanced concepts. It actually came out of the University of Maryland and that was implemented in my high school math curriculum. Now there was kind of an irony to it because as I said this SMSG approach came out of the University of Maryland. But the University of Maryland at the time really was not admitting African American students. But I unwittingly benefited from all of that.

INTERVIEWER: That's extraordinary. What specific messages did you get from those important teachers about how you might end up and the kinds of choices you might make in college? Do you recall any particular?

JACKSON: Well I got the message that I-- they expected me to do great things. In fact, that's what one of my-- we used to have, I'm probably older than you are, we used to have what we called autograph books. And so one would go around when one was leaving first junior high school and then especially high school and have teachers and others sign. So one of my teachers wrote, you know to him or her, to whom much has been given, much is expected. We expect to hear many great things about you. So that was one. And the other was carpe diem. Pick the day. Seize the moment. And so I remember those. Still have those.

So all of that played into it. And in some ways when I think about it -- and you're causing me to think about it a lot more -- there were all of these vectors that all came. And when you did the vector sum, one could argue that it pushed me in a certain direction. My parents' outlook and their perspectives, what happened with the confluence of events, the messages from the teachers, plus my own interest and self-direction. But carpe diem and to her, to whom much has been given, much is expected. So one could say I kind of carried that with me as well. But that's different than having a kind of arrogance that I was better than anybody else. I've never felt that way. But more that I should take the talent I had and do the best I could with it.

INTERVIEWER: Do you remember a teacher at that stage saying to you that you were capable of reaching the edge of scientific inquiry, be it mathematics or physics or the biological sciences, that you could make a contribution? That it wasn't simply about learning but it was also about getting to the edge, the research edge?

JACKSON: All of my teachers told me that. In particular my teachers in math and science, but all of them told me that. That was a constant reinforcement that I got. Which I think-- and that's what I meant when in some ways there might have been a limit, but in many ways because of how I grew up they really wasn't. Because the message that I was getting from these teachers, from these women, who in fact had been limited themselves, even though they had great ability, really great education, and great motivation, was that the combination of the talent they felt I had and the period through which I was coming created a unique opportunity for me to work at that edge.

INTERVIEWER: So they saw the vectors, they saw the confluence.

JACKSON: Yes, yes. But they also felt they were vectors themselves.

INTERVIEWER: So who said MIT to you first?

JACKSON: You really want to know? We had in those days an assistant vice president for girls. I mean assistant principal. In in those days we had an assistant principal for girls and an assistant principal for boys. And I worked in the principal's office just doing things, helping out. Nothing for pay. It was just an honor to work in the principal's office. So the assistant principal for boys suggested I think about MIT.

INTERVIEWER: In what form? Do you remember?

JACKSON: When I was coming up I was coming into junior year, he said, well you know you should be thinking about where you want to go to college and I don't think you should just stay here in the Washington area. Have you ever heard of MIT? I think you should think about that. I said, what is MIT? He said, the Massachusetts Institute of Technology. I said, oh really. So I went home and I asked my father. I said, have you ever heard of MIT? Mr. Boyd, the assistant principal for boys, suggested I think about MIT. My father said, oh yeah, that's that school in Massachusetts where people go and they study a lot of things in math and science and engineering. My father did not graduate from high school. Very smart man.

INTERVIEWER: In addition to telling you about the reputation of MIT, you also got some warning that you'd be part of a bit of an experiment in psychology and sociology going to MIT in the years that you were going there. Right? What were you told about who would be joining you at MIT?

JACKSON: Well the person who had the greatest concern was my mother. And she didn't really want me to go. Because she felt that I would be alone, that I would be isolated, that there would likely not be very many other black students and that they would not be many women. And so she thought I would be by myself. And so she wanted me to think hard about whether I wanted to do that.

INTERVIEWER: Did you think hard about it?

JACKSON: I did. but then I told her it was my life and I wanted to pursue this and I felt that people in science would be different and that I wanted to study science. And of course my father wanted me to go all the time. And in the end my mother said, you're right. It is your life. And so they supported my decision.

INTERVIEWER: Was your mother wrong about the experience you had?

JACKSON: No, she was right. I wasn't the only one, but I was one of a very handful. And it was relatively hostile in the early days. And so in that sense she was totally right. On the other hand, my father was right as well, because it was a unique opportunity to study and learn and do science at a high level.

INTERVIEWER: I read a story that there were two women in the beginning of the undergraduate program, you and one other.

JACKSON: Right. And that people would confuse the two of you.

JACKSON: Yes.

INTERVIEWER: And there was a sense that you both looked alike because there wasn't a lot of interest in knowing you in any sort of detailed way. Can you recall?

JACKSON: Yeah, I mean the other woman in my class was Jenny Rudd. She graduated with me. And we were the first two women, we believe -- or we were told -- to actually get bachelor's degrees from MIT. People talk more about my being the first to get a PhD. But in fact Jenny and I were the first two to-- not necessarily the first two to enroll-- but certainly to end up with a degree.

INTERVIEWER: First two African American women.

JACKSON: African American. Now both of us are relatively short. And our complexions are somewhat similar. But we do look different. And yes, people would call me Jenny and call her Shirley. And so I think people thought they were being nice. They'd say, Hi Jenny. And I said, I'm not Jenny, I'm Shirley. They said, oh you're the other. I said, yes, I'm the other one.

INTERVIEWER: The other one.

JACKSON: Right, the other one.

INTERVIEWER: We have two. Wow.

JACKSON: And then we took a class together and the professor called us Tweedledee and Tweedledum. But it's okay. We persevered.

INTERVIEWER: Now I went to University of Chicago and took the honors physics at the University of Chicago which-- and I've forgotten more physics. I'm not good at physics. But what I will say, is the idea of you doing the physics problem sets by yourself at MIT gives me chills. I couldn't-- I mean, we worked in groups in physics. Because of the-- one consequence of the isolation was that you have to work on a lot of these problems by yourself.

JACKSON: That's right.

INTERVIEWER: How did that work? I mean, how did you discover that that was sort going to be your lot, at least in the early going?

JACKSON: Well, I've talked about it a little in other circumstances. But we-- I was-- we were working on the physics-- I was working on my physics problem set. And it was basically the first problem set. And I had worked my way through about half the problems. and then I had to get up to use the rest facilities. And when I left my room to go across the hall to the restroom, I saw essentially all the other freshman women on my floor, out there kind of spread out in the hall, working on the physics problems together.

And so I went and did what I had to do. And then when I went back to my room, I gathered up all of my papers and books. And I went out to say, may I join you? And one of the women looked up and said, go away. And I said, but I've worked half the problems and I think they're right and I think I know how to do the other half of the problems. And so another woman looked up and said, didn't you hear? She said go away. And so I went back into my room and I did cry for about half hour, 45 minutes. But in the end, I had my physics problems, I figured I had better finish them. So I kind of got myself together and finished the problem set. And then, when I would go to class, a lot of times people wouldn't sit next to me in class.

Now I had a method where if I got to class early enough, I would sit in the middle seat of the second row. It there was a reason for that. And that's because in the lectures, the professors would stand up on an elevated platform many times-- you've seen it I'm sure. And being in the second, sometimes the third row, in the middle, then one was more on an eye level with the professor. It's just easier. So I would come in and sit. And if I were there first, no one would sit in any of the seats around me.

And then similarly, even in the cafeteria, when we had dinner or any meal, if I sat at a table first, in general no one else would sit at the table. And then if I came and joined a table, then they would be done, even though they still have dessert or whatever. And some of them would say, where's Jenny? And I'd say, I don't know. And they were expecting me. This particularly happened my freshman year.

And then I gradually found out that others were working together, not just the women on my floor. And so then-- so I used to do the problems alone. Then I-- we would get the-- when we would do a test there would be a cover sheet. And then as well when one turned in homework problems, one would turn it in with a cover sheet: name, course number, section number, date, problem set number. Or the test would automatically have that kind of information. So when I turned it in and we would get it back, then the grade would be written on the front. So if one got 50 out of 50 or 49 out of 50-- and that's what I would be getting-- then people could see it. And they would be looking and so on. So then people would talk to me a little more. But it was very limited because they would want to ask me about a given problem, whether it was a problem in the problem set or on the exam, and that's what-- that's as far as they'd want it to go.

INTERVIEWER: They didn't want to collaborate.

JACKSON: Right. So they never really invited me to join the study groups. And so yes, I worked alone basically.

INTERVIEWER: I know enough about physics to know that you have to have a very clear mind to solve problems that require you to be very, very patient to see the problem through. I can't imagine it would be useful to be full of anger and resentment and a sense of--

JACKSON: Absolutely.

INTERVIEWER: --how did you clear your mind to do those problems?

JACKSON: Well in about three or four ways. One, I also learned-- and this was part of how I grew up-- that if I were healthy and I had ability and I had an opportunity, then it wasn't enough for me just to succeed for myself. That I needed to try to help somebody else. So I did volunteer work at Boston City Hospital-- what was then called Boston City Hospital. And so I worked on a pediatric ward. And so there were little kids from infant to about age two or so. And these kids were all races. And they had ailments from physical to very serious illnesses like leukemia or whatever.

And so there was one little boy who was a little white kid, blonde hair, beautiful body, except he had no eyes. And his nose was just kind of a hole. And his mouth was just kind of a hole. And he obviously was going to need plastic surgery down the line. But he was never going to see.

And as far as I could tell, no one ever came to see him. So I used to go and just hold him for awhile every day when I would go there before I started the work with the others. And what that taught me is that everybody has a burden. Everybody has something they're dealing with. And so when you see that and it's not specialized to one race, or you know whatever, then you kind of have a better understanding.

The second thing that helped me was that I joined a sorority and I became the president of the chapter.

INTERVIEWER: Of course.

JACKSON: And so we would do a lot of community service work. And then I personally used to tutor at the Y in Roxbury, tutor math and science. Primarily math. And so that was helpful. And then I joined a sorority, Delta Sigma Theta sorority. And I was shaping the chapter, as I said, as president kept me busy. And I would go-- to be honest with you, and they were-- well, let me explain.

There were some of the members of the sorority who lived in Boston, who grew up in Boston. And so their parents were there. And they would invite me over on the weekends. So I would go and spend the weekend. And sometimes I wouldn't come back on Monday because I just wasn't ready to kind of deal with all of what was going on. So instead of coming back to campus, I would just stay there. And I would do my work there. I had all my physics books and math and all of that. And I would just do that and read and because it was somehow more relaxing there. And so I would read and do my problem sets and so on. Sometimes it meant I would miss classes. Now I would structure it where I would never miss my math and science classes, particularly physics. But I would sacrifice some of my humanities classes. And so, but it helped me. And then so that's kind of-- and then finally, the physics itself. I would just get engaged and that put other things out of my mind.

INTERVIEWER: So you found ways to engage with other people in a variety of community settings and you allowed this sense of isolation to push you deeper into the material?

JACKSON: Into the material and in deeper into doing things for other people as well.

INTERVIEWER: But also deeper into the science.

JACKSON: That's correct.

INTERVIEWER: Shedding the whole extraneous stuff.

JACKSON: That's right.

INTERVIEWER: Which is kind of perfect for MIT.

JACKSON: Well it was. And in fact what happened was-- this was before the UROP program. You know, the Undergraduate Research Opportunities Program. I actually started working in a lab in material science and engineering. And I just worked in the lab. In later years I got some academic credit when MIT started thinking about the fact that maybe it could do that. But every-- I worked there during the term. And then I would work in the summer and I then I would get paid a little bit in the summer.

But I used to just go to the lab. I used to like to do the experiments. It was actually more experimental. But I would also take my physics books and math and other things. And I would just work, do my homework in the lab, and so on. and then I got to know some of the scientists and the faculty. So in many ways, what's interesting about my MIT experience is that, if you ask me who my friends were at MIT, they by and large were not my classmates. They were some of the faculty I got to know, some of the younger faculty, couple of postdocs, and people interestingly enough who are younger than I, who came along in classes after mine. so I really--

INTERVIEWER: You were mentoring?

JACKSON: Some were mentoring and some we just were friendly. But that was what was interesting. So I'm about to go and participate in some part of my 40th reunion. And the truth of the matter is I wasn't that much friends with people in my class. But I'm going to go because it'll be an interesting sociological study. But it's a big reunion so I thought I would go.

INTERVIEWER: When did you figured that you could conceivably have a role in changing this kind of social construct at MIT that allowed for the sort of isolation and humiliation that you had to go through?

JACKSON: Well I think they were a couple of things. One, because in the sorority I had become the chapter president and had been able to really reorganize some things to help, in fact, the chapter survive. And let me explain to you about that. This was a New England regional chapter. So in those days, this was a historically African American woman sorority.

So in those days, there were no chapters of this group on campuses. And they weren't particularly welcomed. So instead of being a campus-based chapter, we were a New England regional chapter. So the members were drawn from Boston University, Boston College, Radcliffe, which then stood alone, Pembroke, which was part of Brown but stood alone, Yale, the University of Massachusetts at Amherst, and Northeastern, as well as MIT.

So we actually pledged for six months. So it was very interesting. And we were very serious about community-based programs and social programs. So that made me think that maybe I could lead a little bit. And then the year I graduated, you know this from this being my 40th anniversary year, was the year that the Reverend Doctor Martin Luther King was assassinated.

INTERVIEWER: It was 40 year ago this week, in fact. Last week.

JACKSON: That's correct-- last week. And I was a child of the King era. I'd already applied to grad school and I had been admitted to Harvard, to the University of Chicago, to Brown, to Penn, and to MIT in material science and in physics. My bachelor's degree was in physics but I did a joint thesis in material science and physics bachelor's thesis. So--

INTERVIEWER: And you had a preference for Penn at that point.

JACKSON: Well, no, I was visiting. I had been invited to come to these places to visit. So I had visited Brown and I was visiting Penn the day that Martin Luther King was assassinated. And so, thinking about all that I had been through, thinking about the movement that King and others led to open doors, thinking about what I had learned from all of my experiences, and being a pretty good student, I thought, well if I stay at MIT, one, I'll certainly get a good graduate education. But two, perhaps I, because I knew the place and had been there, that I could make a difference in having MIT be more open and hospitable to minority students. So that was a big reason why I stayed.

INTERVIEWER: So are you saying that King's assassination with a pivotal moment for you in terms of choosing a path that meant you would be at MIT much longer than simply your undergraduate years?

JACKSON: That's right. It wasn't the only thing. I was thinking about MIT. But I was not thinking about it necessarily more than I was thinking about some of these other places. Because I was pretty structured. See, I had my-- when doing the bachelor's thesis, I did superconductivity-- experiments related to superconductivity. What people refer to now as conventional superconductivity or the low temperature superconductivity. And in particular then, the problem I did on tunneling in superconducting niobium-titanium alloys had to be explained using what was then called the Bardeen-Cooper-Schrieffer theory, BCS theory of superconductivity.

So Bob Schrieffer was at the University of Pennsylvania at the time. Leon Cooper was at Brown University at the time. Now John Bardeen was at the University of Illinois, but I had heard that Illinois was not particularly hospitable in Urbana Champaign to minority students, particularly African American. So with all I had already been through at MIT I kind of scratched that out. But a key person who actually made very seminal contributions in many-body theory that helped form the basis of the BCS theory was a gentleman named Leo Falicov and he happened to be at the University of Chicago. So that's why I applied to the University of Chicago. So I was very focused. So the real places that I was most interested in were Brown, Penn, and Chicago. And then I applied to Harvard because it was Harvard. And MIT. But yes, so when this occurred I made a decision that I would stay at MIT.

INTERVIEWER: And that was the pursuit of physics but also social change.

JACKSON: That's correct.

INTERVIEWER: And when you decided to go to MIT, superconductivity began to recede a little bit, at least in your graduate years.

JACKSON: Well that's because superconductivity was part of the study of what we then called solid-state physics. Now it's called condensed matter physics. But MIT had had at an earlier time a very strong effort in solid-state physics. But at the time I was graduating, a big focus was in nuclear and high energy physics or elementary particle physics. In fact, I remember being told by one of my professors at MIT, well Miss Jackson, you've done pretty well at MIT. You know, you could really think about coming to grad school here. But you know, you really need to study maybe nuclear physics or particle physics. And I said, oh, no, no. I'm interested solid-state physics, so I don't know if I'll do that. But having decided to stay for this confluence of reasons, I decided I would do particle physics. And the thought was that the mathematics of particle physics would be useful for me whatever I did. So that's what I did.

INTERVIEWER: And particle physics at that time was a lot math, figuring out how the strong force worked [INAUDIBLE] weak interactions and all that.

JACKSON: That's right. And in fact my thesis area was in what we call strong interaction physics at the time.

INTERVIEWER: So you dove right in.

JACKSON: I did.

INTERVIEWER: And you dove into politics, sort of, on the MIT campus.

JACKSON: Well you could call it politics in the sense that I was one of the co-founders of the black student union. But I was-- interestingly enough, I was probably not into politics in the sense of the politics of things that were directly on the national level. So for instance, as you well know, the Vietnam War was going on and kind of coming to a head and I never really got involved in Vietnam War demonstrations.

INTERVIEWER: And there were a lot of them on MIT campus.

JACKSON: There were a lot of them. But instead, you could say focus related more to what you would say was the civil kind of continuing civil rights struggle. But for me, it took the form of trying to change MIT and to open it up, as I said, to be more hospitable to African Americans, but to minority students generally. And hopefully in the process become more hospitable to women as well.

And so I did co-found the Black Student Union. I was one of the first co-chairmen. Paul Gray was associate provost at the time. And he formed this Task Force on Educational Opportunity. And I worked with him on that. And we used to meet every week, sometimes more than once, for hours at a time. Groups of us went out to high schools to recruit students, minority students, to MIT. And so in the fall of '69 we had 57 black students start at MIT, when the number historically had been about two to five per class.

And that's when the Project Interphase started. But the year before there was a little-- there was an early program that was a precursor to Interphase. And so it was called Project Epsilon. Would you like to know where the name came from?

INTERVIEWER: Sure.

JACKSON: MIT had admitted a few more black students then it had typically admitted. And it wanted to have a kind of a summer bridge type program. So we were kicking around ideas. And I said, well this is a nice start, but it's an epsilon. It's a small step. So we should call it Project Epsilon. So that was it. But then Interphase was much larger and it was really meant to be a bridge.

INTERVIEWER: Every college has a different experience with the Civil Rights movement in the sense that the embrace or controversy associated with the rise of institutions like black student unions or Afro-American assemblies or the various kinds of things that happened on campus represented a particular way that the institution dealt with the problem or the emergence of African Americans wanting to be more visible, have more right now. How did it solve this problem? How did they approach this issue when it became apparent to them that something needed change. And how are you part of that approach?

JACKSON: Well, the Black Student Union presented a list of demands to the administration. Except we actually called them proposals. 10. And that's when the administration formed the Task Force on Educational Opportunity and asked Paul Gray to lead. And so that task force then actually brought students who were involved in the Black Student Union together with the administration in these very intense meetings-- sometimes hot meetings-- to work through strategies for recruitment, for admissions, financial aid, and the design of the Interphase program.

And so it involved a real commitment on the part of the administration and on the part of students. Because students were actually going out and recruiting and spending time doing this. It was actually somewhat controversial. And Jerry Weisner -- I think, who was president at the time or became president not long after that. He might have been provost at the time -- wasn't totally enamored of students spending that much time doing these things because he felt students should be students.

Now I must say the point of view that I had at the time was that if the Institute wasn't going to do it on its own, then it left no choice. But for students to be engaged-- partly because they weren't very many black faculty members and therefore the whole time I had been an undergraduate, there wasn't what seemed like a particularly great commitment to these things.

And so I would argue that those of us who were students did make a sacrifice. I mean, in many ways if you look at when I started and when I got my PhD when I started grad school-- when I got my PhD-- I finished well within the sort of national norms of the time. But I could argue legitimately that I probably could have finished a half year or so or more earlier, but I made this commit to do all of these things.

INTERVIEWER: Did the Institute approach this-- even though the problem was admittedly difficult on both sides and the meetings were hot-- did the Institute approach this with a kind of a well let's figure it out in the way that scientists would do? Were there emotional baggage issues that kind of came to the surface? Was there some sense of tradition that seemed to haunt the whole process? In talking with Paul Gray -- who gets extraordinarily emotional about this time and about this being a part of his legacy and being exquisitely proud of what was achieved and also painfully mindful of what wasn't achieved while he was there -- there does seem to be a sense that on a certain odd level, the Institute rolled up sleeves, regardless of, difficulty and tackled it head-on. Is that your impression?

JACKSON: Yeah, I would say that the Institute rolled up its sleeves and attacked it in the MIT way. That is, being very analytical about what the issues were, what the challenges and problems were, and then trying to figure out solutions to those challenges, and to structure things in a very orderly way.

That doesn't mean there wasn't great emotion around it, because there really, really was on all sides. But Paul was amazing because he kept his cool during some very heated times. And he was called names. But so was I because I was-- for some students-- too much of a collaborationist. But I think we wanted to keep our focus on where we were going. And then this program was brought into existence-- Interphase-- but a lot of things played out. Things got restructured in admissions.

Because one of the proposals, or demands, related to having more African Americans in key roles at MIT, from admissions to faculty and other key staff positions. And those things began to happen. Now, I have to say I don't think MIT has built on that as much as it could or should. And so in fact I think the number of African Americans on the faculty really in the tenured and tenure track ranks is no greater than it was at a certain peak 20 years ago. And so I think that has been where MIT has faltered the most.

I think in terms of staffing they've done well in terms of African Americans and others in key positions. And with students it's kind of been a steady state. It's a bit higher than when we first got a large number, a larger number, of students in the freshman class. And so it's definitely gone up. And the growth of other minority groups has been quite good. But then, the kind of underlying numbers have never gone beyond a certain amount.

So I think Paul created an amazing foundation. And and there wouldn't be a real presence if it weren't for what went on during that period. But the degree to which MIT has gone past that, I think, is a real, still an open issue.

INTERVIEWER: What was the worst name you were called in those times?

JACKSON: Well, I'm trying to remember. No one called me a name like they called Paul. Paul was called some really nasty things.

But this is what people thought about me. There was a group of students-- and I think you'll appreciate this within the context of the times. It was a group of students who thought I was a quote unquote CIA agent. Or that I was working for the FBI, to either spy on or hold back some of the African American-- to hold back African American students. We called them black students, certainly, at that point. And the thought went like this-- and this is how things are very interesting-- as you and I discussed earlier, I did work alone. I did have to do those problem sets by myself. And that characterized my MIT experience almost from start to finish. Because even when I was a grad student, still working on problem sets by and large alone.

And I can remember-- and this is kind of a digression-- but I can remember one of my classmates who had been one of my undergraduate classmates. And we would chat and he would talk and he would tell me how he belonged to something called Physics Family, where a professor would just get a group of students together and they would get together and have brown bag lunches or dinners and just talk physics. And I said, oh that would be so exciting. I said, how can I get in? He said, well you have to be invited. Okay.

And then one day I was meeting with him about something and I happened to go to his lab and to his desk and I was waiting for him. And then I just happened to be looking-- you know how your eyes will wander. I wasn't deliberately trying to snoop. And I found out he had a book open. And I realized as I looked through things that he had, essentially, years worth of graduate problem sets, of things that had shown up on exams and homework, as well as exams from previous general exams, comprehensive exams, for the PhD. And he had never told me about this. And he had a group he worked with. So again, one more time, I was working by myself.

So I've lost the train of thought.

INTERVIEWER: Well you were a loner, so that makes you suspicious to the people who thought you were CIA.

JACKSON: So the real point was--

INTERVIEWER: And you had a lot of faculty friends which probably wasn't good.

JACKSON: Well, but it was really this: that many of the students were having a difficult time. And they had seen that I had graduated from MIT and had done well enough to get into the graduate school. And then by the time a number of students started showing up in more significant numbers, after a couple of classes where they were 50 plus students coming in, then they realized how long I had been there basically alone.

And I had also passed my comprehensive exam, we called it a general exam, for the PhD. And I passed it the first time through. And so people felt, well how could she do this? If we're catching heck and it's been a struggle, then there must be something here that we don't see. And so that took the form of some people saying I must be an agent for the government.

So in many ways, I could say that was the worst thing I was called, but having worked for the government, I don't find that's so bad. But the idea that I was some collaborationist and that that had to do with my pathway through, that hurt my feelings. But I wouldn't say it was the largest number of students. But because I had been involved with founding the Black Student Union, leading it, creating these programs, working, and I taught in Interphase for a couple of years, that hurt my feelings.

But in addition, I ran into something a little bit like it but in a different kind of way a little bit later. I taught in Project Interphase for about to two years in Epsilon four years over a three year period.

INTERVIEWER: And these are teaching programs to--

JACKSON: The summer, the bridge kind.

INTERVIEWER: The bridge programs to bring people up to speed.

JACKSON: Right. And then in my third year of grad school I applied and went off to a theoretical physics summer school at the University of Colorado in Boulder. And doing such summer schools, aside from being exciting, were considered to be prestigious and they were good ways to build a career and so on. And so I went because I was really, then, really getting into my research.

But people were upset with me because I left the Interphase program, that I didn't keep teaching in it. Because I taught in it one year and then I was in charge of the physics track in it the second year I taught in it. But I have taught three years in such summer programs. So people accused me of abandoning the students. But I made the point that I did have a career, I was a grad student, and in the end I couldn't do so much for other people if I didn't build my own career. So I went to the summer school. So the tension there was a little hard.

INTERVIEWER: When you ultimately began your research career that then became an industrial career, describe the excitement of Fermilab when you began.

JACKSON: Well Fermilab was pretty new. It had been fairly recently completed. And what made it exciting had to do with the physics of having at that point the highest energy accelerator and the kind of experiments and the knowledge that came from it.

But what also made it exciting, interestingly enough, was where it was. There was a herd of buffalo. It was out on the planes in Illinois. And so the whole ambiance of this new tool and instrument-- even though I wasn't doing what people call phenomenology-- in high energy theory people talked about theory and then phenomenology, where one did theoretical modeling of actual experiments and things like that. Or one did more mathematical things. And at that point I was more on the mathematical side. But the idea the of the seminars and all of that about the interesting discoveries, and so on, I found that exciting.

I will say that I was once again going through the isolation piece. Where this was a new group. Certainly by the time I had finished my graduate career, people knew me. And there were a number of grad students who had come from other places, and so on. But here we go again, in the sense that people wouldn't work for me, with me.

That the theoretical physics group had a cluster of offices which really were in a cluster of houses that had been there when Batavia was a little village. But this cluster was four or five miles from the main building, which is where the physics colloquia and seminars would be. Now, my second year we moved into that building. But my first year we were in this cluster of houses that comprised the theory group.

Now I used to commute from Chicago-- that's its other own story because I couldn't find an apartment. No one would rent to me in the vicinity of Fermilab. I mean I had the choice of going into the black community in Aurora, Illinois, but I felt I should be able to live wherever I wanted to live. And I never could get that worked out. So I ended up living in Chicago which in the end turned out to be one of the best things. So I would commute. It was a 35 mile commute.

INTERVIEWER: On the train or were you driving?

JACKSON: No I was in a car pool. So different ones of us drove. There were four of us. So in general, I only drove once or twice a week. So once I was deposited at the theory group, then there I was.

So people would get up and go and knock on each other's doors and they would get into the cars to go over to the main building to go to the seminars and the colloquium. But they never knocked on my door. So unless I happened to be looking up from my work to ask for a ride then I didn't have a way to get there. Except then there was a black woman who was the secretary for the theory group so she would lend me her car. And that's how I have to go back and forth. So I would always end up having to make these kind of side adjustments to do the physics because other people had more camaraderie. So it's an interesting existence.

INTERVIEWER: I don't know if I'd use the word interesting. Doctorate though-- it didn't get you much in that route.

JACKSON: No, not there. But then-- but let me just make two comments though. There was a woman there named Mary K. Gaillard who actually was an American citizen but she had been living in Europe. She was part of the CNRS in France. But she actually spent her time-- she was a theorist-- at CERN. And that's how I got interested in CERN.

She in fact suggested I might want to come and visit CERN for a year. They had these visiting scholar programs. And so in fact I got a fellowship from the American Association of University Women initially to go my first year at Fermilab. But I decided before my first year I would've taken the place I decided not to go but then in the end I got a grant from the Ford Foundation plus money from CERN. And I went and spent a year at CERN between the years, two years, at Fermilab. And I collaborated with Mary K. Gaillard on some work there. I worked with another physicist to who had come from Greece although he'd got his PhD in the U.S. and so we did some interesting work on neutrino physics. And I really loved that. Because for the first time, the physics and how I lived, came together. And I was--

INTERVIEWER: Europeans.

JACKSON: --very good friends with a German couple, both of whom were high energy theorists, the [? Shrenths. ?] And we would spend weekends together. We would go into the mountains around Geneva and cook out on a grill and talk about physics, talk about life. And so I almost didn't come back because I thought about trying to get a job in Europe. But then I said, well this is where I grew up and my family was here, so I thought I would come back. And so I did.

INTERVIEWER: Did you have a sense when you got your doctorate of the importance of this first African American woman to get a doctorate in physics in the United States. A milestone that you always carry now. But at the time, what did it mean to you and the teachers around you?

JACKSON: No. I mean my teachers were proud of me. I think it wasn't until there was a little more revelation-- I think we sort of knew at the time I got my PhD that I was the first woman to get a doctorate from MIT. But I think what was on my mind was getting a postdoc and the physics. And so that only began to flower, as it were, kind of more in the late '70s. And then it seem to become more and more a part of my persona.

INTERVIEWER: What sort of industrial jobs were open to you and how interesting was that work and how different was that environment and that experience compared to all these years in an academic research setting.

JACKSON: I got the job offers from Xerox Research, from Corning Research, from Westinghouse-- both in its research lab and its power systems. I got job offers from Ford Motor Company Research, from IBM Watson Research Center and from Bell Labs. And I actually took the job from Bell Labs and then IBM called me. And I said well, could you call me a year from now. Because I was switching fields, sub-disciplines. Because my PhD was in high energy and I was switching into solid state, or condensed matter. So they said okay.

So a year to the day they called me up and asked me to interview. And I interviewed. So I got a job offer at Watson Research Center. But I had done some really interesting work on charge density waves in layered materials and had gotten some interesting results in discovering certain topological structures in the system, and then making predictions about thermodynamic properties from these topological objects. And so that was very nice work.

And so IBM wanted me to come but then Bell Labs offered me a permanent position as a member of the technical staff. And I decided I would stay where I was. It was exciting, and there was a lot going on. And in also met my husband, future husband, and it was just a special period. And it was probably the last great period in the history of Bell Labs. And in fact I went, actually, at the time when it was still called Bell Telephone Labs. And then it became AT&T Bell labs. And then by the time it became Bell Labs, Lucent Technologies, I was gone.

But I stayed there for 15 years doing physics, mainly on two dimensional and quasi two dimensional systems, Lay structures, two dimensional semiconductor system so-called strain layer super lattices. But then the work that I'm most known for had to do with electrons on the surface of liquid helium films. And you say, why is that interesting? It's interesting because if one wants to study phenomena in semiconductors-- you know layers of which where basically the physics is always been the physics of quasi- two dimensional systems--

INTERVIEWER: You need to slow those electrons down.

JACKSON: Well it's not even so much that. It's just that that's the natural geometry. But then in order to know what the electronic properties are going to be, one has to be able to understand how the electrons interact with various kinds of structures. But also excitations in the system. So essentially what one is studying with electrons on the surface of liquid helium films is the interaction with the surface excitations. Which, when one did a quantization of them, they were called riplons. And so I was able to model this as a so-called polaron system, using path integral techniques.

And what would vary the strength of the interaction with the excitations were the thickness of the film, the nature of the material on which the film was deposited, the roughness and so on, and so I was able to make a prediction of a phase transition that would occur in the system where the mass would suddenly change by five orders of magnitude. So it would essentially become localized. So this was what was called a polaron effect.

And let me explain that. A polaron is a particle that people, that was described as digging its own grave. And people had looked in certain kinds of ionic materials at the interactions of electrons with phonons. And these are-- you could think of them as quantized excitations that relate to vibrations of the lattice, the atomic lattice. But people that have looked at what were weak coupling systems and it basically says as the particle moves through its environment it distorts the environment it's in. If you can think of like a mattress kind of effect. But then the environment acts back on the electron and changes its electronic properties. And so in most systems, this mass would kind of change in a gradual way. But it would change by a factor of one and a half. So the mass would be maybe one and a half times. So it was kind of slowly moving and more massive de facto massive object.

But in this particular system that I studied and what we discovered-- I discovered really-- was this jump by five orders of magnitude in the mass so it's kind of almost a localization phenomenon. And then I was able to use that to make further predictions about electronic and optical properties and so on. And then a few years later, these predictions were born out in experiments. So then I was elected a fellow of the American Physical Society. But then I conti--

INTERVIEWER: Just for-- for just one moment: basically you're discovering conditions that exist at this level, this particle level, interacting with these materials that form a set of bounding conditions, for if you want to create devices and computational devices at this level, you're going to have to deal with these phenomena that you discovered.

JACKSON: That's right. This kind of phenomenon. Although there are some differences between the electronic system on the liquid helium films and the electrons in two dimensional semiconductor structures. But the idea of basically being able to model how the electron interacts with quantized excitations in two dimensions is what the basic physics was about.

And this particular system was very interesting because you could vary the properties and tailor them by changing film thickness, by changing the dielectric properties of the surface on which-- I mean the material and which these films were put by changing electron density and so on. And so while there wasn't-- so while the nature of the specific expectation that gave rise to this massive change in the effective mass was different, the basic way you approach the problem was similar. And then later on I actually studied so called magnetic polarons in layered systems. And now you're looking at magnetic excitations so-called magnetic polarons and making predictions then about how that changed the optical properties of the system.

And so that's been kind of the sort of way I started with looking-- it was interesting because we talked earlier about doing high energy physics and in a way doing it when my original interest was in solid-state or condensed matter physics. And I said that I felt that looking at the mathematics and the ways one constructed models in high energy physics might be useful one day in what were condensed systems. And interestingly enough, just as I was about to move from Fermilab to Bell Labs, when I interviewed I talked about the fact that I was beginning to look at topological properties of solutions to so-called nonlinear field theories, certain quantum field theories. And I felt that these concepts or this approach would be potentially useful in condensed matter systems that were modeled using so-called Landau-Ginzburg theories which were very similar.

INTERVIEWER: So again with the vectors. The confluence that lead you into the sciences to begin with and here these vectors of solid-state physics, high energy physics, your unique perspective of these various studies that you'd engaged in, they produced this original work that really is your legacy at Bell Labs.

JACKSON: That's correct. And in fact the paragraph to end it is, that in the very first system I worked on, which was a layered system-- so-called layer transition metal dichalcogenides. These were systems that had metal atoms sitting between layers of chalcogen. So things like cadmium diselenide and so forth, cadmium ditelluride--, you know, CDSe sub two. So that's the two, the selenium level. And then you had the metal.

So it turns out that because of the physics, the electrons would tend to move in the metal layer. But then there were affects of coupling through the layers. And I was able to model it. And lo and behold we discovered that the charged density waves in the system would in fact sometimes under certain conditions create these topological objects. And then we used the topology to be able to make protections. So I was quite thrilled when this occurred. And then I went on to doing the electrons on the surface of liquid helium films and so on.

INTERVIEWER: So at that particular time what did your parents think of what you'd managed to?

JACKSON: Well they were thrilled because I had gotten a PhD from MIT. They were very proud of this. I was out doing my thing in physics and they were proud of that.

INTERVIEWER: And you were a personal beneficiary of the social changes that all of you witnessed.

JACKSON: Exactly.

INTERVIEWER: So social change, success in academia, leadership in civil rights at MIT, original work at Bell Labs, married?

JACKSON: That's right.

INTERVIEWER: What the hell do you need the Nuclear Regulatory Commission for?

JACKSON: Well, two things. I'd already become involved in issues of science technology in public policy in New Jersey. I was appointed by Governor Tom King to the New Jersey Commission on Science and Technology, which was created to bring industry, universities, and the government together. Where one would leverage government funds to create infrastructure and research programs in four of the universities in New Jersey, in areas that were deemed to be important to New Jersey's economy. Things like advanced biotechnology and medicine. Things like informatics, molecular biology. And the four universities that were the beneficiaries were two public, two private. Rutgers University and the New Jersey Institute of Technology on the public side, Princeton University and Stevens Institute of Technology on the private side.

And I was the co-chair of the Scientific Fields Committee, which was in fact headed by Bill Baker, who at an earlier stage had been president of Bell Labs. He wasn't president while I was there, actually; he had retired. But we came together on this committee. And this was the committee that decided what areas of science the Commission would in fact invest in.

I was also on the budget committee, and so we are the ones who apportioned the money. And I served on that committee with Ed David, who was president of Exxon Research and Engineering at that point. And so I got to know people in a broader industrial base.

It was an interesting commission. It had private citizens, and I was one of those. But it had the ex-officio, the presidents of two of the universities at any given time. They were non-voting members. Always a public and a private. And then it had people who were in industry and leading particularly in technology based industries. So that actually broadened my perspective. And there were politicians from the state legislature on it as well. You know, it divided between the Republicans and the Democrats of the Senate and the Assembly. And so I actually got a much broader purview of this intersection of science technology and public policy. And I guess they got a look at me as well. And I was asked to join the board of the big utility in the state, which happened to operate nuclear power plants. They asked me to chair the--

INTERVIEWER: PSEG?

JACKSON: --PSEG. And it was the parent of Public Service Electric and Gas, PSE and G. And they asked me to chair the nuclear committee, the nuclear oversight committee, for the board. And what was interesting, and I must tell you this, is that that was a very interesting committee because it had on it Dennis Wilkinson, who was the commander of the first nuclear submarine, the Nautilus. It had Warren Witzig, who ran R and D for Admiral Rickover for a while. He was a professor at Penn State. It had Sol Levy, Dr. Sol Levy, who had been it ge and was called the father of the boiling water reactor. He led the program that developed the first boiling water reactor at GE. And so on. And so here I was, I was chairing this committee of all these people.

I also got involved more broadly on the industry side because I was asked to join the advisory council of INPO, the Institute of Nuclear Power Operations, which was formed in the aftermath of Three Mile Island by the industry, to improve the industry, nuclear performance. So I had all of these involvements, while still doing research, and then later becoming a professor at Rutgers University.

So then in 1994 I got a call one day from the White House to consider a presidential appointment initially to be a commissioner of the NRC. But then once I was interviewed in Washington at the White House, they offered me the chairship. So I decided I would do it. Because I was interested in issues of science technology and public policy. Two, I've always said that I always felt I would do things where I could make a difference. Three, I'd already made a transition.

Now some people will remain in research their whole lives. I made a move from Bell Labs to Rutgers to becoming a professor. Because I felt I have more ideas in research then I would ever just work on myself and I wanted to have students and bring them into research. I've always referred to my students as my intellectual children. And they are kind of like your intellectual children. And so I thought that was unique. But then I got involved in these larger issues.

So the NRC was, I felt, an important but very serious technology. It was a natural outgrowth of my work on the PSEG board and the nuclear committee and working with INPO. It derived from my original PhD area, because high energy physics is really an outgrowth of nuclear physics. It required this unique ability to bring scientific thought together with public policy and with management. And fifth, it had a domestic and an international focus. Because the NRC shares with other agencies a national defense and security responsibility vis-a-vis nuclear nonproliferation.

And so I got involved with issues with the NPT, nuclear nonproliferation treaty. And the NRC as well is the licensing agency and export control agency for the U.S. government for the export of nuclear technology and nuclear materials for peaceful purposes. And it works together with the Department of State, with the Energy Department and so on, at the IAEA, the International Atomic Energy Agency. And so I was able to get involved there.

And this was occurring both in the aftermath of Chernobyl, but also in the soon after the breakup of the Soviet Union. So they were all these newly independent states which inherited soviet era reactors including the Chernobyl reactors in what now the Ukraine. but they didn't have a regulatory structure and even that much of an operational structure because it was always controlled out of what is now Russia. So we actually had the opportunity to help them Create actual nuclear regulatory regimes. I mean, actually writing regulations, training nuclear inspectors, and then teaching them how to do safety assessments.

INTERVIEWER: You worked closely with Vice President Gore?

JACKSON: I did. There were these new bi-national commissions, but two in particular. I was involved in the US Russian Federation commission on scientific and actor economic cooperation. The so-called Gore-Chernomyrdin Commission because it was headed by Al Gore on our side and the Russian prime minister, Viktor Chernomyrdin on their side.

And then the so--called Gore-Mbeki Commission, which was a similar commission with South Africa. And then Thabo Mbeki was then the deputy president. And then it operated through committees and subcommittee that were headed by ministers and vice ministers on their side and by cabinet secretaries and heads of agencies on our side. And so I was co-chair of the energy committee with-- I mean vice-chair of the Energy Committee with the South Africans and chair of the Nuclear Safety Committee.

And then with the Russians, I was vice chair of the Nuclear Committee, and then head of the Nuclear Safety Committee. But I also formed, pushed to form, an International Nuclear Regulators Association, which brought together the senior regulators of eight countries: Canada, France, Germany, Japan, Spain, Sweden, the UK, and the US. And we worked to harmonize our approaches to providing nuclear safety assistance to countries worldwide. And I was the group's first chairman for two years. And that was during the time I was NRC chairman.

INTERVIEWER: So that sounds very exciting.

JACKSON: We got a lot done. And the group still exists. And it's been expanded to include South Korea and it has China now as an observer. And so we also finally got ratified the convention on nuclear safety, which the US had promulgated but we were the last ones to ratify. So it was an exciting time.

INTERVIEWER: I've talked to a lot of people who've been in government agencies in Washington and rarely do people describe their time there as-- in such sort of exciting terms as you do. I mean, there's a lot of eye rolling, and, I had to deal with them, boy, I can't tell you what went on behind this closed door. But how do you maintain this sense of staying on the focus of what your goal is without getting bogged down in a place like Washington where it seems like people's profession is to get bogged down.

JACKSON: Two things. One, I'm always relentlessly focused on what the mission and the goal is. And I'm always able to keep the big picture in mind. I don't know why. It is a gift. Secondly, I always know how to structure solutions to problems so that one can break them down. They're part of the bigger puzzle, the bigger picture, but to get them done. And I made a commitment to myself when I first went to Washington that I wanted to structure what I did such that I could look back in any three to six month period and know there were discrete things I got done.

Why? Because in Washington, with it being a political environment, you know in theory I had a certain tenure on the Commission, but as chairman I served at the pleasure the President. And so one could never tell whether one would be there for six months or as it turned out for me four years. Particularly since I started in President Clinton's first term. And so I went through the transition of his reelection and into the second term. I started in 1995. Ended in 1999. So there was no guarantee that he would be reelected. But if were going to make this kind of sacrifice and change, not only in my life but my husband and sons' lives, that I wanted to be sure that I could look back and feel that I have gotten something done. But I'd have practice all the time you see, if you think about it, through everything I had been through before then.

INTERVIEWER: What was it like for that bee collecting young girl in Washington to come back home as head of the NRC and to do all the things that you've done?

JACKSON: Well it was exciting. I mean, it was kind of strange in a way. It's like you can never go home again, except I did, literally. Because I made a decision to live with my parents. So I went back to the house I grew up in. Because my husband and I decided it wasn't going to really be worth it to move the whole family for a political job. And our son was just starting high school and he had been in the same school from kindergarten. So we didn't want to disrupt his life. And so they stayed in New Jersey. So I could have gotten an apartment, but my parents were older and I thought it would be good to be with them. And in the end it did turn out to be a good thing because my father passed away while I was at the NRC and then I was still there another year and a half with my mother. But it made my parents very proud. It might have been easier to get an apartment close to Rockville, but I decided I wanted to stay with them. So I went home again. So it was kind of interesting.

INTERVIEWER: When did you realize the Sputnik era was over?

JACKSON: Oh, probably by the time it was beginning to be over. I would say in some ways by the time I started grad school. Because I remember being in a session with one of the physics professors who was talking to the first year graduate students in physics who said, well you know you ought to think really hard. It's not going to be easy to get a job. So you need to think really hard about whether you really want to do physics. And especially theoretical physics. So unless you're really convinced that you're going to be successful, then perhaps you ought to drop out now because the job market is really bad. So that was one kind of seminal moment.

A second was when the Bell System broke up the first time, 1-1-84, when there was this decision that the monopoly needed to break up. And I think many of us who where there kind of began to see the handwriting on the wall. But in many ways, Bell Labs in and of itself epitomized what was so great about science and in particular industrially based research and development. And so these kinds of periods began to say that the love affair with science and the support of it that had come out of World War II and the Vannevar Bush report and the creation of the National Science Foundation, NIH. Even though NIH was ramping up, one could already begin to see some tailing off in the physical sciences and engineering.

INTERVIEWER: So how do you bring that sense of a mission lost to a place like this?

JACKSON: Well it's because places like this, just like MIT, have always been focused on their missions which relate to creating the next generation of the very best discoverers and innovators and designers and people who will create great technological enterprises as well as nurturing the actual research and discovery and innovation that they do. And so in a certain sense, because these are specialized institutions, they are natural magnets for those who have a particular interest in them.

INTERVIEWER: But without the national consensus about science is important for the future of our country, which you experienced in the Sputnik era, how as president of RPI can you do that alone?

JACKSON: Well, no one can do anything in this kind of arena alone. But what I can do is to do my job here, for these young people and for the faculty who teach them and who do the research, the best job I can to create the platforms, the conditions, the community, that allows them to thrive.

I also have a unique opportunity to hopefully inspire them and to turn them to what are the major challenges that we all face, not only nationally, but globally, irrespective of whether there's as much discussion on the national scene as there should be. But it also is inherently a platform to push in the public policy arena, to try to create more awareness and ultimately movement, to re-energize our scientific and engineering capabilities, the support of basic research, and support for looking for talent, continuing to be a national magnet for talent from other places. But also looking for the pearls within all of our racial and ethnic groups and both genders to create the next talent pool.

It's a harder task, when one doesn't have Sputnik and all of that. But the thing people do have to remember is that we benefit because of great enterprises that have been created. We benefit because science and technology have solved many challenges. But they've also been wealth creators for individuals, as well as enterprise. And science and technology are not going to solve all the global challenges alone. But they have a seminal role in addressing them when if one can bring science, technology, and public policy together. And I'm very hopeful, and I'm one who's pushing, to have more attention in the next administration to these issues and to what that unique coupling can bring.

INTERVIEWER: Do you suspect that RPI will ever have the profile of MIT?

JACKSON: Well it's int-- let me let you finish your question.

INTERVIEWER: No, go ahead.

JACKSON: Well, it's interesting. Because of all of my degrees being from MIT, people have always thought well that must be my secret plot to turn Rensselaer into MIT. And they have very different histories and they've evolved along different trajectories. And certainly MIT is the big research behemoth.

But Rensselaer has had a very unique role with building a basic infrastructure in this country. You know, we are the oldest technological university in the country, 1824. Our folks have done everything from the bridges and the canals and the railroads and infrastructure in South America, the Panama Canal. But also running the Apollo program that put man on the moon. Working out the internet protocol that allows us to send e-mails. Developing and leading great enterprises.

So in many ways, the contributions are similar, although the routes to those may be somewhat different. Rensselaer has been much more of an engineering-- I mean an engineering focused place and an undergraduate focused place for longer time in many ways then MIT has been. But now there is a flowering research. But we don't try to do everything. We just aim to be among the best, if not the best, in what we choose to do.

INTERVIEWER: To a young person who's considering MIT or any scientific career, based on your experience, what is the joy of science?

JACKSON: It is the joy of discovery. It is the joy of using one's talents in a unique way. It is the joy of uncovering nature's secrets. It is the joy of being able to create and innovate and do things that others can't do who don't do science and engineering. And it is the joy of being at a special place with very brilliant and motivated people across generations. That's what universities are inherently.

But the concentration that you find at an MIT, at a Rennselaer is really unique. And those institutions-- we talked about the media lab earlier on-- those institutions as well allow a flowering of these other dimensions, you know, the right side of the brain as well as the left side of the brain. And these are important. And these are special people who choose to do these things. And to be part of a special community is a privilege in and of itself in addition to being fun.

INTERVIEWER: And finally, how would you explain to a nine year old why you collected bees rather than something as a nine year old moments ago told me something more normal to collect-- stones or seashells.

JACKSON: Well, one collects things that are part of one's natural environment. And these are living creatures just as we are. And by understanding them and seeing how they interact with their environments-- and stones and seashells are part of that environment-- one can learn things about the development of species and also by observing the differences, learn things about characteristics of living creatures, and seashells themselves were the protective parts of what were living creatures as well. And many stones have come from what were living creatures as well. So the living creature is the root of many things and I think they always will be.