

## WHY PHYSICS?

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Owing to historical circumstances, my early years were eventful and quite unusual. I was born in 1933, the year Hitler came to power, and my life's trajectory was irreversibly altered by subsequent events which caused my family to flee Belgium. We found refuge in late 1941 in Cuba, where I grew up from age 8 to 13 and a half, and then immigrated to the United States, the land of promise, freedom and limitless possibilities. This is where I attended high school, then College and graduate school, where I obtained my advanced degrees.

My family and my community were quite traditional. Women were not expected to work outside the home. Women were responsible for raising and caring for children, which is certainly very hard work. But they did not embark on their own career. If a woman worked outside the home, it was a sign that her husband was an inadequate provider.

I remember my very early years as moderately boring and depressing. My life changed on the day I entered school. It opened an entirely new and exciting world for me. Reading was a pleasure. Numbers were a pleasure. I truly loved it! Before I started school, I was considered sweet, a good child, but a bit of a sad sack. Now I was considered

worthy and special.

After first grade, my education was interrupted for more than a year as we fled from country to country. Although my father disapproved spending money on books (we were in terrible danger and there was no time or money for such things), my mother bought books for me to read. And I read each book over and over and over again until I got another book to read. I was eight years old when my family arrived in Havana, and I could then go to school again.

I was interested in many things. I liked grammar, languages, anatomy, geography, almost everything. I read voraciously, I played the piano and loved music passionately, and I took special pleasure in arithmetic, algebra, patterns and quantitative things generally.

What made me finally settle on physics when I had to make the choice? I'm not sure I know the answer. I found physics the hardest subject I had ever encountered, and I did quite badly at it in the beginning. It was a real challenge. Other things had been relatively easy for me. Physics was TOUGH and physics was held in very high regard. It was considered the epitome of intellectual achievement by my father, whom I loved dearly, and respected and admired very highly. My father was curiously conflicted about my scholastic pursuits. On the one hand, he placed great value on intellectual excellence and encouraged me to excel; he surely would have chosen to be a physicist had life offered him that chance. On the other hand, I was a girl, and girls should marry and have children.

I earned my Bachelor's Degree in 1954 with a major in physics (at Barnard College, although all the courses were given across the street at Columbia because there weren't enough of us girls interested in the subject). Philip Sarachik and I were married that summer, and it was time to move on to the life I was expected to live. But there was no harm in waiting a bit, and I took a job at IBM Watson Laboratories very near Columbia University. By this time, I had been quite captured and captivated by physics. It was still tough but I could do it, and it was fascinating. I very much wanted to go on for a Ph.D., but I felt I must not. But, there was no harm in taking one or two graduate courses down the street at Columbia, was there? My husband then decided to work toward a Ph.D. in Electrical Engineering. I then allowed myself to do the same.

There were many challenges waiting for me along my chosen path. There were very few women candidates for Ph.D.'s in physics in those days. I received no encouragement from the faculty; on the other hand, except for many faculty members' negative perceptions of women's ability and role, there were no overt blocks. We all had to pass the same exams, we all had to do a thesis, and we all had to defend that thesis.

The next step on the road was quite different: I had an incredibly tough time landing my first job. I believe that part, perhaps a large part, of the problem was that I had become a mother, having given birth to my first daughter Karen. But I persisted mightily, and I managed to meet that challenge too.

I will not dwell on my middle years. In brief, after doing a postdoc at IBM Watson Laboratories, and another at Bell Telephone Laboratories, I joined the faculty at City College of New York, where I have spent essentially my entire professional life. I have enjoyed every aspect of my work at CCNY. I began as a middling teacher and grew to love teaching, learning to do it better and better with time. I've taken on the usual responsibilities in my department and university over the years.

But I've derived the greatest joy and satisfaction from my research, where I believe I've made a few significant contributions. While a postdoc at Bell Labs, I did experimental measurements that established a one-to-one correspondence between the presence of a localized moment and the occurrence of a minimum in the resistance versus temperature in certain alloys; contemporaneously, Jun Kondo performed a now-famous calculation that demonstrated that the minimum is indeed due to a local moment. This solved a long-standing puzzle that had existed since the 1930's. More recently, I have done work (with Sergey Kravchenko) that raises the possibility that an unexpected metallic state can exist in two dimensions. And in 1996, a Ph.D. student in my group, Jonathan Friedman, and I discovered tunneling of a large magnetic moment through the observation of steps in the magnetization curve of a molecular nanomagnet, Mn12-acetate, a discovery that has stimulated an enormous amount of activity in what's now referred to as "single molecule magnets".

My interests have taken me to issues and places outside City College. I have participated in many efforts to defend the human rights of scientists. I have served the physics community in a number of ways: through advisory assignments, service to the American Physical Society, organizing conferences, and so on. These activities culminated in my election to the position of President of the American Physical Society in 2003, a year that was unique for its intensity, involvement, and rewards.

My life as a physicist has been enormously satisfying and great fun. That doesn't mean that every moment has been fun. There have been problems and challenges along the way, and there have been setbacks, small and large. One of the most exhilarating aspects of being a physicist (or a mathematician, chemist, biologist, ...) is that one continues to learn, stretch and expand. I'm referring not only to finding truly new facts and phenomena through doing research. I'm referring also to the joy of learning things that are known and understood by others, but that you now understand for the first time. It's a wonderful challenge.