I was very excited to hear that I was selected to receive an honorary Doctor of Science degree from UFMG on December 10, 2012. As I understand this is a special event at UFMG, but it is also a very special event for me.

Although I have already received many honorary degrees, including honorary degrees from Brazilian Universities, this one is very special for me. In fact, each one of my honorary degrees is special because of the different connections I have had and continue to have with the host institution, and the reason why I was selected. This honorary degree is particularly special because of the great impact that UFMG and I have had on each other for the past 15 years, going back to 1997. It was in this year that Professor Marcos Pimenta came to MIT to spend his sabbatical year. The impact of this visit was transformational for both UFMG and for me personally, as I describe today.

You might wonder why Marcos Pimenta chose to come to visit me at MIT. Maybe MIT was a famous institution. Maybe he knew about the Brazilian connection of our group going back to 1971. At that time, I spent about six weeks at Campinas, at a workshop where a high concentration of Brazilian scientists working in my field was gathered to set up a strong graduate education and research program. At Campinas in 1971 I was giving the same lectures given to the MIT graduate students, but now to faculties from all over Brazil, to help them establish a graduate program in Brazil at the international level. One unusual aspect was that, among those gathered for the lecturer in Campinas, there was an unusually large fraction of women attendees as compared to the US, Canada, Europe, Japan and China. By that time I had strong connections to all of these countries.

My relation to Brazil, thus established, continued during the 1980s and 1990s and may explain why Marcos Pimenta came to MIT in 1997.When he came to MIT in 1997, he had the idea to work on phase transitions using the Raman Effect. He knew both phase transitions and Raman scattering very well and was anxious to have time to advance his experience by working on familiar topics in a new environment. I soon convinced him that he should use his great talents to study something new to both of us. The topic we

chose was to use Raman Spectroscopy to study the newly emerging field of carbon nanotubes. At MIT we had already done one pioneering experiment with Peter Eklund and A. M. Rao on the spectroscopy of bundles of carbon nanotubes. I suggested that Marcos and I follow up on this work along different paths than the prior work, which Rao and Eklund were following independently.

This decision turned out to work very well and led to the highly cited work that Marcos and I did together, showing that the Raman spectra for metallic carbon nanotubes was quite different from that for semiconducting nanotubes. The significance of this work was that Japanese visitors to my group had written a theoretical paper in 1992 that predicted that carbon nanotubes could either be semiconducting or metallic depending on the geometrical arrangement of the carbon atoms. The experiment by Marcos Pimenta at MIT not only showed the theoretical prediction to be correct, but provided a non-invasive method for actually finding out whether a particular nanotube was metallic or semiconducting. This finding was surprising andremained surprising to the science community for six years, because small changes in the atomic arrangement of the carbon atoms caused a very large change in the electronic behavior. But after thinking about this point further, the reason why the enhancement factor was so large was precisely because the nanotube was so small, only one nanometer size, where quantum effects were dominant. This has in fact been the reason why this work of Marcos Pimentain 1998 became so important from a historical perspective.

Marcos Pimenta was smart and recognized this important aspect of his own work, so much so that when he returned to Brazil he encouraged his very talented student, Ado Jorio, to come to MIT and continue to work along the same research path. The project that Ado Jorio chose was to try to study the Raman spectra of an individual carbon nanotube, only one nanometer in diameter. The motivation for this difficult experiment came from a surface enhanced Raman study done in my group at MIT, shortly after Marcos returned to Brazil. It was therefore another scientist from UFMG who followed up on exploring the large intensity observed in the Raman spectra or carbon nanotubes. The paper published with Ado Jorio on the Raman spectra of individual semiconducting and individual metallic nanotubes in 2001 was transformative, and launched the new

research field of individual nanostructure spectroscopy. More specifically, we soon saw groups internationally doing related experiments on emission, absorption and even device applications. In his two years stay at MIT, Ado Jorio published about 40 papers and it was the sum total of the work by Marcos Pimenta and Ado Jorio that motivated others from UFMG to come to MIT and to other places worldwide. This activity gained international visibility to UFMG. From a historical standpoint, the visit from Marcos Pimenta started the 15-year research collaboration that we now have between MIT and UFMG. This program now has recognition and encouragement from the MIT side through a new MIT/Brazil program and has become inspirational to many young students.

Since the visit of Marcos Pimenta and Ado Jorio, MIT has received a steady stream of visitors and graduate students from Brazil and also from other countries, and these collaborations continue to the present time. A steady stream of MIT and other international graduate students have likewise come to UFMG and have worked with Marcos Pimenta and Ado Jorio at UFMG and have published research papers with them. Through them and inspired by them, fruitful associations with the Federal University of Ceara at Fortaleza have taken place as well as with other universities in Brazil. These collaborations have also been encouraged by the MIT/Brazil program. In this sense UFMG has furthered research throughout Brazil and worldwide, as was recognized by the Somiya Award, given to Marcos, Ado, myself and a few others by the International Union of Material Research Societies in 2009.

And now receiving this very special honorary degree from UFMG, I wish to emphasize the impact that our collaboration has had on my group at MIT, on my own University, and on the nanoscience research field overall. I recently received two prestigious awards, first the 2012 Enrico Fermi Prize, which is the top prize in Physics in the US, and given by the President Obama, and second the 2012 Kavli prize, which is the major international award in Nanoscience, and presented in Oslo by King Harald of Norway.It should be emphasized that the collaboration between UFMG and MIT played a large role in my being selected for both of these awards.