Physics STAIRSTEP student Nick Lanning attended the 2012 APS March Meeting. This is the largest physics meeting in the world, focusing on physics research from industry, universities, and major labs. Scientific sessions and supplemental events for 2012 took place at the Boston Convention & Exhibition Center. The outstanding scientific program included over 100 invited sessions and more than 550 contributed sessions at which approximately 7,000 papers were presented.

It was a great privilege to attend the APS March Meeting in Boston. I would like to thank STAIRSTEP for this opportunity and especially my advisor Dr. Cristian Bahrim. With his help, my abstract was accepted and I presented my poster entitled “Formation of wave packets in electron diffraction on crystals” at poster sessions II to judges and other interested participants. I also took advantage of all the amazing activities that the conference includes. APS goes to great extents to accommodate undergraduate participation and help promote success and professional development for students. Near the end of the meeting I found myself wishing that it didn’t have to end. The March Meeting is the world’s showcase of physics research and was the most exciting way to learn that I have ever experienced. I attended focus sessions focused on topics that I have been studying during my STAIRSTEP and McNair Scholars Program participation. I also was pleased to attend sessions on topics which I have a genuine interest in but have had less opportunity to study. Lastly, I visited The Massachusetts Institute of Technology and several historical attractions in Boston.
During my visit to The Massachusetts Institute of Technology I toured the campus and talked to a graduate admission administrator about graduate studies. We had a nice conversation about the transition into graduate studies and how new graduate students typically become involved with research groups and pursue their PhD research topics. As one can imagine, MIT is very selective, they admit only about 4% of physics applicants. My visit was valuable because my goal is to be one of ‘the 4%’ that attends one of the top physics programs. I also was able to visit several historic sites during my visit. I saw the Old State House where the Declaration of Independence was first read to Boston citizens in 1776, I shopped for souvenirs at Faneuil Hall Marketplace which was built in 1742 and I dined at the oldest restaurant in Boston and the oldest restaurant in continuous service in the US. The Union Oyster House has had its doors open to customers since 1826.

The March Meeting can be a bit overwhelming because of the very dense conference program. This year in the exhibit hall there were exhibitors showing their products, publishers selling their books, and several hundred participants either setting up their posters or presenting their research. There was also an undergraduate lounge with refreshments and representatives from the graduate programs of different universities. Then, throughout the Convention Center in the satellite rooms, there were focus sessions where about 50 different talks were being given at any one time from
8:00am – 5:00pm. The focus sessions typically arrange 10-15 talks in one room organized by topic. After 5:00pm there were typically receptions, awards banquets, or special social events like the Nobel Prize discussion. I took advantage of several of the focus sessions by listening to talks related to some of my previous research and learning about new topics that I may be able to study in the future. I attended talks on the physics of quantum optics and how it can be used to create circuits. I attended a talk which reported the observation of a "transparency window" in the absorption spectrum of a dielectric material. This topic is very closely related to my McNair Scholars Program research which I conducted with Dr. Bahrim. I attended an entire session dedicated to the theory of quantum information for the foundations of quantum computation. The most challenging session I attended was dedicated to holographic applications in condensed matter physics. Holography theory is a property of string theory and suggests that the entire universe can be seen as a two-dimensional information structure "painted" on the cosmological horizon, such that the three dimensions we observe are only an effective description at macroscopic scales and at low energies. This was a very interesting session because these theories were being applied to Bose-Einstein condensate systems and superconductors which can be readily examined by experiment.

The most exciting part of the conference was the poster session where I presented my research. My research addresses the measurements of electron diffraction patterns which can be used to reveal the atomic structure of crystals and allow finding the length of chemical bonds. The target of my research was to understand and describe how the effective electronic charge of each atom in the crystal acts upon the incident electron beam. In our experiment the projectile electron is accelerated at a fixed voltage and we describe how the crystal acts as a netting of narrow pinholes which Fourier
transforms the unique de Broglie wavelength into a wave packet. Using the uncertainty principle we describe the mechanism that makes an incident electron to become a wave packet travelling inside the crystal at a group velocity identical with the initial speed of the projectile electron. Furthermore, the Pauli Exclusion Principle allows us to understand the fast passage of the projectile electron through the crystal and also, it allows the evaluation of the characteristic time for electron transmission. For about three hours I had the opportunity to discuss my research with a diverse group of individuals. For example, I spoke with individuals from The University of Leeds in the UK, Cornell University, Penn. State, UCLA, and the Argonne National Laboratory. I exchanged information with two visitors and agreed to continue our discussion by sharing more details about our research. After the poster session Dr. Bahrim and I attended the Student Awards and Networking Reception where we had a pleasant surprise. I received one of four awards for outstanding poster presentation out of several hundred student participants.

It is quite an honor to receive an award at such a large event where there are so many presenters representing schools from all over the world, but this was truly a team effort. I humbly acknowledge the guidance from my mentor Dr. Bahrim for without him none of this could be possible. Likewise, the STAIRSTEP program has afforded me the opportunity to develop a whole host of skills that I would not have attained otherwise as an undergraduate. I feel that I have developed skills as a researcher, skills necessary to write and communicate my ideas clearly, and the most challenging for me, the confidence necessary to be a good presenter.