

Statement of Purpose

Two important reasons drove me to undertake a graduate program in Physics and Astrophysics. First, early on during the course of my undergraduate experience at UC Santa Cruz, I developed a deep interest in Cosmology which motivated me to take elective classes that helped me achieve a clear understanding of the conceptual and mathematical framework in which Physical Cosmology is based. Secondly, I believe we are in an era in which very precise astronomical observations are possible, allowing for the collection of great quantities of data to analyze and compare with theoretical predictions. This puts Cosmology and other areas of Astrophysics in an age of rapid growth in which opportunities are abundant. The satisfaction I feel for Cosmology, coupled with the open possibilities of research, strongly motivates me to continue working towards a more in depth understanding of the questions that Cosmology and Astrophysics currently face. Consequently, I would like to work towards a Ph.D as the base for a theoretical career with the aim of answering fundamental questions of Physics and Astrophysics.

In preparation for this goal I have complemented my undergraduate program by taking elective classes such as Physical Cosmology, General Relativity, Origin and Evolution of the Universe and Computational Physics. I must add that two of these classes (Origin and Evolution of the Universe, and Computational Physics) were graduate level classes. Also, I have attended to the Sixth Helmholtz Summer School in Super Computational Cosmology in Postdam, Germany during the summer of 2006. Here I was introduced to the basics of cosmological simulations and how to use codes such as GADGET and ART, which are widely used not only for cosmological simulations, but also for simulations of other astrophysical systems such as galaxy mergers. A talk showing some of the results of my work at this summer school can be seen on my website¹. Besides my classes, I have been working with Professor Joel Primack and his Postdoc Patrik Jonsson on a research project exploring the dependence of dust attenuation in spiral galaxies as a function of the observed disk inclination through simulations. Out of this research project my senior thesis and a paper have been elaborated; please look at them at my webpage². In the last three months, I have had the opportunity to keep working with Joel Primack and Patrik Jonsson by running simulations of dust attenuation in a suite of merging galaxies, which will be used in a project aimed to understand the origin and evolution of galactic spheroids through a direct comparison of merger simulations with observations.

During the last two years I have discovered that it is advantageous to be open and to explore many different areas of research within a given field, leading to the discovery of unforeseen possibilities for research and interest. Still, I have strong interests in the subject of Black Holes and Galaxy Formation, especially on the following questions:

^{1,2} <http://scipp.ucsc.edu/~mrocha/presentations.html>

How did the first massive black holes form? How did they evolve and accrete their mass through mergers within the context of the current cosmological models of structure formation (i.e. cold dark matter hierarchical models)? What are their effects on galaxy formation? Are there alternative methods to include the effects of AGN in hydrodynamic simulations of mergers other than the ones being currently used? I also have a strong interest in subjects such as Big Bang Nucleosynthesis, Dark Energy, Quantum Gravity, and Quantum Cosmology; however I haven't had the opportunity to be fully introduced into any of these areas yet.

These are some questions and subjects that have intrigued me lately and which form a list of topics that could possibly inform my graduate experience, although, as I have mentioned before, I am open to discover in the coming years new opportunities of research that may spark my interest even more.

Personal achievements

Since I was supported financially by my family's savings while paying costly international fees, I had a limited amount of time in which to pursue my undergraduate goals. Back in Mexico my parents and I thought that graduating in four years would be easily attainable, given that a university degree in the United States is always promoted as being completed in four years. In being here, however, I found the reality to be different. At Cabrillo College, where I got my IGTC certificate, they told me that the average time for international students to transfer was about three years. When I transferred to UC Santa Cruz, they placed me at a point in the Astrophysics program in which I was expected to complete the program in another three years. In light of this, I consider my most significant personal achievement was being able to graduate with honors in four years as an international student. I am also proud of the fact that I graduated with more classes than the required, including graduate level courses, while working on a research project that resulted in an honored senior thesis and a published paper. Aside from this, I have obtained an associates degree in Anthropology at Cabrillo College. My interest in a degree in Anthropology comes from a concern with the social and cultural implications of new findings in Cosmology. At some point in my life I would like my work to inform cultural and social awareness based on modern Cosmological discoveries. The hardest of all has been achieving these goals while maintaining a life full of joy, community involvement and my most beloved physical activities, surfing and rock climbing.