High School Student Mr. Frank Cabada
September 6, 2012

Summary of my experience during the NSF Research Project Internship

Towards the end of the 2011-2012 school year, Professor Filipo Capolino and some of the students he works with came to Godinez Fundamental High School and gave a presentation in my physics class about the internship opportunity at UCI. Since I wanted to study engineering, I immediately shared my interest with my physics teacher and Prof. Capolino. I eagerly selected to participate in this program because I knew it would be a great opportunity to gain experience in a field that I may one day pursue.

Upon meeting with Prof. Capolino, I was introduced to the research project's goal of controlling the directivity and intensity of radiation in an optical leaky wave antenna (OLWA). To do this, the carrier movement through the silicon perturbations would have to be modeled. I was expecting to learn concepts about semiconductors. We also focused on current flowing through Silicon and the effect of doping on carrier density. My main goal was modeling a one dimensional PIN junction.

Through the internship I learned the following:

- the drift and diffusion current for both electrons and hole charge carriers
- Band bending and Fermi levels
- a simple PN junction (one dimensional case)
- the built-in potential caused by differences in doping concentration and the effect of that potential on circuit devices such as diodes

This research experience was unique for me. I had never worked with professors, or graduate students before. Also I had never seen any of the material I was studying. To better understand it, I studied the topics at home and we reviewed them together in the UCI laboratory. However, there were some difficulties I encountered in this experience. The greatest issue was using variables rather than numbers while deriving equations. I was used to seeing mostly numbers in mathematical equations so I had a hard time identifying and simplifying equations that only contained variables. This helped me realize that I must adapt to new ways of learning if I am to be successful.

Overall, this research internship in a four year college was a great, new learning experience. It has extended my knowledge in an engineering field which I may not have encountered otherwise. I had envisioned myself in mechanical engineering before, but now I also see electrical engineering as an option. I would like to thank Professor Capolino and the National Science Foundation for making this summer internship possible.

High School Student Mr. Frank Cabada