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A Mathematical Investigation into the Formation and Excitation of a Carbon Nanotorus Orbiter.
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The project that I worked on over the summer period was in the area of carbon nanotechnology. Study in the area of carbon nanotechnology involves analysing the special properties of carbon nanotubes. Carbon nanotubes can be likened to a sheet of graphene that has been rolled into a seamless cylinder. The specific topic that I was involved in studying was the formation of oscillators made from carbon nanotubes.

Currently, carbon nanotube oscillators involve multi-walled carbon nanotubes with the inner tube being much smaller than the outer tube. A multi-walled nanotube is typically one or more nanotubes inside another. The inner tube, since it is much shorter than the outer tube, will oscillate up and down the length of the outer tube due to van der Waals forces. This provides frequencies that are in the gigahertz range.

The goal of this project was to study a different type of oscillator, where the nanotube has been bent to form a perfect torus. If the torus were to contain a C_{60} – fullerene, the fullerene, once started moving, would oscillate around the inside of the torus, with little decay due to almost zero friction. This type of oscillator will theoretically produce frequencies greater than that obtained by the multi-walled oscillator.

Throughout this project, I have needed to develop my knowledge in the area of carbon nanotechnology. By this, I learnt how to evaluate the total forces across two nanotube structures and how to model the stresses and strains from bending the carbon nanotubes. The main part of this project involved researching the different methods that could be used to bend a carbon nanotube into a torus. This involved research into the relevant literature, and determining the best methods from the knowledge I had gained.

This summer project has been very beneficial for me in regards to undertaking honours next year. It has allowed me to learn different skills that I had not previously been exposed to, and learn about the area of carbon nanotechnology. From this project I have decided to undertake my honours thesis in the area of carbon nanomechanics, and build on the knowledge that I have acquired.

Stephen received an ICE-EM Vacation Scholarship in December 2006.
See http://www.ice-em.org.au/students.html#scholarships2007