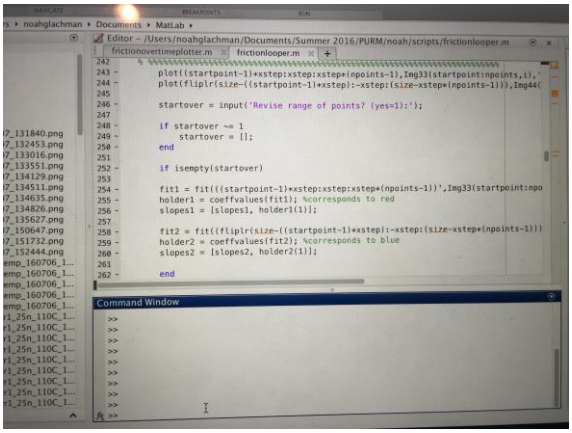

Investigating Mechanisms of Lubricant Additives using the Atomic Force Microscope
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Approximately one-third of the energy used by passenger cars is used to overcome frictional losses in the engine, transmission, tires, etc. One clear path towards reducing this and thus increasing fuel efficiency of vehicles worldwide involves improving upon the currently used lubricant oils. However, there are tradeoffs to be made when it comes to improvement of lubricants. Lower viscosity oils offer more lubrication, but also allow components to wear away more quickly. Hence, development of a novel anti-wear oil additive is crucial to reducing energy consumption worldwide.

This summer I had the opportunity to work with Professor Robert Carpick and Dr. Harman Khare on a project investigating interactions between a zirconia nanoparticle suspension and glycerol mono-oleate (GMO), a common friction modifier in PAO4 base oil. Zirconia nanoparticle suspensions are known to form tribofilms at frictional interfaces, and the goal was to see if the addition of GMO would reduce the frictional force upon formation of the tribofilm. I was able to use an atomic force microscope in the Singh Center for Nanotechnology to form and monitor the growth of these films as well as frictional forces under a variety of conditions designed to emulate the steel on steel contacts common to most engines.

It was an incredible experience to have this summer. I learned so much about both the field of nanotribology and how research is conducted. Learning to use the atomic force microscope to run experiments and gaining experience coding in MATLAB were both valuable skills that I was able to take away from the summer. The whole experience was a great way to spend my summer and I would definitely recommend this program to my peers.