Undergraduate Research Seminar
Wednesday, September 2nd, 2015
5:30 p.m. Leigh 309

Sadie DePeter
"Synthesis of Benzotrifuranone"

Multifunctionalized molecules play a crucial role in the advancement of material science and medicine; however, they are often difficult to synthesize. Molecules which can react sequentially to yield multifunctional targets are extremely useful for organic chemistry but are exceedingly rare. Benzotrifuranone, or BTF, is one such molecule and was first synthesized by the Castellano research group. BTF can react sequentially with three different amines, resulting in a tri-functionalized product. Potential uses for BTF include drug delivery, a FRET cascade system, or polymer end-group functionalization. Synthesis of BTF is a simple, four-step process and yields BTF on a multigram scale. Functionalization of BTF is quick, can be carried out under mild conditions, and results in a high yield of final product. For instance, BTF has been shown to undergo one-pot synthesis of a trifunctional compound through sequential addition of three different amines in under 16 hours in 85% yield. BTF's three reactive lactone rings are electronically and strain coupled, and as each ring reacts, the reactivity of the other two changes. This suggests that there are a variety of yet undiscovered potential uses for BTF which merit future studies.

Lauren McCarthy
"Optically Pumped NMR Study of Lattice Strain in Bulk GaAs"

We present a methodology for the measurement of lattice strain in GaAs epoxy-bonded to a Si support that utilizes optically pumped nuclear magnetic resonance (OPNMR). A biaxial tensile strain in the GaAs layer is induced by differential thermal contraction of the composite structure. The strain is manifested as a quadrupole splitting in the OPNMR resonance. Epoxy-bonding of a GaAs crystal to Si supports of two different thicknesses indicates that strain is relaxed by mechanical bowing of the composite structure. The experimental OPNMR dependence on GaAs film thickness (on a fixed Si support thickness) is interpreted with the aid of calculated absorption coefficients together with an appropriate model for the electron-nuclear spin cross-relaxation dynamics. The combination of OPNMR measurements with electronic band structure calculations provides a new methodology to probe the effects of strain in III-V semiconductors.