Monica Allen

Graduate Institution: Harvard University

Location: Cambridge, MA

Graduate Discipline: Condensed Matter Physics

Hometown: Endicott, NY

Research Interests:

I am interested in graphene transport experiments, particularly in the use of local gating to achieve quantum confinement in bilayers. In dual-gated bilayer graphene, one may induce a tunable bandgap in the density of states by applying an electric field that breaks the inversion symmetry of the layers. This enables production of confined structures with tunable tunnel barriers, providing a new avenue for the exploration of quantum information processing in graphene.

I am also interested in Coulomb-driven broken symmetry quantum Hall states observed in suspended graphene devices and how they evolve in the presence of both electric and magnetic fields. We are exploring competing gapped phases in dual-gated suspended bilayers and observe a new spontaneous insulating phase emerging at low densities and low fields: transitions into a quantum Hall ferromagnet or layer-polarized insulating state are observed as magnetic or electric fields are applied, respectively. Use of high purity suspended devices gives us access to interaction driven effects visible only at low disorder, including a complete lifting of the eightfold degeneracy (spin, valley, and orbital) and highly resistive zero density state in magnetic field.

About me:

I just finished my first year of graduate school and work in Prof. Amir Yacoby's lab in the physics department. I currently participate in monthly Boston Area CarbOn Nanoscience (BACON) meetings, which bring together nearby groups working on graphene and carbon nanotubes. This year I volunteered in the Harvard Science Mentors Program, which pairs female graduate students with undergraduates in the Women in Science at Harvard-Radcliffe organization. In the fall I worked as a counselor for the Harvard Chinatown Afterschool Program, which is the only free afterschool program in Boston supporting low income children from Chinatown.