Colin Delaney, Dario Scotto: Physics
Mentor: Alan Criag -- Physics
Electron Trapping Techniques

Montana State University has never trapped electrons. Our research employs two different trapping methods to constrain and cool particles. The first is a Magneto Optic Trap (MOT); it employs two opposing solenoids coupled with a Doppler laser cooling to spatially constrain atoms to a large region. The next is a Circular Radio-Frequency Quadrupole (CRFQ) trap; it uses an oscillating electric quadrupole in a loop that traps ions in a tightly confined orbit. The combination of these traps can allow sympathetic cooling between the atomic-buffered gas of a MOT and ions in the CRFQ. Instead of ions, we seek to tune our trap for electrons. This technique could be used to study the quantum hall effect, or Bose-Einstein condensate, among other phenomena. My research presents different design configurations implementing combinations of MOT and CRFQ Traps and simulating trade-offs of their performance parameters to contain and cool ions. Variations such as the rotation of the quadrupole loops and their cross sectional shape, diameter and field strength of the anti-Helmholtz coil combined with laser amplitude and detuning from atomic resonance will be explored and tabulated.

Acknowledgements: Dario Scotto (MSU Undergrad Student) - Physics