

Rydberg Atoms

This summer I will be doing research involving Rydberg atoms. Rydberg atoms are atoms where the outermost electron, or valance electron, has been excited to a state above its ground, or lowest, state. To do this, lasers at specific wavelengths are shown through a series of optics into a Magneto-Optical Trap (MOT). The wavelength of the lasers corresponds to the energy difference between energy levels in atoms. For our experiments we will use Rubidium atoms. Rubidium atoms work well for this type of work as they only have a single valance electron. Other alkali metals, such as Sodium or Lithium, are also commonly used to excite Rydberg states.

Rydberg atoms are of interest to the scientific community as they have exaggerated properties that can be studied relatively easily. They also have potential uses in quantum computing. Over the summer I will be making adjustments to the MOT apparatus (aligning lasers, adding mirrors, etc.), as well as conducting experiments involving the interaction of two different Rydberg states. The setup of the apparatus involves different lasers, a trapping laser, a re-pump laser, and several lasers that excite the various Rydberg states.

To conduct our experiments, the trapping laser is shown into the MOT from three directions. It is then retro-reflected back into the trap. This serves to hold the atoms in place as a frozen gas in an excited state. The re-pump laser is combined with the trapping laser and projected into the MOT in order to re-excite electrons that have fallen to the wrong energy level. The remaining lasers are involved in exciting the Rydberg states.