# Project List

Instructions: Work together in groups of 4. Each group will be assigned a project with the 'easy' tag. You job is to work together to complete that project and prepare a presentation for the rest of the class. Your presentation should cover what your project was, relevant physics, how you solved the problem, and your solutions to the problem. You may use any techniques you like to complete the projects. You are encouraged to figure things out as much as you can as a group, but if you are hopelessly stuck, please ask the instructor or TA for guidance. Should you finish your first project early, you may pick a different project to work on.

[*Easy*] **Electron Probability Densities in Hydrogen:** Quantum mechanics tells us that the electron can only exist in discrete 'orbitals' around an atom. You might have seen pictures similar to this one below:
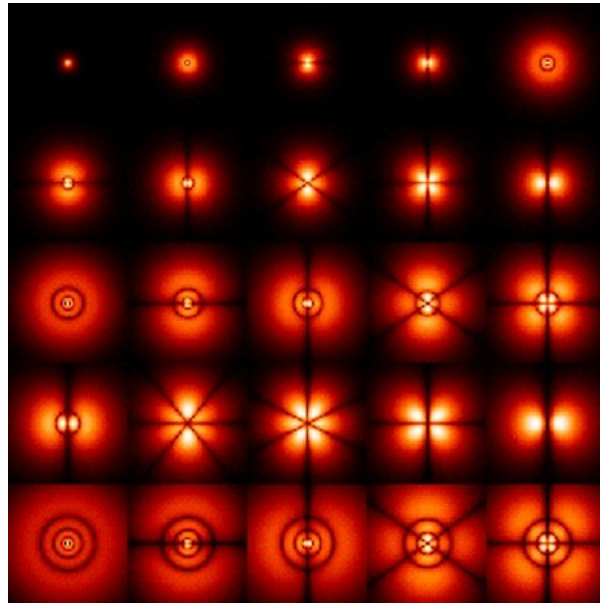
This image is effectively showing us 'where' an electron can exist around a Hydrogen atom for various quantum states n, l, m. **The goal of your project is to recreate these images of orbitals.** I suggest you look for information about the Hydrogen atom wavefunction, orbitals, and the Schrodinger equation. Before coding anything, you should understand as much as you can about the physics of the situation. What exactly goes into these plots? You may make your plots in 2D or 3D. Try to formulate a plan to accomplish your goal on paper before trying to code anything.

[*easy*] **Double Slit Experiment:** Is light a wave or a particle? This simple question was cause for significant debate hundreds of years ago. Today, we know light has both wave-like and particle-like properties. One of the most striking experiments that demonstrates this is Young's double slit experiment. **Your goal is to create a simulation of the double slit experiment**. In other words, you should create a plot that shows what happens when light passes through a double slit. I recommend learning as much as you can about the double slit experiment before you start coding anything.

[*easy*] **Transiting Exoplanets** Exoplanets are planets orbiting other stars. When a planet passes in front of its host star, it will block some of the light from that star. Hence, the star will appear dimmer to us for the duration of the transit. **The goal of your project is to make simulated data of a transiting planet, and fit a curve to it to obtain information about the planet.** I recommend you find information about the "transit method" for detecting exoplanets before you start coding.

Medium/harder projects to be added later.