Goal: Model the motion of an atom in a magnetic field, interacting with 6 laser beams (inside of a MOT).

We would like to investigate a method of gaining quantum control of atoms. Specifically, we plan to derive, plot and simulate the potential, hamiltonian, wavefunction and probability distribution of an atom in a magneto-optical trap. If additional time allows we will complete the analysis with the addition of a stationary atom at the origin (additional interacting term) and finally with the second atom in motion. To ensure that our model theoretically models cooling of the atoms over time, we will plot the total energy of the system as a function of time.

We plan to run through this project in logically segmented iterative steps, from the ground up. By doing it this way, not only do we ensure that there is plenty of documentation for our poster presentation, but we can also verify that our assumptions and models are working correctly. We will explore the best methods for displaying our data and simulations. The workload is split up in a generally equal portion, and plays to our individual strengths in programming and theoretical backgrounds.

TIMELINE

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| Date  (Range from  3/19/17- 5/1/17) | Accomplishment | Steps | Person(s) |
| 3/20/17 - 3/27/17 | Calculate radiation force on an atom at any point inside of the MOT |  | Both - compare |
| 3/20/17 - 3/27/17 | Determine potential/wavefunction/probability distribution of an atom in a MOT as a function of position and time |  | Both - compare |
| 3/20/17 - 4/3/17 | 3d plot of position dependent potential/wavefunction/probability distribution inside of a MOT at a given time and frequency | 1. Decide which programming language is best for our task 2. Learn how to make a 3d plot of selected function and make it 3. Make plot as reable as possible | 1. Both 2. Kristen 3. Parker |
| 3/27/17 - 4/3/17 | Plot of frequency vs. potential at a given position | 1. Make plot | 1. Parker |
| 3/27/17 - 4/10/17 | Simulate motion of an atom over time for given initial parameters | 1. Learn how to make a simulation and set up skeleton in program 2. Insert necessary functions and make beautiful 3. Decide how to prompt for initial parameters | 1. Parker 2. Kristen 3. Kristen? |
| 4/3/17 - 4/10/17 | Calculate the total force including the interaction between atoms /change in potential due to the addition of the second atom |  | Both - compare |
| 4/10/17-4/17/17 | Plot the 3d doubly position and frequency dependent potential of 2 atoms in a MOT at a given time | 1. Make plot | 1. Kristen |
| 4/10/17-4/24/17 | Simulate the motion of an atom in a MOT with a 2nd atom placed at the origin over time | 1. Add additional effects to previous simulation | 1. Parker |
| 4/17/17-5/1/17 | Simulate motion of 2 off origin atom system given initial parameters (over time) (this would be awesome) | 1. Add additional effects to previous simulation | 1. Kristen |
| 4/24/17-5/1/17 | Plot energy of atom and two atoms as a function of time | 1. One atom 2. Two atoms | 1. Parker 2. Kristen |
| 4/24/17-5/1/17 | Make poster, more plots? | 1. Make any additional interesting plots, tables 2. Make poster/powerpoint using plots and simulations | 1. Parker 2. Both |