Over the summer of 2014, physics lecturer Dr. Seth Hillbrand and I designed and built a website for use in a Physics 5B course at California State University, Sacramento. The goal of the project was to eliminate the traditional textbook and homework by creating an intuitive resource to test students’ understanding while also reducing the costs for both the institution and student alike. Incorporating the open source textbook College Physics (Urone et al., OpenStax College), I wrote physics problems to span the curriculum of the 5B course. These problems gave an overview for the material taught in lecture, reinforcing concepts ranging from electricity and magnetism to optics and circuits. To create and implement these problems, I taught myself the necessary JavaScript, HTML, and Python.

In this presentation I will introduce you to my study of the initial spin distribution of neutron stars in the galaxy. In this study I simulated galaxies filled with neutron stars in order to determine the galactic distributions of several observable parameters for these objects. These simulated distributions are then compared to NASA observations of the Milky Way with the Fermi Gamma-ray Space Telescope. I make these comparisons using a non-parametric Kolmogorov-Smirnov test on four different observables (period and total energy output for both the radio detected and gamma-ray detected populations). By optimizing the spin distribution function through successive simulations I have been able to confine the true initial spin distribution.

Crystal lattice structures have a variety of different forms and shapes, and the atoms that make up the lattice can interact in many different ways. This discussion presents the simulation of nearest-neighbor classical two-dimensional Ising square lattice models using Monte Carlo statistical sweeps. The program uses a Metropolis algorithm and single spin-flip updates to take many samples of the spin sites in the lattice and uses the collected data to measure the average energy and magnetization of the model at different temperatures. That information was used to chart the specific heat and magnetic susceptibility of systems ranging from $4 \times 4$ to $64 \times 64$ two-dimensional Ising square lattices. Three different methods, which will be shown in more detail in the presentation, were used to approximate the critical temperature, $T_C$, for an infinitely large lattice.