162. Benjamin Peecher, Hope College **Physics**

(Co-Author: Dr. Jennifer Hampton)

"Electrodeposition and Dealloying of Nickel-Cobalt Thin Films"

A nanoporous thin film's high surface area allows it to act as a particularly efficient capacitor and gives it enhanced catalytic properties. This project focuses on the electrodeposition and dealloying of nickel-cobalt thin films with the purpose of creating such a nanoporous structure on the surface of the film. Using an electrochemical cell and a three-electrode system nickel-cobalt films of various ratios were deposited onto gold substrates. A scanning electron microscope (SEM) with an energy dispersive x-ray spectroscopy (EDS) attachment was used to observe and characterize each sample's appearances, structures, and compositions. The depositions were remarkably uniform and smooth. The only defining characteristic was a large number of tiny holes measuring fractions of a micron scattered across the surface in varying concentrations. Analysis of the data gathered from the EDS showed that the percentage of cobalt in the film averaged nearly double that in the solution, suggesting that, when the two are deposited together, cobalt deposits at a much higher rate than nickel. Select samples were then dealloyed in the same electrochemical cell. This was achieved by reversing the potential across the electrodes, and, since cobalt re-oxidizes at a lower potential, it should strip off first, leaving behind an especially nanoporous surface. Preliminary results from the EDS suggest that dealloying cobalt from a nickel-cobalt sample is more likely with a higher cobalt to nickel ratio on the film.

163. Jonathan Shomsky, Calvin College **Physics**

(Co-Author: Prof. Matt Walhout)

"Using laser light to decelerate argon and krypton atoms"

We model the slowing of argon and krypton atoms as they interact with a laser beam and a magnetic field. Our aim is to identify a set of experimental settings that can be used to trap both species simultaneously. The slowing process involves repeated absorption and emission of laser photons by the atom in question. Each absorption gives the atom a "kick" in the direction of the laser beam. Each emission adds an additional kick in a random direction, but these random kicks cancel out over time. In order for continual absorption and emission to happen, the atom and laser must be in resonance. Therefore, in the experiment we are modeling, the velocity-induced Doppler shift of the atomic resonance frequency must be balanced by the magnetically-induced Zeeman shift. Based on the Monte Carlo method (using computer-generated random numbers to simulate probabilistic events), our simulation follows each atom's position and velocity throughout the deceleration process, and in the end it predicts the fraction of atoms that will be brought to a near standstill for any set of experimental settings. After exploring a range of settings, we identified parameters that allow for simultaneous slowing of both krypton and argon.