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Construction of Zeeman Slower and Ultra High Vacuum for Use in Laser Cooling and Trapping JOSHUA HALBFOERSTER, NICHOLAS HITCHO, JOHN HUCKANS, Bloomsburg Univ — Laser cooling and trapping involves slowing vaporized rubium-87 (^{87}Rb) atoms in a vacuum using red-detuned laser light to observe atomic behavior in a microkelvin environment. ^{87}Rb atoms are first vaporized in a 135° oven, sent through a collimating apparatus down a Zeeman slower toward a counterpropagating laser beam that slows them down to millikelvin temperatures. Subsequent techniques further cool the atoms to microkelvin temperatures. A Zeeman slower consists of a one-meter solenoid of precisely wound copper wire, creating a spatially-varying magnetic field that compensates for the spatially-changing Doppler shift of the ^{87}Rb ground state transition due to the fact that the atoms are decelerating relative to the counterpropagating leaser beam. Our experiment occurs in an ultra-high vacuum (UHV) environment ($\leq 10^{-7}$ Pa). We achieve this level of vacuum using tools and methods such as sonication, baking, turbomolecular, ion and titanium sublimation pumps.

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