Prediction and measurement of the speed-dependent throughput of an octupole filter including nonadiabatic effects: Application to Cs, Li, Rb and S$_2$

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We have investigated the properties of an octupole filter for the production of cold atoms and molecules. The apparatus is predicted to produce a beam of particles at about $T_{\text{eff}} = 1.5$K. We developed a sensitive probe of slow moving Rb-atoms and observed a Rydberg atom time of flight spectrum corresponding to $T_{\text{exp}} = 3.5$K. The difference in temperature is consistent with the uncertainty in the geometry of the Rb source at the entrance to the filter. The transmission of the device is a few parts per million. We also have shown that nonadiabatic motion of particles (with respect to Zeeman transitions) plays a significant role only for the case that the inner diameter of the guide is small. The estimated flux of $^{85}$Rb through the guide is about $10^8$ atoms s$^{-1}$. 