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Multistage Zeeman deceleration of hydrogen S.D. HOGAN, A. WIEDERKEHR, M. ANDRIST, H. SCHMUTZ, B. LAMBILLOTTE, F. MERKT, ETH Zurich, Switzerland — With the goals of: (i) performing ultra-high resolution spectroscopy with long interaction times between a cloud of cold atoms or molecules and a narrow bandwidth radiation field, and (ii) studying cold reactive collisions in which the kinetic energies and quantum states of the colliding particles may be controlled to a high degree, a multi-stage Zeeman decelerator for neutral radicals has recently been developed in our laboratory. This instrument relies on the same concept of phase stability employed in charged particle accelerators. It opens up the possibility to manipulate the translational motion of a wider range of species than has been demonstrated using other quantum-state-selective techniques such as multi-stage Stark deceleration, and applies to a very different class of species than those to which Rydberg Stark deceleration is appropriate. The results of a recent series of experiments in which we have decelerated ground state hydrogen will be presented along with progress toward three-dimensional magnetic trapping of the decelerated radicals. In these experiments magnetic fields of 1-2 T are pulsed in each of the coils which make up the decelerator for tens of microseconds, with rise and fall times shorter than 5 μs. We have characterized the decelerated part of the gas pulse and studied the effect of zero field time windows, in which electron spin flips can occur, on the deceleration process.

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