COLD MULTICHANNEL COLLISIONS OF METASTABLE CALCIUM ATOMS

Andreas Hemmerich

Institut fuer Laser-Physik, Luruper Chaussee 149, 22761 Hamburg, Germany

Recent theoretical work [1] indicates that collisions between metastable alkaline-earth atoms (AEAs) in presence of external magnetic fields are largely determined by a strong mixing of partial waves with large angular momenta even at low temperatures. Unusually large inelastic collision cross sections were predicted, significantly exceeding elastic cross sections, and doubts have been raised regarding the feasibility of evaporative cooling of metastable AEAs in magnetic traps, the standard pathway to achieve quantum degeneracy. Here we discuss corresponding experimental data for ^{40}Ca [4s4p] $^3P_2$. Observed inelastic collision cross sections exceed the predictions by an order of magnitude, while elastic cross sections are found to be similar to the predicted values [2]. Our findings confirm the asserted multichannel character of the collision processes, however, the observed deviations from theory indicate that the underlying collision mechanism may not yet have been completely identified. Our results substantiate the expectation of inefficient evaporative cooling. Possible future experiments involving all-optical trapping techniques are briefly discussed.

[1] V. Kokoouline, R. Santra, C. Greene, Phys. Rev. Lett. **90**, 253201 (2003).
[2] D. Hansen, A. Hemmerich, Phys. Rev. Lett. **96**, 073003 (2006)