

IRTG-Seminar



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“Reactive Scattering between Metastable Helium and State-Selected, Magneto-Optically Trapped Lithium”

The experimental study of Penning ionization, i.e., the reactive scattering of metastable rare gas atoms with neutral species, has recently attracted a lot of attention through the observation of orbiting resonances at low collision energies [1].

Our project is aimed at a detailed experimental study of Penning reaction dynamics in the few-electron He-Li collision system, with full quantum-state control of both reactants and at precisely tunable collision energies ranging from the thermal to the quantum regime. The experimental results will not only shed light on the influence of electron spin polarization and quantum effects on the mechanism of this reaction but they will also challenge the current level of accuracy of ab initio quantum chemical calculations of potential energy surfaces and the associated quantum dynamics in an energy regime dominated by a few partial waves

Our current experimental setup consists of a cryogenically cooled source for the production of velocity-tunable, supersonic beams of metastable helium atoms (He^*) and a magneto-optical trap (MOT) for ultracold lithium atoms which serves as a stationary scattering target. As a first step towards the realization of quantum-state control, we have set-up an array of mechanical shutters which can be used to distinguish between collisions of He^* with electronic ground- and excited-state Li atoms, respectively.

In this talk, I will outline our plans and ambitions for this project, and I will present first experimental results for reactive Penning collisions between He^* and Li at thermal collision energies.

Reference:

[1] A. B. Henson, S. Gersten, Y. Shagam, J. Narevicius and E. Narevicius, *Science* 338, 234 (2012).

**Tuesday, May 16, 2017, 6:00 p.m., HS II,
Physics high rise, Hermann-Herder-Str. 3**