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Kinematically complete study on ion-impact induced ionization of laser-cooled lithium[1]

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The study of atomic fragmentation processes due to charged particle impact provides insight in the dynamics of correlated few-particle Coulomb-systems, and thus advances our understanding of the fundamentally important few-body problem. In this respect, Fully differential data represent the most sensitive test of the theoretical treatment of the few-body dynamics. For ion-atom collisions such data became available exploiting the technique of "Reaction Microscopes." Here we report on the first operation of a new experimental tool, a MOTReMi, i.e. a Reaction Microscope equipped with a magneto-optically trapped target. This setup allows for the first time using lithium as a target for kinematically complete ion collision experiments. The lithium atom is particularly interesting for its simple, but at the same time asymmetric structure with one weakly bound outer shell electron and two strongly correlated K-shell electrons. In first experiments in the ion storage ring TSR at the MPIK in Heidelberg, for the first time initial state selective cross sections for ion impact ionization became available by means of optical excitation. Fully differential cross sections will be presented which reveal detailed information on interference and polarization effects in the scattering dynamics.

[1]Work done in collaboration with Natalia Ferreira, Johannes Goullon, Renate Hubele, and Aaron LaForge, Max Planck Institute for Nuclear Physics, Heidelberg; and Michael Schulz, Missouri University of Science & Technology, Rolla.