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Transfer Ionization Studies for Proton on He - new Inside into the World of Correlation

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Correlated many-particle dynamics in Coulombic systems, which is one of the unsolved fundamental problems in AMO-physics, can now be experimentally approached with so far unprecedented completeness and precision. The recent development of the COLTRIMS technique (COLd Target Recoil Ion Momentum Spectroscopy) provides a coincident multi-fragment imaging technique for eV and sub-eV fragment detection. In its completeness it is as powerful as the bubble chamber in high energy physics. In recent benchmark experiments quasi snapshots (duration as short as an atto-sec) of the correlated dynamics between electrons and nuclei has been made for atomic and molecular objects. This new imaging technique has opened a powerful observation window into the hidden world of many-particle dynamics. Recent transfer ionization studies will be presented and the direct observation of correlated electron pairs will be discussed.