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Double ionization dynamics of Helium dimers investigated during charged particle impact[1]

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Helium dimers (He_2) are a Van-der-Waals bound system and the most extreme quantum matter in AMO physics with a binding energy below 0.1 μeV (1.1 mK). Its internuclear distance varies from 2 to several hundreds Angstrom (even larger than the DNA diameter). Their existence was predicted theoretically by Slater in 1928 and the experimental prove followed 1994 by Schöllkopf in a diffraction experiment. Singly and doubly charged projectiles with energies of 25 - 150 keV/u were used to fragment the Helium dimer into two He^+ ions. Using the COLTRIMS (COLd Target Recoil Ion Momentum Spectroscopy) imaging technique we measured the three dimensional momentum vector of all fragments (He^+ions and emitted electrons). A detailed analysis shows different breakup channels, as a two-step-two mechanism, charge transfer and the so far only in single photon absorption observed interatomic coulombic decay (ICD), induced by the transfer of a virtual photon.

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