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Electron-ion momentum coincidence experiments on hydrogen molecules dissociated by intense femtosecond laser pulses M. MAGRAKVELIDZE, S. DE, F. HE, I. BOCHAROVA, D. RAY, U. THUMM, I. LITVINYUK — We report two experiments on D_2 using electron-ion coincidence momentum spectroscopy in COLTRIMS. In both experiments we measure electron momentum in coincidence with momentum of one D^+ ion. In the first one we used 50 fs circularly polarized pulses of 1850 nm wavelength to measure angular anisotropy of tunneling ionization. By measuring the relative angle between an ionized electron and deuteron we deduce the angular dependence of the molecular ionization probability without aligning the molecules first. With 2×10^{14} W/cm^2 pulse intensity neutral D_2 molecules are 1.15 times more likely to be ionized when the laser electric field is parallel to the molecular axis than for the perpendicular orientation. This is in excellent agreement with our theoretical model which is based on solving the time dependent Schrödinger equation in the velocity gauge. In the second experiment, we used pump-probe technique with two few-cycle 800 nm pulses separated by variable time delay. Neutral molecule is singly ionized with a weak pump pulse and then is exploded by a stronger probe pulse. The fragments of the reaction are detected in coincidence at various time delays. Gating the electron energy spectra on pump-probe delays and kinetic energies of D^+ we observe an evolution of these spectra indicative of changing electronic structure of the D_2^+ ion.

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