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Momentum Imaging Study of the H_2 Coulomb Explosion[1]

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Photodouble ionisation (PDI) of molecular hydrogen results in a "Coulomb explosion," as the two protons rapidly separate in opposite directions. Energy and angle-resolved detection of all four particles – with a well-defined light polarisation state - allows one to study correlated electron pair dynamics within the *molecular* frame. These fully differential cross sections (FDCS) measurements provide the most stringent tests for theory and the greatest possible physical insight into this 4-body process. We report on such measurements recently performed at the Elettra 3^{rd} generation synchrotron source operated in the four bunch mode using the CIEL momentum imaging apparatus. Absolute FDCS of high statistical quality were obtained for hν = 76 eV. Equal electron-energy sharing results will be presented which illustrate the effects of molecular orientation within the Feagin's helium-like model. In the coplanar kinematics the relevant parameters of the FDCS are completely determined, while in the orthogonal kinematics departures from this first-order model are clearly observed. The results will be compared with that of earlier experiments and ongoing theoretical work using the Exterior Complex Scaling (ECS) method. Data for asymmetric electron energy sharing conditions will also be presented.

[1]In collaboration with D.P. Seccombe, University of Windsor, Canada; M. Gisselbrecht, M. Lavollée, A. Huetz, LIXAM, Université Paris Sud, France; and P. Bolognesi, L. Avaldi, CNR -IMIP, Roma, Italy.