B.1.2. Impact Velocity Dependence of Ejected Electron Momentum Distributions for Proton-Hydrogen Collisions--*Emil Sidky and C.D. Lin*

The ejected-electron momentum distributions were calculated for protons on hydrogen collisions at impact energies from 5 keV to 100 keV and an impact parameter of 1.2. a.u, see Publication #76. The calculations were based on the newly developed method of directly solving the time-dependent Schrödinger equation in the momentum space (see B.1.1). The results are summarized in Fig. 1 below for impact energies at: (a) 5 keV; (b) 10 keV; (c) 15 keV; (d) 25 keV; (e) 50 keV; (f) 100 keV. The two-dimensional momentum distributions are obtained after projecting onto the collision plane. Next to each distribution are two plots showing only the longitudinal (p_x) and the transverse (p_y) momentum distributions.

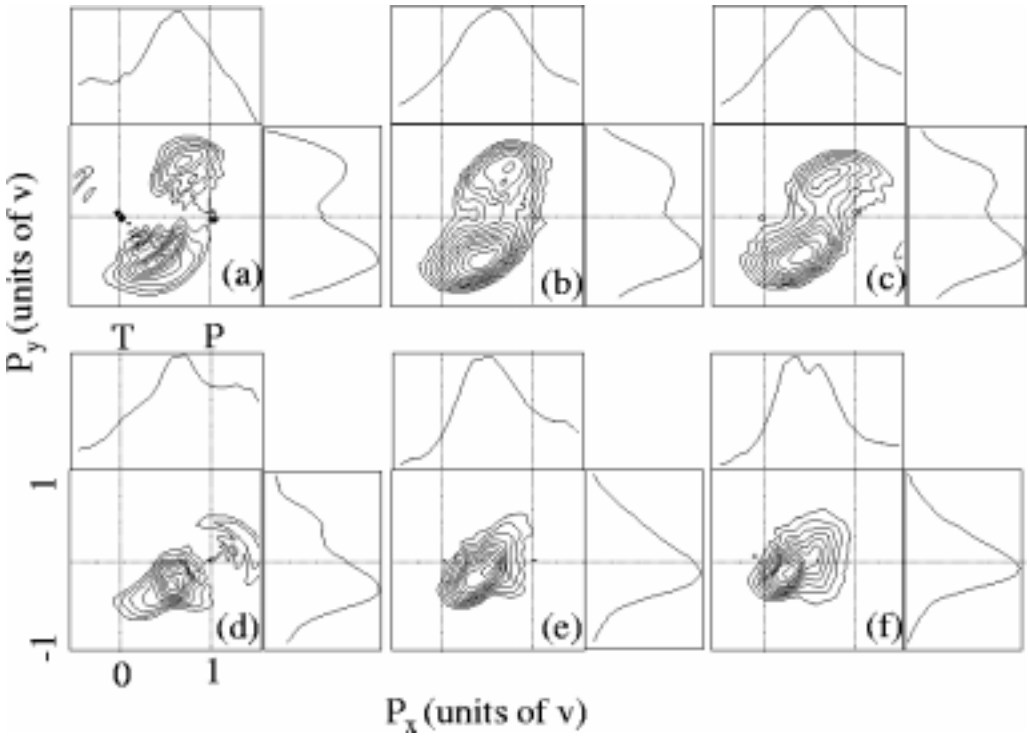

Figure 1. Ejected momentum distributions for protons on hydrogen collisions, see text from Publication #76.

There are no experimental ejected electron momentum distributions for this system. However, such experiments are underway at JRM laboratory. Existing COLTRIMS experiments have used helium or other rare-gas targets [1-3]. For protons on helium collisions, data by Dörner *et al.* [1] showed that the transverse momentum distributions undergo rapid oscillations

as the collision energy changes from 5 to 10 and then to 15 keV. Using the so-called Sturmian theory where ion-atom collisions are solved in the complex internuclear plane, Macek and Ovchinnikov [4] had obtained the ejected electron momentum distributions for protons on atomic hydrogen collisions in the 5-15 keV region. Their results are similar to the observation of Dörner *et al*., [1] for protons on helium collisions. From Fig. 1, frames (a)-(c), we do not find any oscillations in the momentum distributions in the 5-15 keV region. The double peak structure in the transverse momentum distributions stays nearly the same, and the longitudinal momentum distribution peaks at about half the collision velocity for collision energies from 5-25 keV. At 100 keV we begin to see clear evidence that the peak shifts toward the target center. To resolve the discrepancy between the two theoretical calculations we have to wait for the experimental data. On the other hand the current Sturmian theory employs some approximations, which are being further examined.

References

1. R. Dörner *et al*., Phys. Rev. Lett. 77, 4520 (1996).
2. M.A. Abdallah *et al*., Phys. Rev. Lett. 81, 3627 (1998).
3. M.A. Abdallah, Ph.D. thesis, Kansas State University, 1997.
4. J. Macek and S. Ovchinnikov, Phys. Rev. Lett. 80, 2298 (1998).