Positron-impact ionization studied by means of Recoil-Ion momentum distributions

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Positron-impact ionization studied by means of Recoil-Ion momentum distributions

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Synopsis We investigate ionization processes induced by positron impact by studying the momentum distributions of the receding ion by means of Classical Trajectory Monte Carlo techniques. We compare the recoil momentum distributions with those of the electron and positron.

Recent progress towards the use of reaction microscopes to investigate inelastic processes induced by positron and positronium impact [1, 2] makes feasible new research possibilities in a very active and actual field [3]. These systems have the capabilities to perform measurements of the ionized receding nucleus momentum on a full 4π solid angle, increasing the experimental resolutions by reducing measuring times. The goal of this communication is to investigate the phenomenon of the ionization by positron impact by studying the momentum distributions of the recoil ion. These momentum distributions are expected to be soon measured [4], promising a new set of data complementary to the currently available, which is based in detection of the emitted electrons [5, 6, 7].

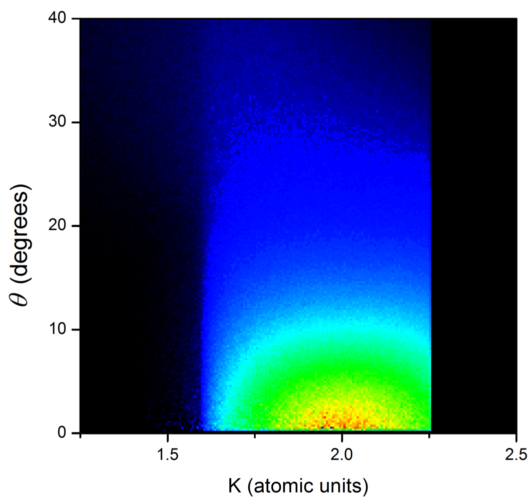

Figure 1. Contour plot of the recoil momentum distribution after ionization of H_2 by 50 eV positron impact as a function of the momentum $\boldsymbol{K} = M_T\, v_{cm} - \boldsymbol{K}_R$.

As an example we can mention the recently predicted alignment effect of the electron-positron subsystem in the continuum [8] that has provided with an explanation of the observed shift in the Electron Capture to the Continuum cusp [9]. This explanation competes with several others that include annihilation and competition between channels. Complementary measurements and calculations as those presented in the figures, will help to settle this issue as well to investigate new phenomena.

In the figure the distribution in the momentum $\boldsymbol{K}$, linearly related to the recoil momentum by $\boldsymbol{K} = M_T\, v_{cm} - \boldsymbol{K}_R$ shows several structures, being the most conspicuous the sharp drop of the cross section which vanishes above a given value of K, marked by a kinematical threshold [10].

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