POSITRONIUM FRAGMENTATION

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With increasing impact energy the main outcome of positronium - atom collisions is fragmentation of the positronium (Ps). In a paper published in 2001 Ludlow and Walters [1] put forward some ideas on coincidence studies of Ps fragmentation. In its most rigorous form the kinematics of such a study would be fully determined, ie, one would measure the momentum of the incoming Ps, the momenta of the outgoing electron and positron, and one would have information on the initial and final states of the atomic target. The result of such an experiment would be a triple differential cross section (TDCS). In analogy with (e, $2e$), Ludlow and Walters termed this a (Ps, e^+e^-) measurement. Despite enormous advances in the experimental study of Ps - atom collisions, it will be some time before it is possible to measure a TDCS. However, the first measurement of a single differential cross section has recently been made [2,3], in this case the cross section differential with respect to the longitudinal energy of the ejected positron. These measurements have been made on a He target and at relatively low impact energies ($\leq$33eV). At impact energies below 27eV excitation/ionization of the He is not possible and between 27 and 33eV it should be unimportant.

In this talk I shall look at the theoretical description of Ps fragmentation and what can be learnt from observing the spectra of ejected positrons and electrons. The theoretical description requires account to be taken not only of collisions in which the target atom remains in its initial state but also of situations in which it is excited or ionized. If we observe the ejected electrons rather than the positrons, then we need also to consider electrons that come out of the target atom.

References

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