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Ionization of atoms by positron and positronium impact

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Understanding the ionization process during atomic collisions is fundamental both from the experimental and theoretical points of view. Ionization by positron impact has also been extensively studied in recent decades. In most cases noble gas atoms were used as the target For designing new experiments, such as production of antimatter, ionization cross sections for any other atoms are also necessary. Recently, improvements in experimental techniques have enabled the determination of inner shell ionization cross sections by positron impact. During the last two decades more and more studies also became available for positronium impact.

In the present work, K-shell ionization cross sections by positron impact have been calculated for Cu in the binary-encounter approximation by the use of velocity distribution of the target electron from the nonrelativistic and relativistic hydrogenic models [1]. The results are compared with the values obtained with velocity distribution in the free-fall model. The effect of choice of atomic models on the ionization cross sections is discussed. We found that the present results are in agreement with the experimental data and other theoretical values.

Moreover, we also investigated the interaction between positronium and a helium atom using the 5-body classical trajectory Monte Carlo method [2]. We present the total cross sections for the dominant channels, namely for single ionization of the target, and ionization of the projectile, resulting from pure ionization and also from electron transfer (capture or loss) processes for 1–5.7 a.u. incident velocities of the positronium atom. Our results are compared with the calculated data using hydrogen projectiles having the same velocities as well as with the experimental data in collisions between H and He [3]. We analyze the similarities and deviations for ionization of helium atoms by positronium and hydrogen projectile impact.

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Primary author: TÖKÉSI, Károly (MTA ATOMKI)

Presenter: TÖKÉSI, Károly (MTA ATOMKI)

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