

# Positronium impact Single Ionization of Alkali atoms

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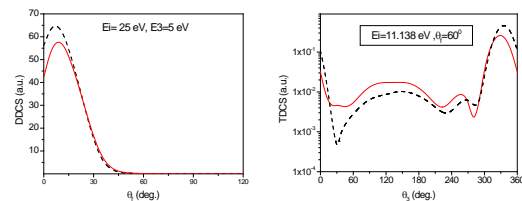
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**Synopsis:** The single ionization of Alkali atoms by Positronium (Ps) impact is studied and comparisons are made with the existing theoretical and experimental results of electron impact ionization of Sodium atom. Calculations are performed in the framework of Coulomb distorted Eikonal approximation.

In collision Physics, alkali atoms as targets are addressed both theoretically and experimentally due to their major interests for application in the design of laser systems in VUV regime [1] and for diagnostics of (fusion) plasmas and their impurities. Further, from the theoretical point of view, the quasi-one electron models of the loosely bound outermost electron and a stationary effective potential due to frozen inner shell electrons are the appealing features of the alkali atoms involved in collision processes. On the other hand, use of positronium as the projectile becomes interesting as new experimental techniques and theoretical methods are enabling increasingly stringent tests of the understanding of basic atomic and molecular collision phenomena as well as of fundamental antiparticle-matter interactions. This paper addresses a theoretical study of Ps impact ionization of sodium and potassium atoms. Such collision processes find interests as the alkali targets possess simple structures, low ionization potentials and large polarizabilities, while the projectile is the simplest particle- antiparticle (electron-positron) system.

From the theoretical perspective, single ionization process of alkali atom by Ps impact, is a bit difficult task as it becomes a four body problem. The complexity mainly arises due to the internal degrees of freedom of the projectile Ps which must be taken into account. However the direct Coulomb interaction between the Ps and the atomic target is very much smaller as compared to that arising from the electron exchange effect between them. The present calculations are done using the Coulomb

Distorted Wave Eikonal Approximation [2] and in the frame work of a model potential formalism. The present target ionization (by Ps impact) is different from the pure single ionization of the target atom/ ion by positron /electron impact [3, 4] and as such the present triple differential cross sections (TDCS) additionally carries the information about the influence of the Ps on the target electron distributions. Depending on the kinematics of the particular collision process, many interesting features are noted in the present work. In the TDCS, qualitative similarities between the electron and the positronium impact ionization of the alkali atoms are revealed for some kinematics, in conformity with the experiment [5], while for some other kinematics, both qualitative and quantitative discrepancies are prominent between the two cases. Study of the equal energy sharing and the velocity matching between the ejected electron and the positronium shows that both the kinematics depend on the incident energy and the collision geometry.



## References:

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