Investigation of electron and positron induced processes on plasma and astro relevant materials

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The electron and positron impact ionization cross section data of atomic and ionic targets are important for understanding collision dynamics having application in the field of astrophysics, plasma chemistry, physics of stars and interstellar gases. The ionization cross sections are essential in the modeling of plasma in fusion research. Electron collision processes on the Be, W and their charged states play an important role in the fusion edge and diverter plasmas. Beryllium has traditionally been considered a suitable plasma-facing material in the divertor region of fusion tokamaks due to its low atomic number and favorable thermal properties. The tungsten (W) and tungsten based materials have also been recommended as one of the materials to be used as plasma facing components for the International Thermonuclear Experimental Reactor (ITER) [1], and it is also been used in the number of current tokamaks such as JET, ASDEX-Upgrade and DIII-D. Electron induced processes are prevalent in such magnetic fusion devices in a wide range of energies. We report the results of our recent work on calculation of electron impact ionization cross sections for Be and W atoms and their charged states [2-3]. The distorted wave approximation and binary encounter Bethe method have been used for the calculation of ionization cross sections.

There has also been interest of the researchers of the field to study the charged particle impact collision mechanism of Pb atoms following the discovery of an abundance of Pb atoms in stars [4] and interstellar gases. The heavier metal ion Cs^+ is not an essential element, but its role in biochemistry and physiology is well established; however, Cs^+ is toxic, but it has applications in green energy [5]. We report the results of our recent work based on calculations of electron and positron impact elastic scattering cross sections for Pb atoms in the energy range from 10 eV to 20000 eV [6] and for Cs^+ ion in the energy range 1 eV to 5 kev. The elastic cross sections are obtained in Dirac Partial-Wave analysis approach using optical-model potential for target and relativistic partial wave calculation for the projectile (electron & positron).

References:

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