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XXIX International Conference on Photonic, Electronic, and Atomic Collisions (ICPEAC2015) IOP Publishing
Journal of Physics: Conference Series **635** (2015) 022073 doi:10.1088/1742-6596/635/2/022073

Beryllium ionisation by ion impact

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Synopsis We study ionization of Beryllium atoms by ion impact with continuum distorted waves models. We calculate cross sections in the intermediate to high energy regime for state resolved and total ionization.

The knowledge of cross sections of atomic ionization and capture by charged particles plays a key role in the development of models for plasma dynamics in fusion reactors. Besides the constituents of the fuel, deuterium and tritium, and the byproducts of the reaction, alpha particles and neutrons, the plasma is contaminated by atomic species detached from the tokamak recipient. In this work we investigate the beryllium (Be) ionisation by ion impact, predicted to appear in ITER plasma since Be is the selected material for the walls [1].

From the theoretical point of view, Be ionisation presents several interesting features to be considered. The ground state has closed shells with zero angular momentum for the four electrons. This fact allows us to study the effect of the ground state by comparison between electron emission from $n = 1$ and $n = 2$ levels with the same angular symmetry.

In this work Doubly differential and total cross sections (DDCS) are calculated in the continuum-distorted-wave-eikonal-initial-state (CDW-EIS) approximation for ion-impact [2, 3].

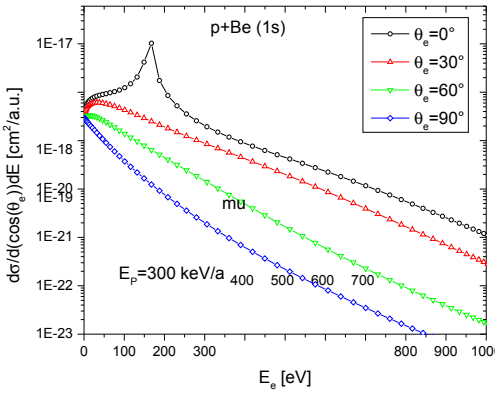

Figure 1. DDCS as a function ef the electron energy for single ionisation of Be(1s) by proton impact at 300 keV/amu for different emission angles.

The initial bounded and final electronic wave functions are obtained with the Optimized Potential Model (OPM) presented by Talman [4].

As an example, in Fig. 1 and 2 we present DDCS where we can observe the electron capture to the continuum (ECC) peak for emission at 0 degrees in both subshells ionisation. For higher emission angles this peak vanishes and for lower angles the 2s ground state displays a large binary peak, opposite to the case of 1s ground states. On the other hand, for 1s electrons the DDCS monotonically decreases with the emission angle, whereas for the 2s ground state the behaviour is very different. These observations will be discussed during the conference.

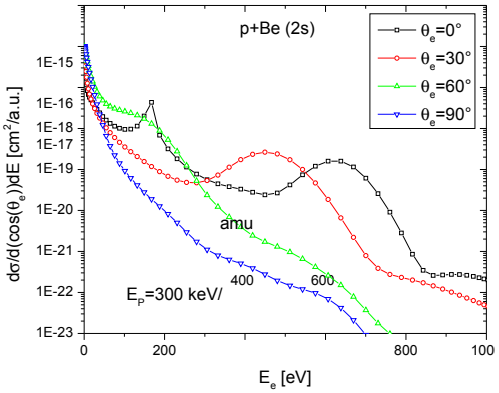

Figure 2. Same as Fig. 1, for Be(2s) ionization.

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