

# Cusp-electron production in collisions of open-shell $O^{6+}(1s2s)$ ions with He

S. Nanos<sup>1,2</sup>, N.J. Esponda<sup>3</sup>, P.-M. Hillenbrand<sup>4,5</sup>, A. Biniskos<sup>1</sup>, A. Laoutaris<sup>6,2</sup>, M.A. Quinto<sup>3</sup>,  
N. Petridis<sup>5</sup>, E. Menz<sup>5,7,8</sup>, T.J.M. Zouros<sup>6</sup>, Th. Stöhlker<sup>5,7,8</sup>, R.D. Rivarola<sup>3,9</sup>, J.M. Monti<sup>3,9</sup>  
and E.P. Benis<sup>1</sup>

<sup>1</sup>Department of Physics, University of Ioannina, GR-45110 Ioannina, Greece

<sup>2</sup>Tandem Accelerator Laboratory, INPP, NCSR "Demokritos", GR-15310 Ag. Paraskevi, Greece

<sup>3</sup>Instituto de Física Rosario (CONICET-UNR), Bv 27 de Febrero 210 bis, 2000 Rosario, Argentina

<sup>4</sup>I. Physikalisches Institut, Justus-Liebig-Universität, 35392 Giessen, Germany

<sup>5</sup>GSI Helmholtzzentrum für Schwerionenforschung, 64291 Darmstadt, Germany

<sup>6</sup>Department of Physics, University of Crete, GR-70013 Heraklion, Greece

<sup>7</sup>Institut für Optik und Quantenelektronik, Friedrich-Schiller-Universität, 07743 Jena, Germany

<sup>8</sup>Helmholtz-Institut Jena, 07743 Jena, Germany

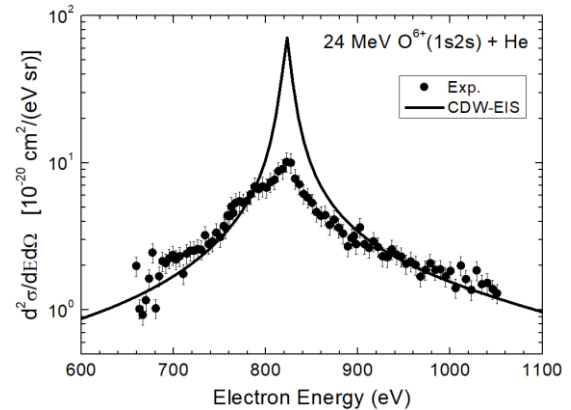
<sup>9</sup>Laboratorio de Colisiones Atómicas, FCEIA, IFIR, Universidad Nacional de Rosario, Avenida Pellegrini 250, Rosario 2000, Argentina

**Synopsis** We report on a combined experimental and theoretical study of cusp electrons emitted at zero degrees in 24-MeV collisions of open-shell  $O^{6+}(1s2s)$  projectiles with He targets. Theoretical cusp DDCS results, obtained within the CDW-EIS framework, are compared to the measurements, showing an overall good agreement. Details on the contributions of the ECC and ELC processes from the different ion cores are discussed.

Fast ion-atom collisions involving unpaired electrons have proven to be a powerful tool for studying subtle dynamic aspects of fundamental processes. In this report, we present a combined theoretical and experimental investigation on the processes of electron capture to the continuum (ECC) and electron loss to the continuum (ELC), for fast ion-atom collisions involving open-shell projectiles. Specifically, we studied the sharp cusp peak of the electrons emitted at zero degrees with respect to the projectile velocity, bearing the signatures of ECC and ELC, in collisions of 24-MeV pre-excited  $O^{6+}(1s2s)$  ions with He gas targets.

The experimental cusp DDCS electron spectra were obtained by applying our double measurement technique, involving a measurement with a mixed-state  $O^{6+}(1s^2, 1s2s)$  and a measurement with a ground state  $O^{6+}(1s^2)$  beam [1]. The measurements were conducted using an electrostatic single-stage hemispherical deflector spectrograph operating at the NCSR "Demokritos" 5.5 MV tandem accelerator laboratory [2]. The theoretical DDCS calculations were obtained within the continuum distorted-wave eikonal initial-state (CDW-EIS) framework [3]. A direct comparison between the DDCS of the CDW-EIS results and the measurements are

presented in figure 1, showing an overall good agreement [4]. Details on the contributions of the ECC and ELC processes from the different orbitals of the ion cores are discussed.



**Figure 1.** Theoretical and experimental DDCS of cusp electrons for collisions of 24-MeV open-shell  $O^{6+}(1s2s)$  ions with He gas targets.

## References

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\* E-mail: [s.nanos@uoi.gr](mailto:s.nanos@uoi.gr)