

Oscillations in the Auger energy distribution following atom impact with molecules

This article has been downloaded from IOPscience. Please scroll down to see the full text article.

2012 J. Phys.: Conf. Ser. 388 102009

(<http://iopscience.iop.org/1742-6596/388/10/102009>)

View [the table of contents for this issue](#), or go to the [journal homepage](#) for more

Download details:

IP Address: 181.1.214.180

The article was downloaded on 08/11/2012 at 01:21

Please note that [terms and conditions apply](#).

Oscillations in the Auger energy distribution following atom impact with molecules

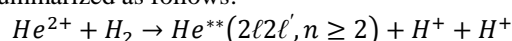
B. S. Frankland^{*1}, R. O. Barrachina^{†2}, J. Y. Chesnel^{*}, F. Frémont^{*3}

^{*}Centre de Recherche Ions les Matériaux et la Photonique (CIMAP) ; Unité Mixte CEA-CNRS-Ensicaen-Université de Basse-Normandie, 6 bd Maréchal Juin, F14050 Caen Cedex France

[†]Centro Atómico Bariloche and Instituto Balseiro (Comisión Nacional de Energía Atómica and Universidad Nacional de Cuyo), 8400 S.C. de Bariloche, Río Negro, Argentina

Synopsis In this report we will present a theoretical study of Auger deexcitation in the Coulomb field of another charged particle.

In 2004, a novel Young-type experiment was proposed and studied theoretically by Barrachina and Zitnik [1]. The collisional process can be summarized as follows:



where the outgoing autoionizing helium plays the role of the source of a single electron, while the two residual protons provide the double-center interferometer [2].

The angular distribution (open circles of Fig. 1) shows oscillations of the autoionization intensity at angles in the range 90°-170°. The theoretical interpretation of these results is not straightforward for several reasons. First, the autoionization process depends on the double capture process. In addition, autoionization is affected by the post-collisional interaction due to the presence of the protons, creating a distortion of the energy and angular distributions of the emitted electron.

The Final State Interaction (FSI), based on the decomposition of the continuum state of the emitted electron into an in-going continuum wave function and a distortion factor, allows a better incorporation of the post-collisional interaction than a perturbation treatment in quantum mechanics. Barrachina and Zitnik calculated the autoionization probability for the configuration $2s^2 \ ^1S$ by using a peaking approximation. Their results show that the autoionization intensity presents oscillations on the angular distribution.

However, the peaking approximation is valid in very limited cases. To go further, we improved the study by avoiding this approximation. In addition, the interferences between different Auger lines $2\ell 2\ell'$, were included as well as the interference between direct ionization and autoionization. Oscillations appear in the Auger profile due to the interferences between the Auger lines. The insertion

of direct ionization makes the oscillations much visible. Surprisingly, the expected oscillations due to Young interferences are absent in the angular distribution (full curve in Fig.1). Nevertheless, a Fast Fourier transform analysis reveals frequency structures corresponding to a period of $\sim 14^\circ$ that are not visible in the case of $He^{2+} + He$ collisions. The results will be discussed in details during the conference.

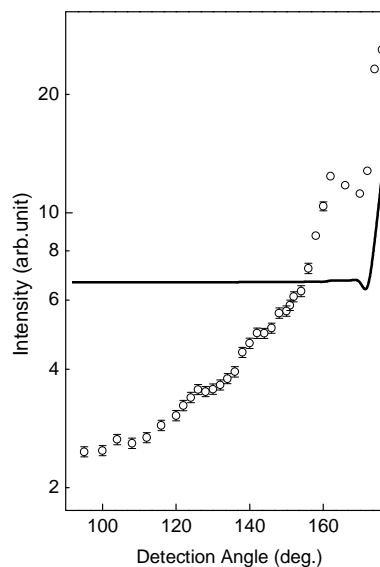


Figure 1. Total intensity for autoionization following double capture in 30 keV $He^{2+} + H_2$ collisions, as a function of the detection angle. The circles: the experimental result. The solid line: the theoretical result.

References

- [1] R. O. Barrachina, X. Zitnik 2004 J. Phys. B. **37** 3847
- [2] J. Y. Chesnel et al. 2007 Phys. Rev. Lett. **98** 100403, and references therein

¹E-mail : burcu.frankland@ensicaen.fr

²E-mail : barra@cab.cnea.gov.ar

³E-mail : francois.fremont@ensicaen.fr