EXPERIMENTAL EVIDENCE FOR YOUNG'S INTERFERENCE EFFECTS IN AUTOIONIZATION FOLLOWING 30 keV HE^{2+} + H_2 COLLISIONS

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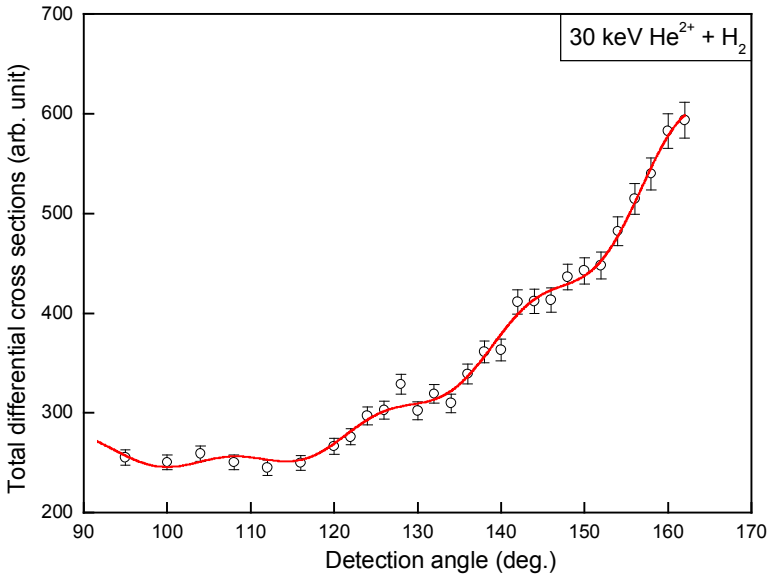
Recently, post-collision interaction effects produced on the autoionization effects of doubly excited states He** atoms in slow He^{2+} +H_2 collisions have been studied theoretically [1]. Oscillations could be evidenced in the angular distributions of the Auger electrons emitted by the projectile. These oscillations were attributed to Young's interference effects due to the interaction of the emitted electron and both H^+ target centres.



In the present work, emitted electrons following double capture in 30 keV He^{2+} +H_2 collisions have been analyzed at detection angles ranging from 90° up to 162°. From low-resolution electron spectra, differential cross sections $d\sigma_A/d\Omega$ for total Auger electron emission were determined. Figure 1 shows the results for $d\sigma_A/d\Omega$ as a function of the detection angle.

The cross section increase by a factor of about 2.5 when the detection angle increases from 90° to 160°. More important, the cross sections are found to oscillate. Four oscillations are clearly visible between 90° and 160°. To emphasize these oscillations, the cross sections are fitted by the sum of a second-order polynomial, and a Bessel function. The result of the fit is given in the present Figure (full curve). The period of the oscillations is ~17°, which is close to the value found theoretically [1]. The observation of oscillations suggests that the present experiment provides an unprecedented proof of the wave nature of the electron, by showing that a unique electron interferes with itself while passing a Young-like two centre system.

References

[1] R. O. Barrachina and M. Žitnik, J. Phys. B **37**, 3847 (2006).