A collision process leading to the emission of H^- ions

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In this work we observed H^- formation in collisions of 7-keV OH^+ projectiles with Ar atoms. The experiments were conducted at the ECR ion source of the ARIBE facility, at GANIL in Caen, France. Electrons and negative ions produced in the collision were at angles ranging from 2° to 150° with respect to the beam direction. The most remarkable feature of the spectra was the appearance of a well-defined peak [1]. This structure could not be attributed to electron emission. A kinematic analysis has shown that this peak is due to the emission of H^- ions moving with nearly the velocity of the OH^+ projectile ion. Moreover, we compared the measured cross sections with a classical two-body potential-scattering calculation.

Fig. 1 shows the measured cross sections for H^- emission in OH^+ + Ar collisions (open and solid circle symbols). A notable feature is that the H^- production cross section is proportional to the calculated H + Ar elastic scattering cross section. This fact can be explained by a two step process: (*i*) A large momentum transfer collision liberates a proton. (*ii*) The receding proton grabs two electrons in a double capture process with a practically observation-angle-independent probability. The agreement of the theoretical curve with earlier experimental data [2] for H^{2+}+Ar collisions at the same velocity (open square symbols in Fig. 1) supports this picture and its generalization. This process is likely to be of general relevance since it may take place in any collisions of H-containing molecules at few-keV energies [1].

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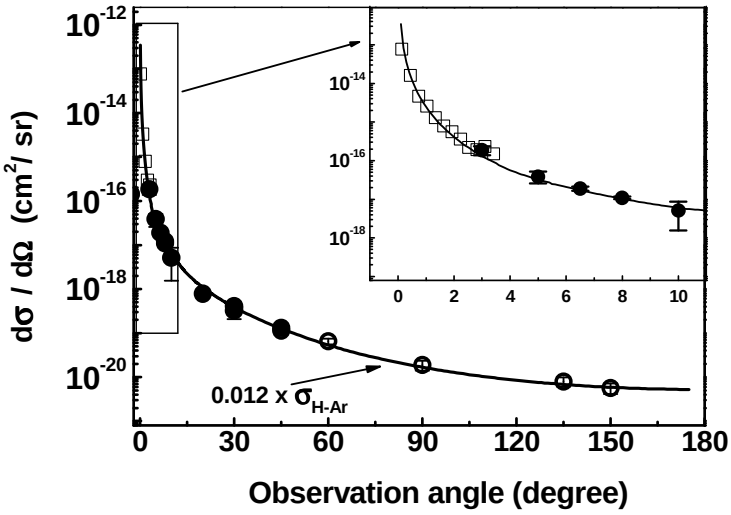

Figure 1. Measured cross sections for H^- ejection from the OH^+ projectile as a function of the observation angle for an Ar target. The curves represent 2-body elastic scattering cross sections multiplied by a factor of 0.012. Squares: data of Ref. [2] for H^{2+} impact on Ar.

References:

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