Dissociative Electron Attachment Cross Section in H_2 and D_2 at the 4 eV resonance

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The 4 eV resonance in electron-H_2 collision is in principle the simplest resonance in electron-molecule scattering. Due to its large width, the isotope effect in the dissociative electron attachment cross section is very large. So far there have been two quantitative measurements of the $\sigma(H^-/H_2)$ / $\sigma(D^-/D_2)$ ratio: Schulz and Asundi[1] measured the often quoted value of 200, more recently Čadež and co-workers [2] determined this ratio to be 325.

We have determined cross sections for dissociative electron attachment in H_2 and D_2 using a trochoidal electron monochromator in combination with an anion time-of-flight mass analyzer. The use of time-and-position sensitive delay-line detector for anion detection has enabled an efficient signal-background separation, which is crucial for measuring cross sections that are as low as in the present systems. We have examined only the cross sections at the 4 eV and 14 eV resonances, since in both energy ranges the DEA is a threshold process yielding slow fragments. The cross sections were calibrated against those of O^- from CO_2 and $HCOO^-$ from HCOOH.

For the 14 eV resonance the present energy-integrated cross sections (independent on electron energy resolution) are in very good agreement with recent measurements using the velocity-map imaging technique [3]. However, the isotope ratio of integrated cross sections in H_2 and D_2 at the 4 eV resonance is 800. The critical re-examination of previous experiments shows, that the difference with present results is to a large degree caused by an insufficient separation of background signals in those experiments.

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[1] G. J. Schulz and R. K. Asundi Phys. Rev. 158 (1967) 25

[2] I. Čadež et al. J. Phys. Conf. Ser. 133 (2008) 012029

[3] E. Krishnakumar et al Phys. Rev. Lett. 106 (2011) 243201