Dissociative Electron Attachment Cross Section in \( \text{H}_2 \) and \( \text{D}_2 \) 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 \( \sigma(\text{H}/\text{H}_2) / \sigma(\text{D}/\text{D}_2) \) 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 \( \text{H}_2 \) and \( \text{D}_2 \) 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 \( \text{O}^- \) from \( \text{CO}_2 \) and \( \text{HCOO}^- \) from \( \text{HCOOH} \).

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 \( \text{H}_2 \) and \( \text{D}_2 \) 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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