

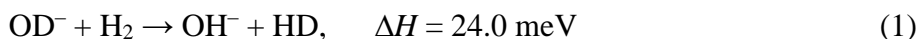
# Reactions of OD<sup>−</sup> with para-enriched H<sub>2</sub> at low temperatures

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Ion-molecular reactions play an important role in natural and technological plasmas including plasmas in interstellar space. In our laboratory we study ion-molecular reactions at temperatures from 10 K to 300 K using the 22-pole ion trap.<sup>1,2</sup> The recent discovery of negative ions in interstellar space triggered intensive studies of anions<sup>3</sup> and their reactions with molecules at astrophysically relevant conditions. We have measured several reactions of anions, including the reaction of OD<sup>−</sup> with molecular hydrogen<sup>4</sup>:



The results of our experiments (see Figure 1) affirm endothermicity of the reaction (1). Molecular hydrogen exists in two nuclear spin isomer forms, parahydrogen (p-H<sub>2</sub>) and orthohydrogen (o-H<sub>2</sub>). The endothermicity of the reaction (1) is comparable with the difference of energies of lowest states of p-H<sub>2</sub> and o-H<sub>2</sub>, that is why strong dependence of the reaction rate coefficient on the para to ortho ratio ([p-H<sub>2</sub>]/[o-H<sub>2</sub>]) can be expected.<sup>4</sup> In our previous experiments the reaction (1) has been studied with normal hydrogen with the para to ortho ratio 1:3. To study this reaction with para-enriched hydrogen we will use the para-hydrogen generator, which produces almost pure p-H<sub>2</sub> (99.5 %).<sup>5</sup> This state selected study can help with better understanding of the reaction mechanism and comparison with theoretical predictions.

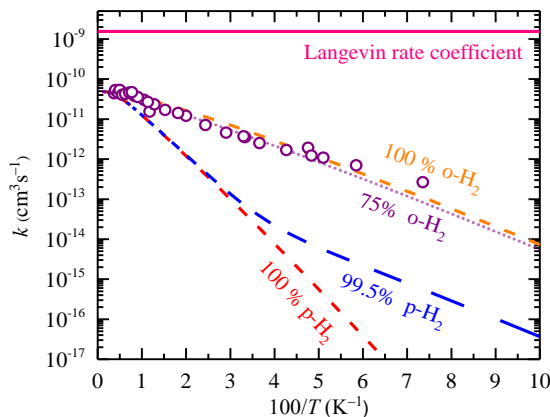


Figure 1. Measured temperature dependence on the reaction rate coefficient of the reaction OD<sup>−</sup> + H<sub>2</sub> (circles), their fit (dotted line) and theoretical predictions which are based on results of the fit (dashed lines). Measurement has an accuracy about 20 %. Also the calculated reaction rate coefficient of the reaction with pure p-H<sub>2</sub> and the expected dependence measured with hydrogen containing 99.5% of p-H<sub>2</sub> are indicated. Note that small concentration of o-H<sub>2</sub> in the mixture influences the reaction rate coefficient mainly at low temperature.

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## References

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