

Institutsseminar

Hydrogen Tunneling Reaction: Probing Fundamental Physics in Interstellar Conditions

Dr. Robert Wild

Institut für Ionenphysik und Angewandte Physik
Universität Innsbruck - Austria

The cold and dilute conditions of the interstellar medium preclude many neutral chemical reactions, and ion chemistry is required to explain the observed chemical complexity. Much of cold ion chemistry must still be explored both theoretically and experimentally in order to understand the chemical networks in diffuse molecular clouds, and hydrogen plays an important role in this search due to its abundance in the ISM and its accessibility for theoretical calculations.

In this seminar, some of our recent work on astrochemical experiments in a 22-pole cryogenic radiofrequency ion trap will be presented. The focus will be on the reaction of the deuterium anion with molecular hydrogen: $D^- + H_2 \rightarrow H^- + HD$. This reaction occurs via tunneling through a reaction barrier, and the reaction could serve as a benchmark process for quantum tunneling at low temperatures. We have previously published an upper limit to this reaction rate as well as theory predictions [1,2]. Recent experimental improvements have led to a significant increase in sensitivity, and our newest results will be presented.

[1] E. S. Endres, O. Lakhmanskaya, M. Simpson, S. Spieler, R. Wester, Phys. Rev. A 95, 022706 (2017)

[2] C. H. Yuen, M. Ayouz, E. S. Endres, O. Lakhmanskaya, R. Wester, V. Kokoouline, Phys. Rev. A 97, 022705, (2018)

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