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【441】 Measurement of the quantum tunneling reaction $\text{H}^2 + \text{D}^- \rightarrow \text{HD} + \text{H}^-$

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Quantum tunneling reactions can play a significant role in chemistry, and hydrogenic systems allow for first-principles calculations. The rate of the tunneling reaction $\text{H}^2 + \text{D}^- \rightarrow \text{HD} + \text{H}^-$, for which the collision complex is closely related to the H_3^- anion, has been calculated but has lacked verification. Here we present high-sensitivity measurements of the reaction rate carried out in a cryogenic 22-pole ion trap. We model the effect of a high-energy tail in the velocity distribution to investigate its influence on the reaction rate. Our measured value agrees with quantum tunneling calculations, serving as a benchmark for molecular theory.

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