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TRIMS: Testing Molecular Effects in Tritium Beta Decay

The beta decay of molecular tritium (T_2) allows sensitive, kinematic probes of the neutrino mass scale, but analysis of the beta spectrum must account for electronic, vibrational and rotational excitations of the final-state molecule. While the final-state spectrum cannot be measured directly, experiments can access the probability that the daughter molecule dissociates following beta decay. Precise theoretical calculations are discordant with historical measurements of this probability. We present results from the Tritium Recoil Ion Mass Spectrometer (TRIMS), a novel time-of-flight mass spectrometer designed to avoid known and suspected biases in the earlier measurements. Our measurements of beta decay in T_2 and HT agree closely with theoretical expectations, supporting the spectral analysis presently used by the KATRIN and Project 8 neutrino-mass experiments. This work has been supported by the US DOE Office of Science, Nuclear Physics.

Mini-abstract

TRIMS experiment measures ions from beta decay in HT and T_2 molecules, results support theory.

Experiment/Collaboration

TRIMS

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