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# Microwave trapping of cold $NH_3$ molecules

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**Abstract**

In this experimental study, the trapping of the translational motion of a supersonic beam of polar ammonia ($NH_3$) molecules in the rotational ground state (J = 0) of the para species using a microwave field is demonstrated. A cold beam of ammonia molecules seeded in argon gas passes through a superconducting Fabry–Perot resonator, where a standing-wave microwave field in the $TEM_{02}$ transverse mode is generated near the molecular transition frequency of 23.7 GHz. The mixed gas trapped at the center of the vacuum chamber is cooled to a temperature of 2.3 mK and ionized using the Resonance-Enhanced Multiphoton Ionization (REMPI) technique with the 16101 $cm^{-1}$ line of a Rhodamine dye laser. The emission spectrum is then recorded with the microwave field switched on and off. The change in the angular momentum of the polar ammonia molecule without the required excitation energy being supplied indicates a quantum tunneling effect induced by the Stark shift. This article presents the first report of the experimental results of this research conducted at the University of British Columbia.

**Keywords:** Microwave trapping, Superconducting cavity, Tunneling, Stark shift, Cold molecules.

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