BOUND-BOUND AND BOUND-FREE SPECTROSCOPY OF COLD TRAPPED NEGATIVE IONS

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Cryogenic radiofrequency ion traps are a versatile tool to prepare molecular ions at cold translational as well as rovibrational temperatures [1,2]. For negative ions, electron affinities and internal state populations can then be studied using photodetachment spectroscopy near threshold. We have used this approach to investigate rotational cooling of OH^- anions [34] and to determine the electron affinities of CN, C_3N, and C_2 with better accuracies [5,6,7]. In the case of C_3N^- this provided evidence for a dipole-bound state just below threshold, in good agreement with theoretical calculations. Furthermore, we have studied high-resolution bound-bound spectroscopy of a vibrational overtone in OH^- [8] and an electronic transition in C_2^- [9], which provided direct access to the translational velocity distributions of the ions. Recently, we have also observed the fluorescence from the excited B-state in C_2^-, mediated by vibrational quenching collisions [10].

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