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Blackbody thermometry with quantum state control of trapped SiO^+ [1] SRUTHI VENKATARAMANABABU, PATRICK STOLLENWERK, IVAN ANTONOV, BRIAN ODOM, Northwestern University — Despite the complex internal structure of molecules, we have demonstrated a technique based on spectral pulse-shaping with a broadband laser to arbitrarily populate a narrow distribution of rotational states (upto N 65) in the ground electronic state of SiO^+. We use a 1-photon resonance enhanced dissociation via a $\prod$ state that is sufficiently long-lived to resolve rotational transitions in SiO^+. For precision measurements of frequency using ion traps, measuring the blackbody radiation (BBR) is critical and in-situ trapped ion BBR thermometer is a promising solution. The combined ability to cool and carry out state readout opens the possibility of using rotational transitions in trapped molecular ions for BBR thermometry. In the first use of trapped molecules as a BBR thermometer [1], the molecular ions were allowed to equilibrate with the black body field. However, with our ability to prepare the sample in rotational states of our choice, we can probe the different spectral components of the blackbody field and thus create a spectral map for the BBR field. As a first step towards this goal, we are in the process of studying population dynamics and time scales for population distribution using single photon dissociation. I will discuss results from this work and possible techniques for black-body thermometry with our system. 1. Koelemeij, J.C.J., et.al. Phys. Rev. A 76, 23413. doi:10.1103/PhysRevA.76.023413

[1] Office of Naval Research, NSF

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