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Toward internal cooling of trapped molecular ions using a spin-orbit split ground state V. RAJAGOPAL, J.P. MARLER, L.C. RUTH, C.M SECK, B.C. ODOM, Northwestern University — Preparation of state-selected trapped molecular ensembles is a promising starting point for precision measurements on trapped molecular samples. Translational cooling of trapped molecular ions can be accomplished sympathetically by laser cooling a co-trapped atomic species. To date, in situ cooling of rotational degrees of freedom has been demonstrated only for polar hydrides, by optical pumping into an excited vibrational level. However, with increasing reduced mass, the time for vibrational relaxation within the ground state increases, making this scheme problematic for heavy species. We introduce a new cooling scheme, exploiting the diagonal Franck-Condon factors present for molecular ions with spin-orbit split ground states, applicable to certain heavy as well as non-polar species. Progress towards the experimental realization of this scheme for cooling IF$ˆ+$, including the molecular ion production technique, details of the state-preparation, and the proposed state-resolved detection scheme will be discussed.

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