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Multiply charged ionic crystals for nuclear laser spectroscopy COREY J. CAMPBELL, ADAM V. STEELE, LAYNE R. CHURCHILL, MICHAEL V. DEPALATIS, DAVE E. NAYLOR, Georgia Institute of Technology, DZMITRY N. MATSUKEVICH, University of Maryland, MICHAEL S. CHAPMAN, ALEX KUZMICH, Georgia Institute of Technology — Coherent excitation of the electronic states of atoms and molecules with lasers is at the heart of modern spectroscopy and metrology. To extend these techniques to nuclear states would be a tremendous advance. However, the typical excitation energies for nuclear matter are in the keV to MeV energy range, where coherent radiation sources are lacking. In the remarkable case of the ^{229}Th nucleus, the energy splitting of the ground state doublet is only several eV [1], which may be within the reach of coherent table-top UV lasers. We have produced laser-cooled crystals of the more abundant $^{232}Th^{3+}$ in an rf Paul trap. This is the first time that a multiply charged ion has been laser cooled. Our work opens an avenue for excitation of the nuclear transition in a trapped, cold $^{229}Th^{3+}$ ion. Laser excitation of nuclear states would establish a new bridge between atomic and nuclear physics, with the promise of new levels of metrological precision. [1] Kroger, L. A. & Reich, C. W. Features of Low-Energy Level Scheme of Th-229 as Observed in Alpha-Decay of U-233. *Nucl Phys A* **259**, 29 (1976).

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