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An Electron Microscope for Viewing a Deformed Nucleus[1]
THOMAS DELLAERT, PATRICK MCMILLIN, University of California, Los Angeles, ANTHONY RANSFORD, Honeywell Quantum Solutions, CONRAD ROMAN, WESLEY CAMPBELL, University of California, Los Angeles — The metastable $^2F_{7/2}$ state is predicted to be sensitive to the structure of the deformed ytterbium-173 nucleus in two ways. First, the high multiplicity of the electronic state ($J = 7/2$) allows the high spin ($I = 5/2$) nucleus to leave fingerprints of its multipole moments on the hyperfine structure, up to and including (at least in principle) the nuclear magnetic 32-pole moment. Using the fact that the F state is both long-lived and easily read out using techniques developed for quantum information processing, we are performing the first spectroscopy of this hyperfine structure. Second, the electric quadrupole hyperfine interaction in $^{173}Yb^+$ has been predicted to quench 4 of the 6 hyperfine levels of the $^2F_{7/2}$ state from the 5-year lifetime of the other isotopes to the clock-friendly timescale of about 1 day. We will present prospects for achieving sub-Hz accuracy of the hyperfine splittings and lifetime measurements of the quenched hyperfine levels of $^{173}Yb^+$ and their implications for clockwork and electron microscopy of the shape of a nucleus.

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