RADIUM-225: THE PATH TO A NEXT GENERATION ELECTRIC DIPOLE MOMENT MEASUREMENT*

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Permanent electric dipole moments (EDMs) in atoms or molecules are signatures of Time (T)-and Parity (P)-violation and represent an important window onto physics beyond the Standard Model. In the nuclear sector, the strongest limits have been set by cell measurements which restrict the EDM of Hg-199 to $< 2.1 \times 10^{-28} e$ cm. A promising avenue for extending these searches is to take advantage of the large enhancements in the atomic EDM predicted for octupole-deformed nuclei. One such case is Ra-225, which is predicted to be two to three orders of magnitude more sensitive to T-violating interactions than Hg-199. Ra-225 is spin-1/2, has a relatively long half-life ($t_{1/2} = 15$ d), and is available from the decay of Th-229.

We are developing a next generation EDM search around laser-cooled and trapped Ra-225. We will discuss our progress, including the successful laser cooling and trapping of Ra-225 and Ra-226 atoms. Using the $^1S_0$ - $^3P_1$ transition at 714 nm, we have demonstrated transverse cooling, Zeeman slowing, and capturing of Ra-225 and Ra-226 atoms in a magneto-optical trap (MOT). The primary loss mechanism for our atoms is decay out of the $^3P_1$ state into the dark $^3D_1$ state. By repumping the $^3D_1$ dark state to the $^1P_1$ state (1429 nm), which decays back to ground $^1S_0$ state, we have extended the lifetime of the trap from milliseconds to seconds. We have measured many of the transition frequencies, lifetimes, hyperfine splittings and isotope shifts of the critical transitions. We will discuss the planned measurement, including the measurement scheme and the expected sensitivity.

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