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First Measurement of the Permanent Electric Dipole Moment of Radium-225

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Electric dipole moments (EDMs) are signatures of time-reversal (T), parity (P) & charge-parity (CP) violation. CP-violation beyond the Standard Model is generally believed to be required to explain the observed prevalence of matter over antimatter in the universe. Radium-225 ($T_{1/2}$ = 14.7 d, I = 1/2) is mostly sensitive to T- & P-violating interactions originating within the nucleus. The best limits on these types of exotic interactions are derived from the atomic EDM limit for Mercury-199. Because of its unusual nuclear structure (octupole deformation), Ra-225 is expected to have a physics sensitivity that is a few hundred to a few thousand times higher than Hg-199. Laser cooling & trapping techniques are performed to collect & transport the cold Ra atoms into the measurement region. An EDM measurement is then performed by searching for a linear electric field dependent shift in the nuclear spin precession frequency of Ra-225. We will report on the first measurement of the atomic EDM of Ra-225 as well as plans for future improvements. This work is supported by U.S. DOE, Office of Science, Office of Nuclear Physics, under contract DE-AC02-06CH11357.

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