Contribution ID: **51** Type: **Invited Oral**

Laser-Cooling Cadmium with only Triplet Excitations and Cadmium Isotope Shift Measurements

Tuesday 17 October 2023 15:00 (30 minutes)

Cadmium is attractive for optical lattice clocks and for searches for Dark Matter and beyond-Standard-Model physics via isotope shift measurements. The cadmium clock transition has a small sensitivity to blackbody radiation and it has 8 stable isotopes, 6 spin 0 bosonic isotopes, and 2 spin ½ fermionic isotopes. Without using 229 nm light to drive the singlet transition, we capture thermal Cd atoms directly into a 326 nm narrow-line MOT. We then increase the loading rate by capturing atoms using the 361 nm $^3P_2 \rightarrow {}^3D_3$ transition. We measure the isotope shifts of the 326 nm intercombination transition, and the 480 nm $^3P_1 \rightarrow {}^3S_1$ and $^3P_2 \rightarrow {}^3D_3$ transitions. These clarify a discrepancy of the nuclear charge radius and suggest that cadmium isotope shifts can sensitively test beyond standard model physics.

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Session Classification: Precision Measurements and Fundamental Physics II

Track Classification: Precision Tests on Fundamental Physics