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Three-Photon EITA for Observing the $^1S_0 \rightarrow {}^3P_0$ Clock Transition in Atomic Yb AMAR ANDALKAR, ERYN COOK, TAO HONG, ANNA MARKHOTOK, WARREN NAGOURNEY, NORVAL FORTSON, University of Washington — Recent experiments have observed the $^1S_0 \rightarrow {}^3P_0$ clock transition in odd isotopes of atomic Yb, where the transition is weakly allowed through internal hyperfine coupling. We report on progress towards an observation of this transition in the even isotopes, which offer the advantage of a narrower clock transition in which the energy interval is not affected by external magnetic fields or light polarization. While the single-photon transition is strictly forbidden in this case, three-photon electromagnetically induced transparency and absorption (EITA) can be used to produce a sharp resonance line. With this method, the width and rate of the clock transition can, in principle, be continuously adjusted from the MHz level to sub-mHz without loss of signal amplitude by varying the intensities of the three light fields. Doppler and recoil effects can be eliminated by proper alignment of the three optical beams. Theoretical calculations have shown that sharp Doppler-free EITA features can be expected on the three-photon clock transition and also on a simpler three-photon scheme using the $^1S_0 \rightarrow {}^1P_1$ (399 nm) and $^1S_0 \rightarrow {}^3P_1$ (556 nm) transitions. Experimental work is underway to test this arrangement, with eventual application to the clock transition via the 556 nm, 680 nm, and 649 nm transitions involving the $^1S_0$, $^3P_1$, $^3S_1$, and $^3P_0$ states.

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