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Atomic clocks based on extened-cavity diode laser in multimode operation SIN HYUK YIM, D. CHO, Korea University — We demonstrated the possibilities to develope an atomic clock based on coherent population trapping(CPT) without using a local oscillator and a modulator. Instead of using a modulator, we use two modes from a single extended-cavity diode laser in multimode operation. Two different types of feedback system are applied to stabilize a difference frequency between the two modes and eliminate the need for an extra frequency modulation. In the first type, we employ an electronic feedback using dispersion of the CPT resonance as an error signal. The two modes are phase locked with reference to a dispersion signal from a CPT resonance of ^{85}Rb at 3.036 GHz ground hyperfine splitting. We use D1 transition at 794.8 nm with lin$\perp$lin polarizations to obtain large-contrast CPT signal. Allan deviation of the beat frequency between the two modes is 1×10^{-10} at 200-s integration time. In the second type, we employ optoelectronic feedback to construct an opto-electronic oscillator(OEO). In an OEO, the beating signal between two modes is recovered by a fast photodiode, and its output is amplified and fed back to the laser diode by using a direct modulation of an injection current. When the OEO loop is closed, oscillation frequency depends on variations of the loop length. In order to stabilize an OEO loop length and thereby its oscillation frequency, CPT cell is inserted to play a role of microwave band pass filter. Allan deviation of the CPT-stabilized OEO is 2×10^{-10} at 100-s integration time.

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