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Miniaturized Optical Clock using Rb Two-Photon Transition

We introduce our research in developing a miniaturized optical clock at KRISS using 87Rb two-photon 5S1/2 to 5D5/2 transition in a chip-scale vapor cell. This transition provides a narrow spectral linewidth with potential applications in deployable optical clocks. We obtain a resonance spectrum of the two-photon transition with a chip-scale rubidium vapor cell with a size of 4×7×2.6 mm. The chip cell is made by 5-layer-wafer bonding procedure for longer interaction lengths with the atoms. The wafer is dichroic-coated to reflect 778.1 nm while transmitting the fluorescence signal of 420 nm. The spectral signal is used for locking the laser frequency. The error signal is processed by a
FPGA and is fed into the driving current of laser to construct a frequency servo. Preliminary stability without optimization shows 2×10ˆ-11@1 s and is expected to be improved in the future. By further miniaturizing the two-photon spectroscopy apparatus, we plan to develop a mobile optical frequency synthesizer platform combined with microcomb and photonic pre-stabilization technique for field applications.

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