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Progress Towards a $^{40}Ca^+$ Optical Clock with a Fractional Uncertainty at the E-18 Level[1] HUA GUAN, YAO HUANG, KELIN GAO, Wuhan Institute of Physics and Mathematics of Chinese Academy of Sciences, ION TRAP TEAM — As its simplicity on the laser system, $^{40}Ca^+$ optical clock can be made a low-cost, compact, and robust optical clock. We built two $^{40}Ca^+$ optical clocks in WIPM. Based upon the comparison of two $^{40}Ca^+$ optical clocks, the frequency difference was measured to be 3.2E-17 with uncertainty of 5.5 E-17. And a fractional stability of 7 E-17 in 20,000 s of averaging time is achieved. (*Y. Huang et al., Phys. Rev. Lett.116, 013001 (2016)*). In order to reduce the BBR effect caused by the differential static scalar polarizability $\Delta\alpha_0$, we measured $\Delta\alpha_0$ with high precision by the comparison of two clocks. And result is -7.2653(44) $*10^{40}$ J m^2/V^2, 19 times better compared to the best atomic structure calculation. The contribution of the blackbody shift coefficient to the uncertainty of the optical clock at room temperature has been reduced to the E$-$19 level, the excess micromotion induced clock uncertainty is also reduced to the E$-$19 level by choosing the *magic* trap drive frequency. With the above improvements made, the total clock uncertainty is reduced to 2.2 E-17, limited by the BBR field evaluation like most of the state-of-art ion or neutral atom optical clocks.

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