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Progress in the miniature trapped ion optical clock development with 16 cc sealed trap tube

At 3x10ˆ(-13)/tˆ(1/2) and a stability floor at 10ˆ(-15) level, JPL's Deep Space Atomic Clock (DSAC) is the state-of-the-art (SOA) microwave clock of its size, close to the size constraints in deep space applications [1]. To reach frequency stability beyond that of DSAC in a similar size, one will have to take the new approach of the optical clock where the clock ticking rate is at hundreds of terahertz rather than tens of GHz. The high oscillation frequency enables the clock stability and accuracy significantly exceed what today's microwave clocks can achieve, pushing 1x10-17 accuracy and beyond [2]. The challenge is to take advantage of the optical clock performance capability in a small enough size and power to be deployed in deep space platforms. The miniature Space Optical Clock (mSOC) program focuses on studies and development efforts in reducing the size and power of an optical clock while still outperforming any microwave clocks of similar size today by an order of magnitude in all time scales. Specifically, our objective is to develop and demonstrate an mSOC concept that will have 1x10ˆ{-14}/t1ˆ{2} frequency stability with a stability floor <1x10-16.

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