Abstract Submitted
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Benchmarking a Trapped-Ion Quantum Memory with a Cryogenic Sapphire Oscillator[1] TING REI TAN, CLAIRE EDMUNDS, ALISTAIR MILNE, CORNELIUS HEMPEL, MICHAEL BIERCUK, Univ of Sydney, QUANTUM RESEARCH LABORATORY TEAM — Individual qubits encoded in the hyperfine ground states of trapped ions can be a robust quantum memory [1]. Their coherence, however, is not just limited by the atomic system, but rather by the phase noise of the reference local oscillator [2] used to generate the control fields. Upconversion by a factor of N from a reference at 10 MHz to the qubit frequency at several GHz leads to multiplicative phase noise of 20 $\log_{10}(N)$ dB, reducing achievable fidelities. Local oscillators at GHz frequencies provide a way to circumvent this problem. Here, we report progress on the benchmarking of an ytterbium ion qubit at 12.6 GHz using a 10.6 GHz cryogenic sapphire oscillator [3] as a reference clock.
Citation: [1] M. Sepiol, et al. Probing Qubit Memory Errors at the Part-per-Million Level. Physical Review Letters 123(11), 110503 (2019). [2] H. Ball, et al. The role of master clock stability in quantum information processing npj Quantum Information 2(1), 16033 (2016). [3] N. Nand, et al. Ultra-Stable Very-Low Phase-Noise Signal Source for Very Long Baseline Interferometry Using a Cryocooled Sapphire Oscillator. IEEE Transactions on Microwave Theory and Techniques 59(11), 2978-2986 (2011).

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