

Abstract Submitted  
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**Progress towards spectroscopy of forbidden vibrational overtones in  $\text{O}_2^+$** <sup>1</sup> ANNIKA LUNSTAD, JULIA PFATTEICHER, DAVID HANNEKE, Amherst College — The rich internal degrees of freedom of molecules provide opportunities such as tests of basic physics, precision timekeeping, and searches for new physics. For example, the vibrational overtones of  $\text{O}_2^+$  have intrinsically narrow linewidths and are naturally immune to many systematic effects. They could form the basis for optical clocks or probes of variation of fundamental constants. The transitions are electric-dipole forbidden, but can be driven with two photons. We report on progress towards measuring overtone frequencies and reducing their uncertainties from the current level of many gigahertz. Our efforts include state production by photoionizing from a cold, pulsed beam of neutral molecules as well as state detection by photodissociation and time-of-flight mass spectrometry.

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