

Abstract Submitted  
for the DAMOP19 Meeting of  
The American Physical Society

**Molecules Functionalized with Optical Cycling Centers**

CHANGLING ZHAO, SEEJIA YU, Department of Physics and Astronomy, University of California Los Angeles, ASHLEY SHIN, Department of Chemistry and Biochemistry, University of California Los Angeles, XUEPING LONG, Department of Physics and Astronomy, University of California Los Angeles, TIMOTHY ATALLAH, JUSTIN CARAM, Department of Chemistry and Biochemistry, University of California Los Angeles, WESLEY CAMPBELL, Department of Physics and Astronomy, University of California Los Angeles — Repeatable, state-selective optical transitions are widely used for state preparation and measurement of qubits hosted by trapped atoms. Due to the vibrational structure that is introduced when trying to apply this technique to molecules, optical cycling is typically unavailable. Inspired by the recent experimental demonstrations on laser cooling of polyatomic molecules that contain an Optical Cycling Center (OCC) in the form of a bonded alkaline earth atom [?, ?, ?], we propose building a candidate quantum system consisting of assembled monovalent molecules of alkaline-earth (AE)-oxide that are bonded to a surface. These surface-bonded molecules will be functionalized with alkaline earth OCCs to endow them with the ability for fast and high-fidelity qubit operations and *in-situ* coherent transport of quantum information. We report our current progress on synthesizing molecules with OCCs, and observing and characterizing their spectroscopic properties.

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Date submitted: 03 Feb 2019

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