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Progress towards Cold Molecule Synthesis and Single Molecule Detection with a Micro-resonator[1] MING ZHU, TZU-HAN CHANG, CHEN-LUNG HUNG, Purdue University — Ultracold molecules have wide applications in ultracold chemistry, quantum computation and quantum many-body physics. Photoassociation (PA) is a powerful approach to the assembly of molecules from cold atoms into their deeply bound molecular states, even the rovibrational ground state. However, traditional ways to determine molecular state such as resonance enhanced multiphoton ionization method require large number of molecules to be tested. To detect the final state of PA-assembled molecules, we propose to make use of a high-Q micro-resonator supporting a whispering gallery mode to achieve state-sensitive detection of molecules. Although it is difficult to find a close cycle in the complex energy structure of a molecule, the weak photon signal could be detected via the high-cooperativity coupling of a molecule to a micro-resonator, which prolongs the interaction time by way of modifying photon mode density in resonator. Here, we discuss an apparatus for cold molecule assembly and present theoretical simulation on single molecule detection with a microcavity.

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Ming Zhu
Purdue Univ

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