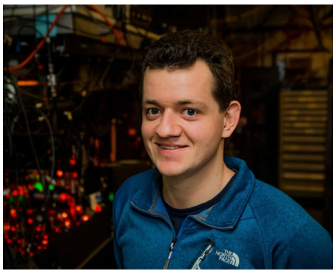
Fundamental Quantum Science Program
Seminar series No.1

●Date & Time : **Thursday 18th April 2024 10:00-11:00**
●Venue : Room309, Frontier Research Laboratory

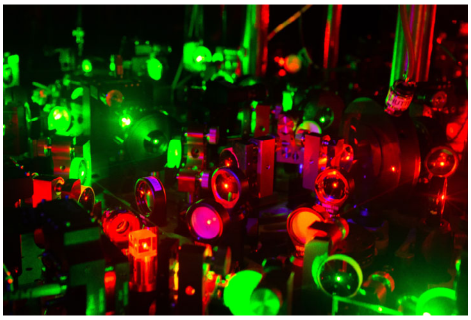
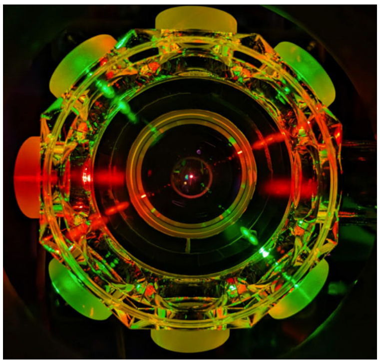
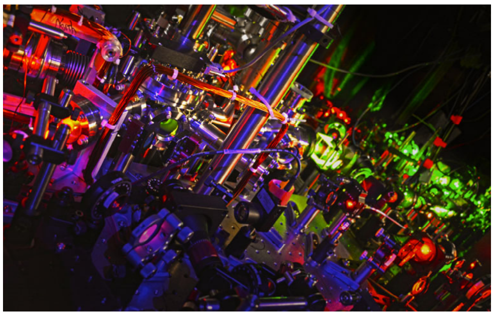


Dr. Loic Anderegg

HARVARD UNIVERSITY
Dolye Group

" Laser Cooled Molecules for Quantum Science and Fundamental Physics"

Ultracold molecules offer a diverse array of potential applications ranging from fundamental physics to quantum simulation and computation. Motivated by potential discoveries in these areas, significant advances in controlling molecules at the single-quantum-state level have occurred over the past decade. Recently, molecules have been loaded into optical tweezer arrays allowing both high-fidelity readout and quantum control of individual molecules. In this talk, we will discuss creating and employing optical tweezer arrays of diatomic (CaF) and polyatomic (CaOH) molecules to unlock new quantum science applications. We demonstrate second scale coherence times for molecular qubits in optical tweezer traps, parametrizing the potential performance of polar-molecule-based quantum simulators or computers. Additionally, we show progress towards realizing the goal of high-fidelity molecular qubits by demonstrating dipolar interactions and entanglement between molecules. The full quantum state control afforded by this platform allows us to study quantum state specific collisions and control the dynamics of the molecular collisions. Finally, extending the tools of quantum control to polyatomic molecules leads to powerful new scientific avenues, including significant improvements to searches for physics beyond the Standard Model. We demonstrate the experimental protocols needed for such a search and leverage the structural characteristics of polyatomic molecules to extend coherence times, paving the way towards orders-of-magnitude improved experimental sensitivity to time-reversal-violating physics.

・Hosted by : Dr. Naoto Nagaosa
(Fundamental Quantum Science Program)