

Physics Colloquium

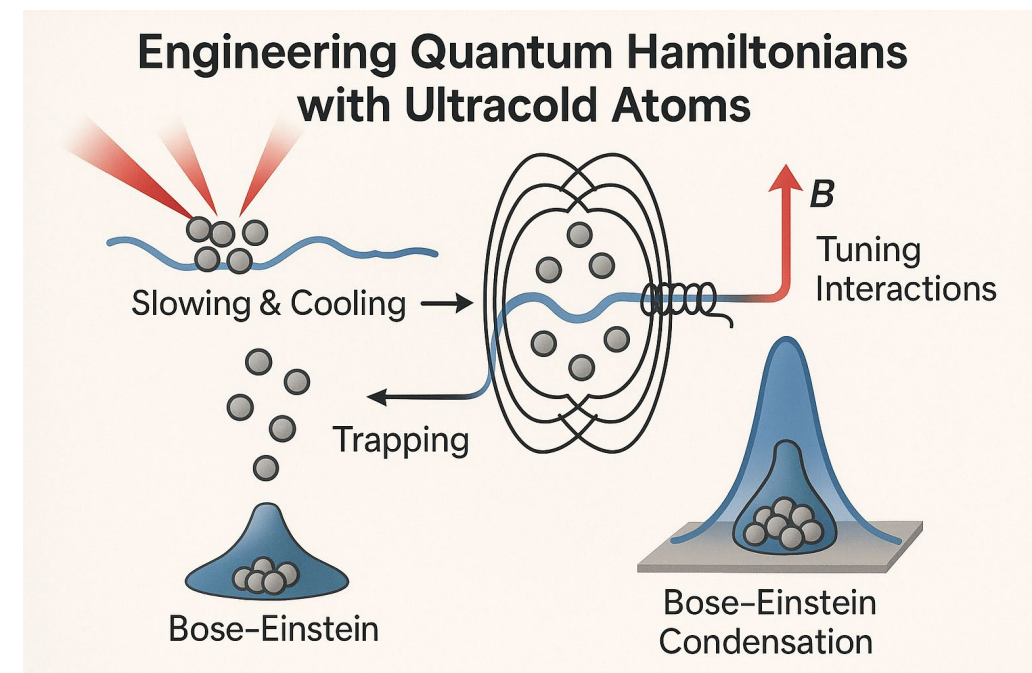
Dr. Ettore Vitali, California State University, Fresno

Engineering Quantum Hamiltonians with Ultracold Atoms

ABSTRACT

In the last two decades, ultracold atomic gases have become a uniquely versatile platform for exploring quantum many-body physics. By combining laser cooling, magnetic and optical trapping, and precise control of interatomic interactions, we can now create dilute quantum systems whose behavior is governed by simple, tunable Hamiltonians.

In this talk, I will introduce the key physical ideas behind this control: how light and magnetic fields are used to slow and trap atoms to microkelvin and nanokelvin temperatures, and how interactions between atoms can be tuned using magnetic Feshbach resonances. These techniques allow us to move seamlessly from classical gases to strongly interacting quantum matter, providing a clean laboratory for phenomena ranging from Bose–Einstein condensation to correlated Fermi systems.



3:00-4:00 p.m., Friday, November 21st, 2025

In-person in McLane Hall 162