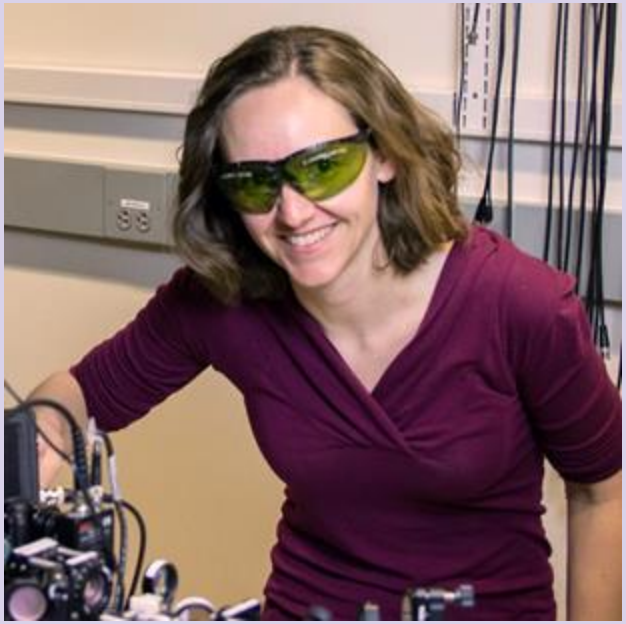
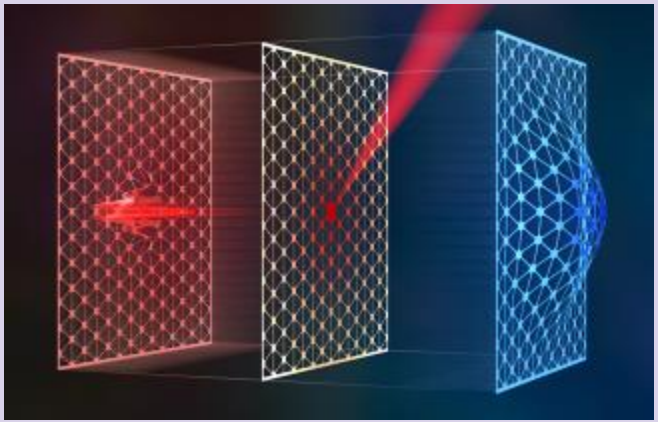
Cindy Regal is an American experimental physicist known for her work in **ultracold fermionic condensates** and **quantum optics**. She is an associate professor of physics at the University of Colorado, and a fellow of the Joint Institute for Laboratory Astrophysics. In her own words she aims “to engineer and explore new quantum systems with controlled connections for **quantum information** and **quantum optics**”

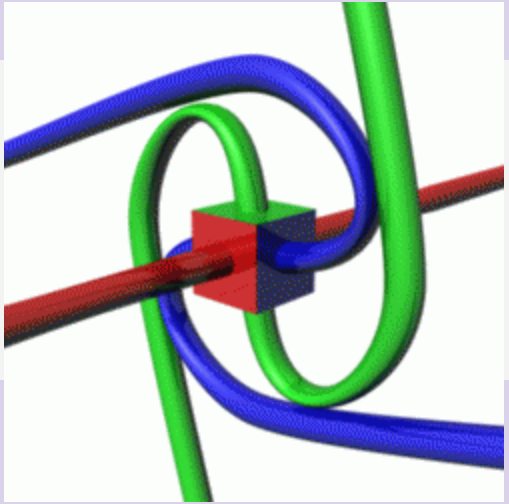


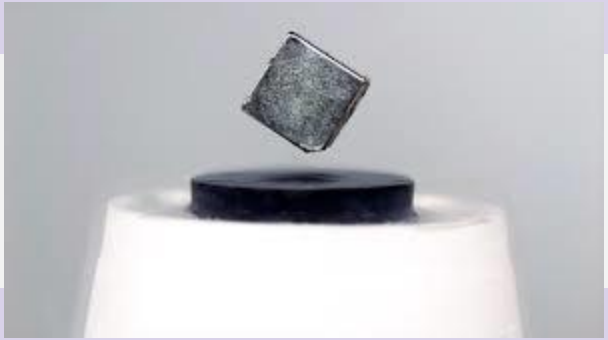


SiN Resonator under localized heating, Image from Steven Burrows/Regal group

Cindy Regal is an American experimental physicist known for her work in **quantum optics**, and **cavity optomechanics**. She was part of the group which measured **ultracold fermionic condensates** for the first time.

Under specific circumstances, spin ½ particles (**fermions**), such as electrons, pair up to form integer spin particles, known as **bosons**. Rather than repelling each other, they collect to form a molecule.

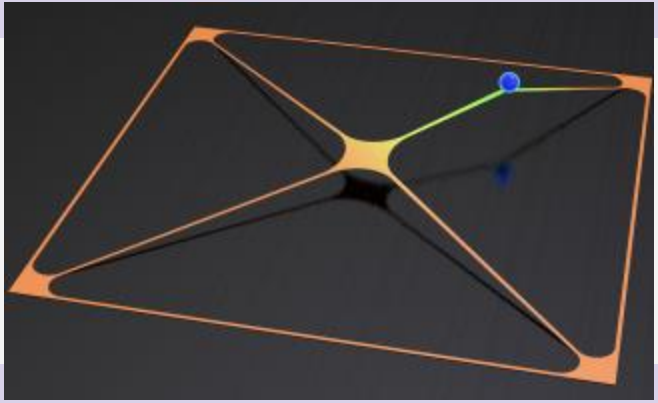




Probing the ultracold fermionic condensate can give insights into high temperature superconductors which are difficult to probe

Cindy Regal is improving measurement precision and **quantum state stabilization**. Through **laser cooling**, her group measures displacements and forces at quantum limits which contributes to **many-body physics**.

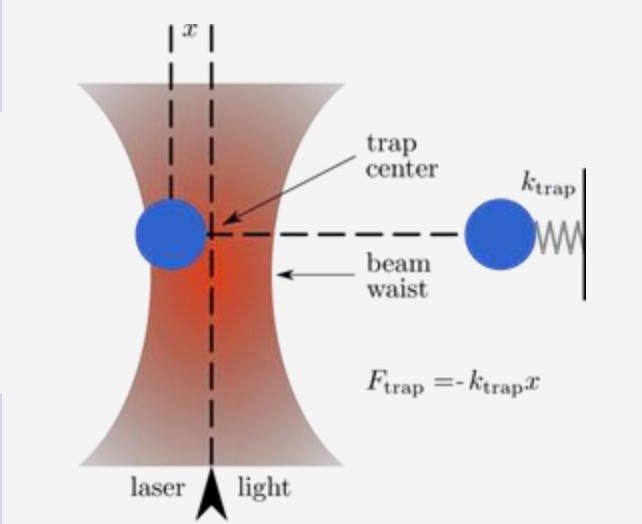
Creating a system which stays in a given **state** for any length of time is exceedingly hard. The Regal group designs mechanical resonators for this purpose.



One of many motivations for this work is the applications to **quantum information**; the ability to place a system into a specific state for an extended period is vital.

Regal uses **optical tweezers** to collide individual atoms

Optical tweezers manipulate nano-scale **dielectrics** via very small forces. At the narrowest point of the beam, the amplitude of the electric field is largest.



The dielectric is attracted to the area with the strongest E-field. The photons also exert a force along the beam direction due to their collisions with the particle.

Cindy Regal is a pioneer in the field of atomic, molecular and optical physics. Her numerous contributions to her field have earned her the **Presidential Early Career** Award and a **Packard Fellowship**. Her early career work in ultracold fermionic condensates was groundbreaking and she continues to explore quantum systems with her eye on applications.