Contribution ID: **29** Type: **Talk 18min**

Single ion dynamics in a phase-stable polarization gradient

Wednesday 10 July 2024 09:00 (18 minutes)

Sisyphus cooling below the Doppler limit in polarization gradients has been a backbone of ultracold atom experiments for decades. It has recently been demonstrated for trapped ions as well. The potential advantage is that it can simultaneously cool multiple modes of a Coulomb crystal below the Doppler limit and could thus improve the time required to cool all modes of large ion crystals close to the motional ground state. So far, this has only been done using running wave polarization gradients. Localizing the ions at particular phases of the polarization gradient lowers the cooling limit by a factor of two. We demonstrate cooling in a phase-stable polarization gradient. The interferometric stability is created by splitting the light on-chip in integrated photonic waveguides and overlapping the emission from separate diffraction grating couplers. To our knowledge, this is the first experimental demonstration of the phase-dependence of polarization gradient cooling. This technique could cut down cooling times in large ion crystal quantum simulators and computers.

Primary author: KNOLLMANN, Felix

Co-authors: CLEMENTS, Ethan (NIST/CU Boulder); Prof. CHUANG, Isaac (MIT); Dr CHIAVERINI, John (MIT Lincoln Laboratory); Ms CORSETTI, Sabrina (MIT)

Presenter: KNOLLMANN, Felix

Session Classification: Quantum Technologies

Track Classification: Quantum Technologies