

# IQSE AMO QO Seminar Series

Tuesday, January 30th, 2024, 11:30 am ZOOM  
& IQSE seminar room (MPHY 578)

Pizza will be served for IQSE members at 11:00 am. The talk will start around 11:30 am

## Dana Z. Anderson

(University of Colorado Boulder)

### Maxwell Matter Waves & The Oqtant Quantum Matter Machine

**EVENT DETAILS:** Historically, Maxwell's equations arose from a recognition that separate physical laws describing electric and magnetic phenomena were in reality manifestations of a single encompassing theory of electromagnetism. Among the revelations in physics in the past half century is that Maxwell's equations can be derived through a gauge-field treatment of interacting identical charged particles. In fact, gauge field theory produces a family of Maxwell's equations, with the familiar set describing electromagnetism identified by incorporating empirical aspects, namely the impedance of free space and the speed of light. In modern gauge-field treatments, the latter is imposed by seeking consistency with Relativity. In the gauge-field context one begins with the description of the physics of the particles, and a gauge field necessarily arises to account for particle interactions. In other words, the electromagnetic field is the gauge field associated with charged particle interactions. As do charged particles, identical neutral atoms also interact. Ultracold rubidium atoms, for example, repel each other through s-wave scattering. If instead of Relativity one imposes (non-relativistic) quantum mechanics as a consistency constraint for the dynamics of neutral particles, there appears a set of matter-wave duals to Maxwell's equations. Of particular interest is that these Maxwell matter waves have temporal coherence properties analogous to their electromagnetic counterparts. Such coherence properties and other aspects are distinct from the more familiar de Broglie matter waves. Indeed, Maxwell matter waves enable one to construct sensors that are analogous to optical and microwave devices that take advantage, for example, of resonators. Inflection has recently provided access to an ultracold matter machine called Oqtant that will enable the generation, study, and utilization of ultracold matter, particularly Maxwell matter waves. This talk introduces Oqtant, Maxwell matter waves and potential sensing capability enabled by temporally coherent states of matter.

**ZOOM information:**

<https://tamu.zoom.us/j/98156251523?pwd=QVdSdGxtL1UyY0g1L083SU5QR0QrUT09>

Meeting ID: 981 5625 1523

Passcode: 297578

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