

Massachusetts Institute of Technology  
Department of Physics

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## Condensed Matter Theory Seminar

### “General Relativistic Phenomena in Optical Settings”

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**Abstract:** In 1916 Albert Einstein published the General theory of Relativity (GR) predicting a plethora of exciting gravitational phenomena. Some of these have been directly observed, such as the deflection of light by the sun. However, many of GR’s predictions still elude observation to this day. Consequently, mathematically analogous physical systems were suggested as platforms for emulation experiments, among which optical systems are prime candidates.

The talk will cover my work on gravitational effects with optical wavepackets in linear and nonlinear optical systems. We present a highly nonlocal nonlinear optical system that is mathematically equivalent to the Newton-Schrödinger model commonly used to describe the inherently nonlinear dynamics of gravitational systems. We use this setting to demonstrate gravitational phenomena in tabletop experiments: the wave dynamics of the interaction of a quantum wavefunction with a massive star. Such wavefunction interact in the curved space that they themselves induce, displaying complex nonlinear dynamics arising from the interplay between diffraction, interference and the emulated gravitational effects. Finally, we study the behavior of wavepackets on curved surfaces and design macro and micro sized optical structures suggesting new photonics applications by controlling the curvature of space.

**10:30am**  
**Thursday, May 7, 2015**  
**Low Room (6C-333)**