



**INSTITUTE FOR THEORETICAL ATOMIC, MOLECULAR AND OPTICAL PHYSICS**  
at the Harvard-Smithsonian Center for Astrophysics and Harvard Physics Department, Cambridge MA USA

**HARVARD** Quantum Optics Center

## **Joint Quantum Sciences Seminar**

**Wednesday | Oct. 3 | 4:00 pm**  
**Jefferson 250**

# **Charles S. Adams**

**Professor, Durham University**

### **"Photon-Photon Interactions using Cooperative Non-linear Optics"**

Ever since the invention of the laser, the field of non-linear optics has been at the forefront of progress in optical information and communication technologies. However, one area where non-linear optics has been constrained by fundamental physics is the control of photons at the single quanta level. We address this issue using an alternative type of optical non-linearity that is mediated not directly by the interaction between light and matter, but indirectly by the interaction between light-induced excitations, i.e., dipole-dipole interactions. For example, the giant dipoles associated with highly excited Rydberg states can induce a cooperative response of say 1000 neighbouring atoms, thereby greatly amplifying the effect of each photon. In this talk I will present some interesting consequences of this cooperative response including light induced phase transitions and optical bistability.

**Student Presentation by Emanuele Dalla Torre,  
ITAMP/Lukin Lab**

**"Dissipative Preparation of Spin Squeezed Atomic Ensembles in a  
Steady State "**

**Student Presentation will begin promptly at 4:00 PM**  
**Guest Presentation will begin promptly at 4:30 PM**