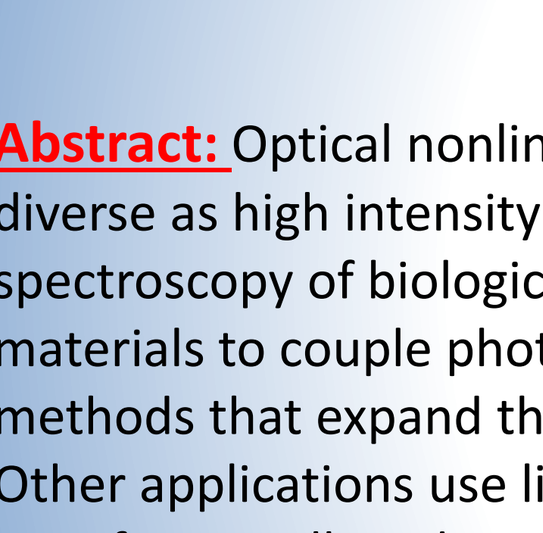
The Center for
Light Matter Interaction
Tel Aviv University

LMI Seminar:

Tackling longstanding challenges in ultrafast nonlinear optics via foreign but familiar physics



Prof. Jeffrey Moses

School of Applied and Engineering Physics,
Cornell University NY

Sunday December 11nd, 2022

13:00-14:00

Light refreshments and drinks will be served at 12:30

Auditorium 011, Engineering Classroom Building, Faculty of Engineering, Tel-Aviv University

Abstract: Optical nonlinearities have expanded the optics and photonics toolset for applications as diverse as high intensity laser science, quantum information processing, and the imaging and spectroscopy of biological systems. Key to many applications is use of the nonlinear polarizability of materials to couple photons between optical fields, giving rise to amplification and frequency conversion methods that expand the reach of lasers and other photon sources, both classical and non-classical. Other applications use light 'self-effects' to guide, switch, and modulate. However, optical nonlinearities are often small, and even when large enough, the spatiotemporal and spectral inhomogeneities in nonlinear optical systems can severely hamper the efficiency and bandwidth of power flow between waves.

Our group has been seeking ways to 'trick' nonlinear systems into modes of evolution that can avoid the normal limiting behaviors or to make use of unconventional nonlinear interactions. I will discuss two examples that possess familiar physics that are somewhat foreign to optical light pulses. First, I will discuss how hybridized nonlinear processes can be used to achieve dissipative, non-Hermitian-like dynamical behavior in parametric frequency conversion despite no loss, and how this can be used to overcome a longstanding barrier to efficient parametric amplification. Second, I will discuss the phenomenon of optical polarizability involving coherent phonon coupling, which we predict gives rise to a giant Raman scattering susceptibility and a new way to control the optical properties of materials with mid-IR and THz light.

Bio:

Jeff Moses joined the faculty at Cornell University in 2014, where he leads the Ultrafast Phenomena and Technologies Group in the School of Applied and Engineering Physics. He received his B.S. from Yale University and Ph.D. from Cornell University, with both degrees in applied physics, and spent 2007-2014 at the Optics & Quantum Electronics Group in the Research Laboratory of Electronics at MIT as a postdoctoral associate and research scientist. He has received the US National Science Foundation CAREER award and was an US Air Force Office of Scientific Research Young Investigator.