Solid State Institute
המכון למצב מוצק

TECHNION
Israel Institute
of Technology

הטכניון
מכון טכנולוגי
לישראל

SPECIAL SEMINAR

סמינר מיוחד

Quantum electrodynamics at the surface of a polaritonic medium

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Abstract

Quantum electrodynamics is one of the most successful theories in the history of science, describing accurately nearly all known phenomena involving electromagnetic fields. Central in QED is the concept of the photon, a quantum of electromagnetic energy with properties such as energy, momentum, and angular momentum. For photons in complex arrangements of optical media, these properties are in general very different than in free space, leading to vastly altered interactions between matter and electromagnetic fields. As a result, "QED in a medium" features a vast set of phenomena that either do not exist or are very hard to realize in "free space QED". For example, QED effects in photonic crystals and optical cavities have been leveraged to achieve ultrafast spontaneous emission of light by molecules, vacuum Rabi oscillations, atom-photon bound states in photonic crystals, and exciton-polariton condensation and superfluidity.

This talk presents new developments in this field which result from extreme (nanoscale) confinement of light by optical media supporting surface polaritons. These polaritons, which include the family of plasmon-, phonon-, exciton-, or magnon- polaritons, enable new quantum regimes of interactions with different kinds of matter such as atom-like emitters, electrons in quantum wells and in electron microscopes, and ultrarelativistic Dirac fermions. From this theory, we find that nanoscale confinement of electromagnetic energy enables high-order angular momentum transfer with light, indirect optical transitions, efficient high-order QED processes such as multi-photon spontaneous emission, as well as conversion of plasmons into x-rays and gamma rays by relativistic electrons, and high-harmonic emission of femtosecond plasmonic pulses by electrons modulated by mid-to-far-IR driving fields.

[1] N. Rivera*, I. Kaminer*, B. Zhen, J.D. Joannopoulos, and M. Soljacic. *Science* 353.6296 (2016): 263-269.
[2] Y. Kurman, *et al.* In review.
[3] N. Rivera, G. Rosolen, J.D. Joannopoulos, I. Kaminer, and M. Soljacic. *PNAS* (2017): 201713538.

ההרצאה תתקיים ביום שלישי,ה- 27.3.18 , בשעה 12:30
באודיטוריום המכון למצב מוצק, קומת כניסה

The lecture will take place on Tuesday, 27.3.18 at 12:30
at the Solid State Institute auditorium, entrance floor

Host: Professor Ido Kaminer