PHYSICS AT QUEENS COLLEGE

Colloquium Notice

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Coherent control of wave propagation inside scattering media

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Alexey Yamilov, Missouri S&T
https://web.mst.edu/~yamilov/

Concept of diffusion is widely used to describe propagation of light through multiple scattering media such as clouds, interstellar gas, colloids, paint, biological tissue, etc. Such media are often called random. This terminology is, however, misleading. Notwithstanding its complexity, the process of wave propagation is entirely deterministic – uniquely defined by the exact positions of scattering centers and the shape of the incident wavefront – making it possible to deduce the precise pattern of wave field throughout the system. Technological advances over the last decade enabled one to synthesize an arbitrary wavefields opening new frontier in light control inside strongly scattering media.

Feasibility of the coherent control necessitates a general framework for predicting and understanding the ultimate limit for a targeted energy delivery into a diffusive system. In this talk, we will discuss such scientifically and technologically important questions as “How can one systematically find the incident wavefront that optimally deposits energy into a target region of arbitrary size and shape, deep inside a diffusive medium?” and “What is the ultimate limit on the energy enhancement in a region?” Predictable energy delivery opens the door to numerous applications, e.g., optogenetic control of cells, photothermal therapy, as well as probing and manipulating photoelectrochemical processes deep inside nominally opaque media.

Alexey Yamilov (QC alum, PhD 2001) is a professor of Physics at Missouri S&T. His research activities are in the areas of theoretical and computational condensed matter physics and optics, he employs a variety of analytical and numerical techniques to study transport of the electromagnetic, electronic and other types of waves in the inhomogeneous media, where a line-ofsight propagation is hindered by scattering. The purpose of the research is to uncover and exploit physical phenomena caused by wave interference with the goals of: (i) understanding new behaviors originating not only from the fundamental laws of physics but also from complexity of the system itself; (ii) developing techniques for coherent control of wave propagation; (iii) designing artificial structures/systems with a set of desired properties.

Monday

March 14, 2022

Starts at 12:15 PM

If not mentioned otherwise, all **online Zoom.us events are accessible via this link**
or use **meeting ID 829 2687 2594** and **passcode 866995**.
