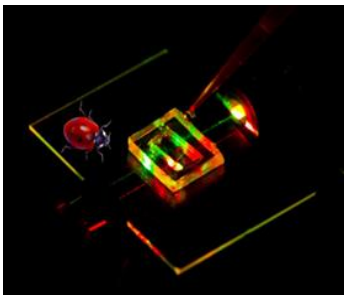
Molecules, glass & light

Alina Karabchevsky

Optoelectronics Research Centre, University of Southampton, Southampton, SO17 1BJ, UK

Email: A.Karabchevsky@soton.ac.uk

In this seminar, I will introduce the fundamentals of guided optics. A brief overview will be given over design, fabrication and characterization of integrated optical components and microfluidic channels. I will focus on the conceptual importance of the integrated optics and surface modification for chemo- and bio-applications. The potential of disorder-enhanced photonics in vibrational spectroscopy on waveguides will be discussed and new directions will be proposed.

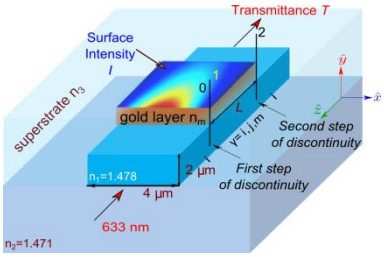


Rainbow on a chip: Tasting molecular cocktails, Author: Alina Karabchevksy, University of Southampton, UK.

Vibrational spectroscopy relies on absorption of electromagnetic radiation by molecular vibrations.

It is a powerful tool for drawing information on molecular structure and dynamics.

In the first part of the talk I will present an intriguing physical effect of disorder-enhanced absorption of light by molecular overtones of amines in a: 1) silicate channel waveguide and 2) microtapered fiber with adsorbed gold nanoparticles. Due to the guides' surface modification, aromatic rings tend to stack together, and N-H bonds in amines form hydrogen bonds with each other. This 8 nm thick multilayer structure of lamellar liquid crystal shape leads to the switch from ballistic to diffusive propagation of light which results in the enhanced absorption. I will also address a dynamics of absorption as a function of time of adsorption of the organic molecules on waveguide. These phenomena are expected to find application in organic solution based optical sensors for detection of explosive materials and diagnostics of psychoactive stimulants based on amines.



Transmittance and surface intensity in 3D composite plasmonic waveguides, Karabchevsky et. al , Opt. Express **23**(11) 14407-14423, 2015.

In the second part of the talk, I will present a theoretical study of composite plasmonic waveguide structures for design of integrated optical components and Purcell enhanced chemiluminescence in a microfluidic channel.