μphotonics

NANOPHOTONICS

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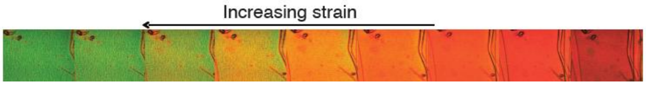
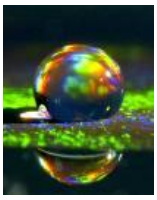
Soft NanoPhotonics: Our recently-funded new centre in Soft NanoPhotonics makes unusual sorts of nano-materials which combine novel optical properties built from structuring components on the nanometre scale, with the (literal) flexibility of using soft materials. The physics of combining electromagnetism and quantum mechanics produces emergent surprises in new and useful properties. This collaboration between NP and BSS groups involves many research disciplines around the University including Chemistry, Chem. Eng, and Physics of Medicine, and internationally.



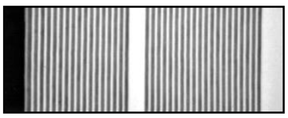
Stretcheable photonic structures: A wide range of projects are available including making elastic optical mirrors that tune colour when stretched and making elastically-tuneable lasers, as well as microcavities that can be acoustically controlled. You will develop new fabrication techniques combining self-assembly and soft polymer materials to create and spectroscopically measure these nanomaterials. The new applications for such materials are widespread and you would investigate novel emission physics.

Nano-assembly of optically-active polymer opals: Recently we discovered a new way to make photonic crystals which uses self-assembly by shear-alignment of core-shell polymer nanoparticles. These materials resonantly interact with light in peculiar ways, and we are exploring ways that we can use such nano-assembly to produce metallic ordered opals. You would investigate making and utilising such novel materials.

Rolled-up MetaMaterials: We work on a wide variety of composite nanostructures (often called metamaterials) with metallic, semiconducting and dielectric nano-components which produce new and unusual optical properties such as sub-wavelength imaging, anisotropic propagation and electromagnetic cloaking. The challenge of this PhD is to put these together into organised 3D soft architectures which are functional metamaterials.



Biosensing with nano-structured plasmonic surfaces: Our group has pioneered various ways to trap light inside gold metallic nanostructures producing strong concentration of the optical fields. Light then couples to dipoles inside our nanostructures, enhancing coupling to them by up to 10 orders of magnitude. This project would involve trying to make active plasmonics, and use the extremely-small trapped field volumes to directly sense molecules passing through the nanopores, for high throughput biosensing.



Strong-coupling soft semiconductor microcavities: Our recent break-throughs in making room-temperature Bose-Einstein condensates of composite light-matter quasi-particles (called ‘polaritons’) trapped in optical cavities suggests the possibility of turning organic semiconductors into self-assembled microcavities. These can have highly-enhanced lasing and optical nonlinear properties. This PhD would aim to incorporate hybrid organic semiconductors in a variety of nano-cavities.