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Resonant Soft Matter Photonics –
Microcavities, Strong Light-Matter Coupling and Living Cells That Become Lasers

My lab is most well-known for our work on laser emission in live cells; the original experiment on this is listed in the Guinness World Records as “the world’s first living laser”. By inserting microlasers into live cells, we are able to follow the path of individual cells in large cell populations and over extended periods of time[1] and are currently developing this method further to perform intracellular sensing in living organisms.

Beyond these exotic lasers, my lab studies a range of optical resonators that use soft materials. These involve simple structures, which use the same effect that gives a soap bubble its rainbow-like colours, to image the piconewton mechanical force an immune cell applies when it migrates to a site of inflammation[2]. They also include complex microcavities with embedded field-effect transistors in which we investigate the rich physics of strong coupling between the electronic excitations of e.g. carbon nanotubes and microcavity photons, work that may eventually lead to electrically pumped organic lasers[3].

[1] Fikouras et al, Nature Comm (accepted); http://arxiv.org/abs/1806.03366

[2] Kronenberg et al, Nature Cell Biology (2017)

[3] Graf et al, Nature Materials (2017)