Seeing individual molecules by confining light to the nanoscale

How tightly can we confine light? For many years this was thought to be on the order of the optical wavelength, but new insights allow us to squeeze it down to nearly a single cubic nanometre. This opens up a new regime where we can watch single molecules, and sculpt directly on the nanoscale using light. By combining metallic nano-objects at very close distances, we squeeze light into these tiny dimensions at resonant wavelengths whose colour depends exquisitely on the nanoscale geometry. Below 1nm gaps, we detect the influence of quantum mechanics in the optical signatures, at room temperature and ambient conditions. We also show how it is possible able to track single molecules, and discuss the implications for nano-chemistry and healthcare technologies.

Prof. Jeremy J. Baumberg FRS, directs a UK Nano-Photonics Centre at the University of Cambridge and has extensive experience in developing optical materials structured on the nano-scale that can be assembled in large volume. He is also Director of the Cambridge Nano Doctoral Training Centre, a key UK site for training PhD students in interdisciplinary Nano research. Strong experience with Hitachi, IBM, his own spin-offs Mesophotonics and Base4, as well as strong industrial engagement give him a unique position to combine academic insight with industry application in a two-way flow. With over 10000 citations, he is a leading innovator in Nano. This has led to awards of the Royal Society Rumford Medal (2014), IoP Young Medal (2013), Royal Society Mullard Prize (2005), the IoP Charles Vernon Boys Medal (2000) and the IoP Mott Lectureship (2005). He frequently talks on NanoScience to the media, and is a strategic advisor on NanoTechnology to the UK Research Councils. He is a Fellow of the Royal Society, the Optical Society of America, the Institute of Physics, and the Institute of NanoTechnology.
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