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New frontiers in integrated nanophotonics: Harnessing Stimulated Brillouin Scattering

One of the surprises of nonlinear optics – the field of optics with high intensity lasers – is that light may interact strongly with sound, the most mundane of mechanical vibrations. Intense laser light literally “shakes” the glass in optical fibres, exciting acoustic waves (sound) in the fibre. Under the right conditions, it leads to a positive feedback loop between light and sound termed “Stimulated Brillouin Scattering,” or simply SBS. This nonlinear interaction can amplify or filter light waves with extreme precision in frequency (colour) which makes it uniquely suited to solve key problems in the fields of microwave and optical communications amongst others.  SBS in compact chip-scale structures was recently achieved the first demonstration, in carefully designed structures so that the optical fields and the acoustic fields are simultaneously confined and guided. This new platform has opened a range of new chip-based functionalities that are being applied in digital and analogue communications with record performance and compactness. This new Brillouin-device reveals new regimes of light sound interactions at the nanoscale, which has required new theoretical developments. My talk will introduce this new field, review progress in the field and achievements and recent highlights that point towards a new class of silicon based optical phononic processor that can be manufactured in semiconductor CMOS foundries.