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Biography

Shangran Xie received his B.E and Ph.D. degrees from Department of Electronics Engineering, Tsinghua University (P. R. China) in 2007 and 2013 respectively. From 2010 to 2011, he joined Fiber Optics Group in University of Ottawa in Canada as a joint Ph.D. student, working on long-distance distributed temperature, strain and birefringence sensing using Brillouin scattering in optical fibers. From 2013, he was appointed as a postdoctoral fellow in Russell Division, Max Planck Institute for the Science of Light in Germany, working on mid-IR supercontinuum generation, optical tweezers and optomechanics based on custom-designed specialty fibers, including hybrid waveguides, tapered waveguides and photonic crystal fibers. He is currently the group leader for the optomechanics team in Russell Division. He has published several papers on high-impact journals, including Optica, Phys. Rev. Lett., ACS photonics, Opt. Lett. and Opt. Express. His research interests cover fiber-based optical tweezers and optomechanics, mid-IR supercontinuum generation and fiber sensing.

Flying particle irradiation sensing and optomechanically self-aligned coupling in microfluidic hollow-core photonic crystal fibers

In this talk, I will focus on our recent work on particle guidance and optomechanics in optofluidic hollow-core photonic crystal fibers (HC-PCFs). In the first part I will introduce a flying particle irradiation sensor realized in liquid-filled HC-PCF, where we applied a dual-beam optical trapping scheme to tweezer a fluorescent particle inside the HC and to propel the particle along the HC-PCF via balancing the radiation pressure forces. When the fluorescent particle is flying through irradiated regions, its emitted fluorescence is captured by guided modes of the fiber core and so can be monitored at the fiber end. The system works as a remote irradiation sensor for visible and ultraviolet wavelengths (determined by the absorption properties of the fluorescent particle) with a measured spatial resolution of ~10 µm.

In the second part, I will talk about a new method to efficiently couple broadband light into optofluidic hollow waveguides, based on the optomechanically trapping of a silica nanospike inside the core of the HC-PCF. The nanospike, fabricated by thermally tapering a piece of standard single mode fiber (SMF), guarantees the adiabatic evolution of the fundamental mode from SMF to HC-PCF. Meanwhile it can be optically trapped in the center of the HC due to its strong optomechanical interaction and back-action with the HC. We demonstrate that using a silica nanospike, a trapping beam (at 1064 nm wavelength) with relatively high power can optically align the coupling of another weak broadband supercontinuum signal (~575 – 1064 nm) into the HC-PCF, with the unique advantages of self-stabilization and reflection-free. This method is of potential relevance for any application where the efficient delivery of broadband light into liquid-core waveguides is desired.

References:

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