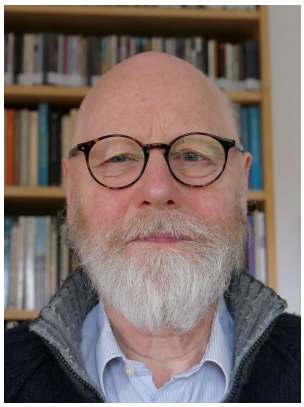
Nonlinear optics in chiral photonic crystal fibres

Photonic crystal fibres (PCFs)—thin strands of glass with an array of hollow channels running along their length—offer light guidance in both hollow and solid glass cores. They permit unprecedented control over dispersion, birefringence and nonlinearity, and over the last three decades have ushered in a new era of linear and nonlinear fibre optics. Gas-filled hollow-core PCF provides low-loss diffraction-free transmission of light in a single transverse mode, and through pressure-adjustable dispersion provides a simple means of compressing pulses to single-cycle durations, as well reducing the threshold power for nonlinear effects by orders of magnitude. Operating on opposite sides of the gas-pressure-tuneable zero dispersion point permits a novel form of holography based on Raman coherence, which has been used for highly efficient state-preserving frequency up-conversion of single photons by 125 THz in hydrogen (doi.org//10.1126/science.abn1434). In the lecture I will explain how chiral PCF, formed by spinning the preform during fibre drawing, provides circular and vortex birefringence, opening up new opportunities for controlling nonlinear optical processes.



Lecturer: Philip Russell (Max Planck Institute for the Science of Light, Erlangen, Germany ; www.mpl.mpg.de ; is an emeritus founding director at the Max-Planck Institute for the Science of Light in Erlangen, Germany. He obtained his D.Phil. degree in 1979 at the University of Oxford, working on volume holography. Since then he has worked in laboratories and universities in Germany, France, the USA and the United Kingdom. His interests focus on scientific and technical applications of photonic crystal fibres, which he first proposed in 1991. He is a Fellow of the Royal Society and Optica (formerly The Optical Society, OSA) and has won a number of awards including the 2000 OSA Joseph Fraunhofer Award/Robert M. Burley Prize, the 2005 Thomas Young Prize of the Institute of Physics (London), the 2005 Körber Prize for European Science, the 2013 EPS Prize for Research into the Science of Light, the 2014 Berthold Leibinger Zukunftspreis, the 2015 IEEE Photonics Award and the 2018 Rank Prize for Optoelectronics. He was OSA's President in 2015, the International Year of Light.