**Designing fiber-tip optical resonators for strong field enhancement**

Peter Horak and Denis V. Karpov

*Optoelectronics Research Centre, University of Southampton, U.K.*

**Abstract:**

For many applications in quantum technology or optical sensing strong coupling between light and micro- or nano-particles is highly desirable. Fabry-Perot optical resonators formed between mirror-coated tips of two optical fibers lead to field enhancement and can be exploited for strong coupling of light to a particle, but the enhancement factor is still limited by geometrical restrictions.

In our work we investigate new designs of such fiber-tip resonators where the shape of the mirrors is optimized to create interference patterns inside the resonator that lead to high peak intensities at the position of the particle. We use a range of approaches, such as analytical theory, evolutionary algorithms, and machine learning, to find the best designs. Our results suggest that significant field enhancement is possible with mirror shapes that deviate only moderately from spherical shapes. These can be fabricated by laser ablation, focused ion beam milling, or micromachining of fiber ends and could give rise to more precise optical sensors and faster quantum information processors.

**Biography:**

Dr Peter Horak is Associate Professor at the Optoelectronics Research Centre (ORC) at the University of Southampton, UK, where he leads the Computational Nonlinear Optics group. He received his PhD degree in Theoretical Quantum Optics from the University of Innsbruck, Austria, and held positions at the Ecole Normale Superieure in Paris, France, and at the University of Strathclyde in Glasgow, UK, before joining the ORC in 2001. His research focuses on theory and numerical simulation of nonlinear optics, optical fibers, integrated photonics, and quantum technology.