Karlsruhe Institute of Technology

# Kerr soliton comb sources for ultra-fast signal processing

The goal of this PhD project is to explore and to demonstrate concepts for generation and characterization of ultra-broadband optical waveforms using chip-scale frequency comb sources. Frequency combs provide a multitude of phase-locked carriers that can be individually modulated by electro-optic devices, thereby synthesizing optical waveforms with THz bandwidths. Comb generators based on dissipative Kerr solitons have the potential to considerably reduce the complexity and the cost of the comb source, thereby bringing integrated systems for generation and detection ultra-broadband arbitrary optical waveforms into reach. This is not only of great interest for legions of applications in optical communications, sensing and metrology, but may also enable entirely new concepts for generation of electronic signals at THz frequencies by down-conversion from optical carriers.

We seek for candidates with strong interest both in experimental and theoretical aspects of ultra-fast signal processing and nonlinear optics. Your work will focus on exploring the potential of chip-scale frequency comb sources for generation and characterization of optical waveforms having bandwidths of 100 GHz. The project will build upon previous activities in the area of optical communications and metrology [1,2]. Your activities will cover theoretical concepts and models of Kerr frequency comb generation, the associated devices and photonic integrated circuits (PIC), as well as experimental proof-of-concept demonstrations.

**The following qualifications are required** seeking your consideration for this position:

- Excellent Master or an equivalent degree in Electrical Engineering, Photonics, Physics, or related fields.
- Strong theoretical and/or experimental background in integrated photonics and/or nonlinear optics.
- We expect excellent writing and oral communication skills along with the ability to work independently within an international team.

The successful candidates will be part of a European Marie Skłodowska-Curie Innovative Training Network. There are strict requirements associated with this funding scheme: At the time of appointment, applicants must not have resided or carried out their main activity (work, studies, etc.) in Germany for more than 12 months in the 3 years immediately before the recruitment date. Applicants shall also be in the first four years of their research careers at the time of appointment and have not been awarded a doctoral degree.

**We offer** an inspiring, attractive, interdisciplinary, and internationally recognized scientific environment with access to excellent research facilities, as well as a wide scope of advanced training options. In case of questions, please contact Prof. Christian Koos (christian.koos@kit.edu), Tel. +49 - 721 - 608 42491

Apply through the KSOP PhD application portal with the reference number **KSOP-2020-09**.


[1] Marin, P.; Kemal, J. N.; Karpov, M.; Kordts, A.; Pfeifle, J.; Pfeiffer, M. H. P.; Trocha, P.; Wolf, S.; Brasch, V.; Rosenberger, R.; Vijayan, K.; Freude, W.; Kippenberg, T. J.; Koos, C.: 'Microresonator-based solitons for massively parallel coherent optical communications'; Nature **546**, 274–279 (2017), https://www.nature.com/articles/nature22387

[2] Trocha, P.; Karpov, M.; Ganin, D.; Pfeiffer, M. H. P.; Kordts, A.; Wolf, S.; Krockenberger, J.; Marin-Palomo, P.; Weimann, C.; Randel, S.; Freude, W.; Kippenberg, T. J.; Koos, C.: 'Ultrafast optical ranging using microresonator soliton frequency combs'; Science **359**, 887–891 (2018), https://science.sciencemag.org/content/359/6378/887.full