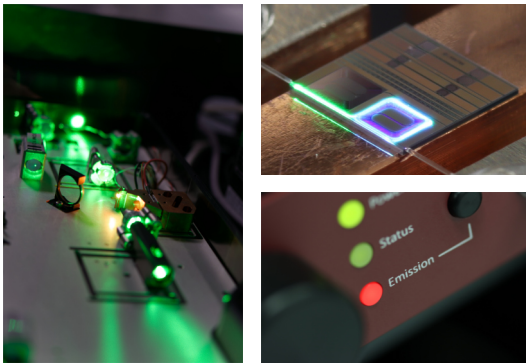


PhD/MSc Thesis Sensing of relativistic electrons with chip-integrated photonics



Are you interested or would you like more information? Please don't hesitate to get in touch.

Ultrafast Micro Photonics Lab

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References:

- ¹ Gaeta et al., *Nature Photonics* 13, 3, 158 (2019)
- ² Ludwig et al., <https://arxiv.org/abs/2306.13609> (2023)
- ³ Steffen et al., *Rev. of Sci. Instr.*, 91, 045123 (2020)

About the project

Nonlinear optical effects can be utilized to manipulate light with light. A drastic enhancement of these effects can be achieved in chip-integrated integrated nonlinear photonic waveguides^{1,2}.

In this project, we will develop a novel on-chip photonic sensor for relativistic electrons in DESY's free-electron lasers (FELs). Specifically, we will design and test a nonlinear photonic microchip to record the interaction between the electric field of the electrons with the electric field of an ultrashort laser pulse³. Such sensors can provide precise timing and spatial information of the relativistic electrons - a critical prerequisite for atomic-resolution imaging of biomolecules. The photonic chip-integrated platform is expected to boost the current sensitivity by orders of magnitude and may also be used to study fast and non-repetitive phenomena in chemistry and biology.

The **PhD thesis** will combine experimental, numerical, and analytical techniques at the forefront of integrated photonic technology, ultrafast lasers and nonlinear optics. It includes the design of integrated photonic circuits and advanced microphotonic laser systems as well as experiments in our state-of-the-art laboratory (<https://ump.cfel.de/>). The **MSc thesis** will focus on one of these aspects.

If you like working collaboratively with a highly motivated team in a fast-paced research field at the interface of fundamental science and applied photonic technology, please don't hesitate to get in touch. Curiosity and general understanding of physics are more important than field-specific prior knowledge.

