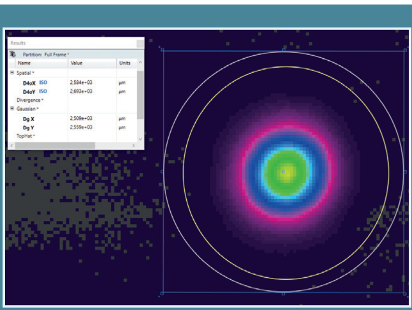
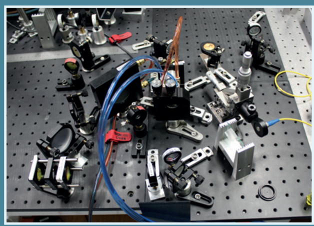
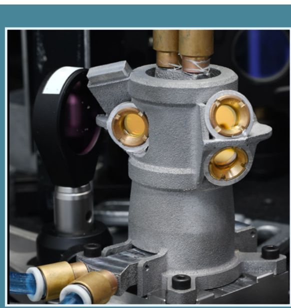
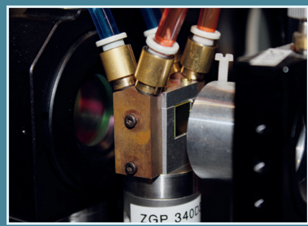
French-German Research Institute of Saint-Louis

The French-German Research Institute of Saint-Louis (ISL) situated in the border triangle of Germany, France and Switzerland is an internationally renowned research institute belonging to a global industrial and economic network.

The spectrum of our core activities comprises a variety of topics: aerodynamics, energetic and advanced materials, lasers and electro-magnetic technologies, protection, security and situational awareness. Our activities are related to both basic and applied research.

Research field: Physics, Non-linear Optics, Laser sources, Photonics

Investigation of mid- and long-infrared coherent sources based on frequency down-conversion in non-oxide nonlinear optical crystals

Context

The thesis proposes a study focused on the investigation of nonlinear optical (NLO) crystals that allow mid- and long-infrared wavelength generation with a variety of pump sources. The project will be carried out in partnership with Valentin Petrov from the Max-Born Institute for Nonlinear Optics and Ultrafast Spectroscopy (MBI) and Christian Kränkel from the Leibniz-Institut für Kristallzüchtung (IKZ) in Berlin.

Pulsed radiation of high power and energy in the mid-wavelength (MWIR) and long-wavelength (LWIR) infrared (IR) spectral ranges is important for remote sensing, spectroscopy, and defense applications. Sources covering the 3-15 µm wavelength range are mainly based on optical parametric oscillators (OPOs) with nonlinear optical crystals. The availability of other solid-state sources is restricted to quantum cascade lasers and transition metal-doped chalcogenide lasers, which are limited in wavelength coverage, average power and temporal regimes. Zinc-germanium-phosphide (ZGP) is the most widely used material in OPO experiments due to its superior properties as a nonlinear material suitable for IR conversion when pumped near 2 µm. Besides mature ZGP crystals, new promising nonlinear materials based on non-oxide compounds are emerging, such as few Barium chalcogenides, which potentially suppress some limitations of ZGP related to residual absorption at the pump laser wavelength and enable pumping at shorter wavelengths (1.5 or even 1 µm). Selenium compounds show also much longer mid-IR cut-off wavelengths compared to ZGP, outperforming it above 10 µm.

The thesis will include the experimental campaigns at ISL with 2 µm high-power and high-energy pump sources and investigations of alternative pump sources available at the MBI in Berlin, including tandem OPOs extending the emission of commercial 1 µm pump lasers, intracavity pumped OPOs and OPO – difference-frequency generation (DFG) cascades utilizing the dual OPO output. The experimental campaigns will be supported by a range of numerical modeling with custom and commercially available codes.

Candidate profile

- A Master's degree in Physics, Photonics, or a related field
- Proficiency in English, with excellent written and spoken communication skills
- Strong initiative, collaborative abilities, and effective interpersonal skills
- Practical experience in experimental research
- Experience with numerical modeling (preferred)

What we offer

- A PhD project within a dynamic and internationally collaborative environment
- Access to state-of-the-art laser infrastructure and experimental facilities
- Competitive salary

Localization

The project is carried out in collaboration between the French-German Research Institute of Saint-Louis (ISL) and the Max-Born Institute (MBI) in Berlin.

Support

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