French-German Research Institute of Saint-Louis (ISL)

Ph.D Thesis

Investigation of mid infrared supercontinuum generation from a pulsed 2 µm fiber laser

High-power, mid-infrared (mid-IR) radiation is needed for numerous applications in spectroscopy and detection systems. One promising and efficient attempt is supercontinuum generation (SCG) in soft-glass fibers. ISL has demonstrated a watt-level output power SC sources from a fluoride fibers with an output spectrum up to 4.2 µm [1]. Further wavelength broadening has been achieved in chalcogenide fibers with several tens of milliwatts output power up to 5 µm. The pumping source for these experiments has been a Q-switched mode-locked high-average-power 2 µm fiber laser. Task of the thesis is the further investigation of high-average-power mid-IR SCG in nonlinear fibers (fluoride, chalcogenide) pumped by a 2 µm pulsed fiber laser.

What we offer

ISL is a multi-disciplinary French-German research laboratory in Saint-Louis, France. We provide access to all necessary measurement and simulation equipment. Being a bi-national government facility, the applicant has to possess an EU member state citizenship to be eligible for this work.

Your Task

First, power scaling of the pump fiber laser system. Different fiber geometries, doping concentrations and cavity designs have to be investigated with the main goal of obtaining 50 W average power in mode-locked operation and simultaneous Q-switching with well-suited pulses for high SCG efficiencies.

Second, mid-IR SCG in fluoride fibers has to be enhanced in output power and spectral coverage. So far, 5 W are achieved with moderate conversion efficiency. The task will be power scaling and the study of different fiber designs for high power handling and conversion efficiency.

Third, further spectral broadening by SC generation or Raman processes in chalcogenide fibers and other emerging non linear fibers will be investigated for high-power broadband output radiation towards 5 µm.

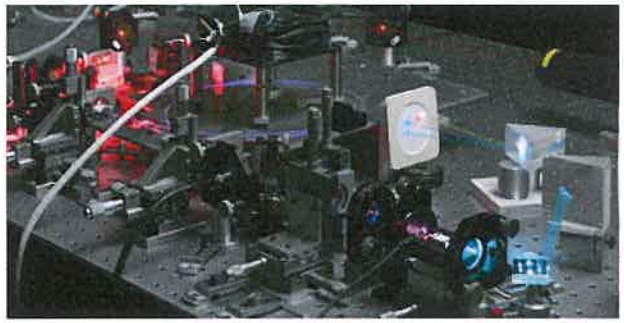

Fig.1: Demonstration laser setup including a Tm^{3+}- doped fiber laser

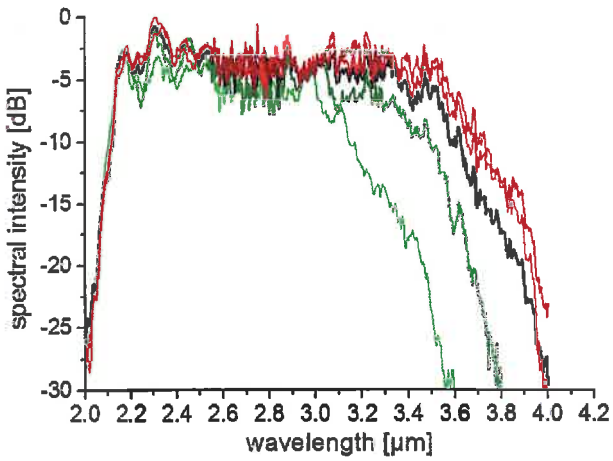

Fig.2: Spectra of the supercontinuum output radiation

[1] C.Kneis, et al., "Mid-IR Supercontinuum Generation in ZBLAN Fibers with High Output Power and High Conversion Efficiency," in Advanced Solid State Lasers, OSA Technical Digest (online) (Optical Society of America, 2015), paper AW4A.10

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