We are pleased to advertise 4 Early-Stage Researcher (PhD) positions to begin as soon as possible, as part of the Innovative Training Network of the European Commission GREAT “Grating Reflectors Enabled laser Applications and Training”. The positions will all last three years, and will allow all students to participate in an exciting programme comprising international schools, workshops, and secondments at academic as well as industrial partners (see the overview of the project below).
Overview of the project and of the training offered to all Early Stage Researchers of GREAT

The overall aim of the GREAT (Grating Reflectors Enabled laser Applications and Training) project is to train a cohort of 15 Early-Stage Researchers (ESRs) through the completion of interconnected individual projects which will deliver innovative approaches for development and use of Grating Waveguide Structures (GWS), from design to implementation in several laser systems. GWS results from the combination of sub-wavelength gratings and planar waveguides. This combination results, by means of an appropriate design of the overall GWS resonances, which are more efficient than current grating-only devices, unique optical components that are enabling for a range of applications. The GREAT projects encompass Photonics, Micro-Nano technologies, Advanced Materials as well as Nanotechnologies, which are among the Key Technologies defined within the H2020 framework, underpinning the competitiveness and renewal of European manufacturing. Moreover, Lasers, is identified as an important industrial sector, where the European Community is a key player, who aims to keep its competitive position (http://www.strategies-u.com/lasers-photonics.html).

The ESRs will be embedded within leading international institutions and trained to work collaboratively to deliver ground-breaking research solutions and novel systems, whilst responding to real-world problems. This is a crucial skill, particularly since there is an overall lack of qualified specialized personnel in this field, with a growing number of active companies worldwide. Critically, this lack of skilled workforce has been identified by the ETP Photonics21 (Photonics21 (2013), “Towards 2020 – Photonics driving economic growth in Europe-Multiannual Strategic Roadmap 2014 – 2020”), as a major challenge for the photonics community, but also highlighting a rich landscape for career progression.

Therefore, the GREAT network will provide each ESR with key learning opportunities along with project specific exposure to important modelling methods, world-leading fabrication tools, or systems development. These will be paramount for the realization of optics based upon GWS, leading to the consolidation and expansion of their use in several advanced application-themes in the field of Laser, such as pulse compression, spectral stabilization and wavelength multiplexing, as well as polarization shaping (generation of beams with radial and azimuthal polarization).

The GREAT consortium includes:

- UNIVERSITAET STUTTGART (USTUTT)
- UNIVERSITE JEAN MONNET SAINT-ETIENNE (LabHC)
- ECOLE CENTRALE DE MARSEILLE (IF)
- UNIVERSITY OF SOUTHAMPTON (ORC)
- UNIVERSITY OF EASTERN FINLAND (UEF)
- GESELLSCHAFT FUR ANGEWANDTE MIKRO UND OPTOELEKTRONIK MIT BESCHRANKTER HAFTUNG AMO GMBH (AMO)
- DILAS DIODENLASER GmbH (DILAS)
- CENTRE TECHNOLOGIQUE ALPHANOV (ALPHA)
- UNIVERSITE DE BORDEAUX (UBx)

plus private sector partners:

- FIBERCRYST SAS
- TRUMPF LASER GMBH
- MODUS RESEARCH AND INNOVATION LIMITED
- Novae
- AMPLITUDE SYSTEMES SA
Available projects (here we summarize the titles and host institutions for the 4 ESR positions):

**ESR 8** (USTUTT, ITO, Stuttgart): Interference lithography (SBIL resp. SMILE) for the fabrication of circular and segmented GWS for the generation of beams with radial and azimuthal polarization.

**ESR 11** (ALPHA, Talence): Highly efficient compressor for high average power and high-energy mid-IR femtosecond lasers.

**ESR 13** (USTUTT, IFSW, Stuttgart): Efficient intra-cavity and extra-cavity generation of beams radial and azimuthal polarization in high-power thin-disk lasers.

**ESR 14** (UBx, Bordeaux): Picosecond and femtosecond high power Ytterbium fiber laser designed for optical parametric devices pumping.

Job descriptions

**ESR 8** (USTUTT, ITO, Stuttgart): Interference lithography (SBIL resp. SMILE) for the fabrication of circular and segmented GWS for the generation of beams with radial and azimuthal polarization.

Support in design of GWS. Accomplishment of development of cost efficient, flexible and high-quality fabrication processes of intra-cavity and extra-cavity polarization shaping GWS. Accomplishment of fabrication and characterization (AFM, SEM) of large areas (> 15 mm in diameter) GWS as cavity end-mirrors and output coupler for 1030 nm wavelength. Accomplishment of fabrication and characterization (AFM, SEM) of large area (> 20 mm in diameter) GWS as extra-cavity polarization converters for 1030 nm wavelength. More specific:

- Development of dedicated Interference lithography setups including its automation.
- Development of process parameters for high quality elements.
- Development of circular GWS with diameter > 15 mm produced and made available for partners for evaluation in high-power laser cavities (CW, ps and fs).
- Development of segmented GWS as polarization converter produced for partners for evaluation in high-power laser systems (CW, ps, fs).
- Development of large area (> 20 mm in diameter) GWS as extra-cavity polarization converters for 1030 nm wavelength.

Specific requirements: Basic knowledge in programming (e.g. MATLAB, python or C++) required. Basic experiences in production processes of optical components (lithography, etching process), basic experiences in handling of optics.

**ESR 11** (ALPHA, Talence): Highly efficient compressor for high average power and high-energy mid-IR femtosecond lasers.

Accomplishment of demonstration of low-energy, low power mid-IR compression with overall compression efficiency (4-passes) exceeding 95%. Accomplishment of CPA amplification in the mid-IR using fiber amplifiers with compressed output > 20 μJ, > 30 W of average power and pulse duration below 300 fs. Accomplishment of demonstration of CPA fiber laser compression with ultrashort 2 μm pulses, i.e. with compressed output > 40 μJ, > 100 W of average power and pulse duration below 150 fs. Accomplishment of scaling of CPA 2 μm fiber amplifier to state of the art high energy, high average power, ultrashort pulse compression. Demonstration of pulse compression to > 1 mJ, sub-ps regime using a regenerative amplifier.

Specific requirements: Basic experiences in handling of fiber optics, laser alignment, and fundamentals of laser physics. Knowledge of ultrafast optics phenomena (femtosecond) would be ideal.
ESR 13 (USTUTT, IFSW, Stuttgart):
Efficient intra-cavity and extra-cavity generation of beams radial and azimuthal polarization in high-power thin-disk lasers
Accomplishment of implementation and qualification of highly efficient grating waveguide structures developed within GREAT for the generation of CW beams with radial and azimuthal polarization in high-power thin-disk lasers at an average power higher than 1 kW with high optical efficiency (> 50 %). Implementation of GWS for the generation of beams with radial/azimuthal polarization in mode-locked thin-disk lasers (> 50 W). Accomplishment of demonstration of power capability of the developed GWS within the experimental investigations. Thermal analysis of the GWS at high-average power. Implementation of GWS as extra-cavity polarization converter in the beam path of CW, ps, and fs lasers.
Specific requirements: Basic experiences in handling of optics, fundamentals in laser physics.

ESR 14 (UBx, Bordeaux):
Picosecond and femtosecond high power Ytterbium fiber laser designed for optical parametric devices pumping.
Accomplishment of implementation of picosecond high power (> 50 W) rod-type Yb fiber laser for pumping of optical parametric oscillator. Comparison of working conditions compression between conventional and GWS filtering within the laser. Accomplishment of recompression of the pulses generated by the Yb fibre laser using GWS gratings and generation of high energy pulse at high repetition rate (~1 μJ, at 50 MHz) and pulse duration lower than 150 fs. Demonstration of pumping ability of an optical parametric oscillator and amplifier using the designed laser to generate tunable (1.3 - 4.5 μm) picoseconds and femtosecond pulses.
Specific requirements: Basic experiences in handling of optics, fundamentals in laser physics. Knowledge of ultrafast optics phenomena (femtosecond) and nonlinear optics would be ideal.

Additional information
The successful candidates will receive a 36 month, full-time employment contract as per Marie Skłodowska-Curie Actions (MSCA) regulations for early stage researchers. The monthly salary will be confirmed upon offer, paid in the currency of the host country, and with a correction factor applied to the host country. The approximate monthly salary before employer and statutory deductions is €3,783 (France) and €3,172 (Germany) plus an additional mobility allowance of €600/month. Researchers may also qualify for a family allowance of €500/month depending on family situation at the time of recruitment. Please visit the EU MSCA website for further information.

The ESRs will be enrolled in an exciting PhD programme of leading academic and industrial researchers. In addition to their individual scientific projects, all ESRs will benefit from a dedicated training program comprising an integrated curriculum of local and intensive network courses, schools, workshops and engagement with cutting-edge research.

Eligibility criteria
There are strict eligibility requirements within Marie Skłodowska-Curie Innovative Training Networks. At the time of appointment, applicants must not have resided or carried out their main activity (work, studies) in the country for more than 12 months in the 3 years immediately before their appointment; AND 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.
Offer Requirements, Skills and Qualifications

- Must have Master (or equivalent) degree in Mechanical Engineering, Mathematics, Physics or Photonics with solid knowledge of optics and its applications.
- Must be in the first 4 years of his/her career, measured from the date of graduation (MSc degree or equivalent).
- Should not hold a PhD degree.
- Should not have resided or carried out their main activity (work, studies) in the country of their appointment for more than 12 months in the 3 years immediately before their appointment. For refugees under the Geneva Convention, the refugee procedure (i.e. before refugee status is conferred) will not be counted as ‘period of residence/activity in the country of the beneficiary’.
- Must be able to communicate fluently in English, in oral and written form.

Selection process

Applicants will need to submit for each application:

- Brief description of why the applicant wishes to become a PhD student within GREAT (Letter of motivation).
- Copy of transcripts and of their degree, and a copy of master's thesis and any other publications (if available).
- Curriculum vitae of three pages maximum.
- Two written recommendation letters (e.g. one by the former Master thesis supervisor and their referees contact details).

PLEASE SEND YOUR FULL APPLICATIONS TO THE FOLLOWING E-MAIL ADRESS:

great@ifsw.uni-stuttgart.de

Only complete applications will be considered.