

2017 HGF - GSI - OCPC - Programme

for the involvement of postdocs in bilateral collaboration projects

Part A:

Title of the project:

Qualification of new laser glass types as amplification medium for FAIR activities

Helmholtz Centre and institute:

GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

Project leader:

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Description of the project (max. 1 page):

The plasma physics program at the FAIR facility relies on the use of a 100 J laser that is going to be built in the next years and made available for day-one experiments in the APPA cave. Such a laser will deliver energetic light pulses at a repetition rate of one shot per few minutes, matched to the repetition rate of the FAIR ion accelerator facility.

The technology chosen for the laser relies on the neodymium-doped glass as an amplification medium because it is a robust and economical solution. While a large part of the laser is going to be built of mostly off-the-shelf components, a few technical bottlenecks have been identified that require a research and development effort. In particular, the repetition rate imposed by the experiment requires operating laser glass amplifiers in an operation mode that is thermally loaded. In this regime, thermally-induced birefringence losses or laser wavefront distortion have a negative impact on the laser beam quality and can ultimately compromise experiments or damage the machine itself. As a consequence, a special care has to be taken in the design of the laser amplifier as well as the thermal properties of the glass that is employed as an amplification medium.

The post-doctorate will have in charge the experimental realisation of a test stand to qualify new types of glass that have been advertised by vendors in the last years. In particular, GSI has built a relationship with the Shanghai Institute of Optics and Fine Mechanics, CAS in China and would need

to evaluate the different type of laser glass that is being offered in views of our application. The test stand will be made to test sizeable samples in a real size prototype laser head.

The results of this study are of interest to a wider community as such materials are being used commercially by laser firms and research institutes worldwide. For instance, institutes like those of CAEP in China or the ELI pillars in Europe will be able to make a direct use of these characterization results. A series of publications is therefore expected as an outcome.

The project is most likely going to be completed in about 12 months. However, depending on the outcome and based on re-evaluation, the project could be extended by 6 to 12 additional months.

Description of existing or sought Chinese collaboration partner institute (max. half page):

The project aims at developing laser amplifiers and qualifying laser glass. In this project, GSI brings its expertise in laser amplifier design optimisation. It is obvious that a partner having a strong expertise in the development of laser glass as a laser amplification medium or having access to such a source is essential to the success of the project. The institute should be also interested in exploring the thermal properties of such material under thermal loading.

In the last years, GSI has built a commercial relationship with the Shanghai Institute of Optics and Fine Mechanics, CAS (SIOM) in China. SIOM has manufactured N31-type glass rods for GSI, a standard commercial product for them. Now, GSI would like to build attest stand were innovative new glass types can be tested and establish an R&D collaboration with this Chinese Institute.

Required qualification of the post-doc:

- The candidate should have a PhD in experimental optics or experimental laser physics. The candidate should have graduated at the time when the post-doc stay in Germany starts and he should have graduated within the 5 years before its stay begins.
- Experience with laser materials, optical metrology: wavefront sensing techniques and polarisation analysis. In particular, the experience of neodymium glass performance evaluation, operation or maintenance in large-scale high-power laser devices is a plus. This includes being familiar with the neodymium glass physical and chemical properties, and processing parameters influence on the final laser output characteristics and being familiar with gain test methods of neodymium glass rod (disc) and optimisation methods.
- Additional skills in programming language: LabVIEW, and in high voltage electronics (power supply) and optomechanics.
- Language requirement: A fluent level of English is mandatory. German is not mandatory but it is a plus.

Part B:

Documents to be provided by the post-doc:

- Detailed description of the interest in joining the project (motivation letter)
- Curriculum vitae (CV)
- copies of degrees as a proof of education qualification
- List of publications (if any)
- 2 letters of recommendation

Part C:

Additional requirements to be fulfilled by the post-doc:

- Very good command of the English language
- Strong ability to work independently and in a team