Centrum HiLASE
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HiLASE Centre is pleased to invite you to attend the seminar:

Development of a Cryogenic Disk Laser System for Application in High-Field Science and Industry

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Tabletop Yb:YAG laser systems can be applied in treatment of micro cracks on the surface of solids through laser shock peening as well as many other areas in high-field science. The repetition rate of such laser systems is mainly limited due to thermal lensing in the gain medium. An elegant technique to increase the repetition rate of a high-pulse-energy laser amplifier towards 1 kHz is cryogenic cooling of a disk with a high aspect ratio while keeping a sufficient gain. Due to a higher absorption cross section at 77 K, the pump laser can be efficiently absorbed in a double-pass geometry without the need of a pump chamber necessary in thin disk lasers. The main drawback of this approach is a much higher level of ASE compared to lasers operated near 300 K. To suppress ASE in a high-gain amplifier, a well-known technique is cladding the disk by Cr^{4+}:YAG or parabolic treatment of its edge. In this talk, through ray tracing of ASE photons inside a disk and solving rate equations, we show that a disk with an optimized bevelled edge can also closely perform to the aforementioned techniques and yield a high pulse energy of 100 mJ at 1 kHz. Towards fabrication of such a cryogenic disk, we report bonding of thin optics onto metallic heat sinks using a two-component epoxy compound with a low coefficient of thermal expansion. Through optimizing the bonding process, we could achieve a surface profile with a PV deviation less than 60 nm, which is necessary to obtain a high beam quality in an amplifier. Testing the bonded optics by a thermal shock to the heat sink in a range of 77-520 K did not result in any cracks or delamination. We also found a way to further improve the surface profile of the disks by a thermal shock at 77 K leading to a smooth spherical surface. We could also expand the bonding technique towards development of efficiently water-cooled optics. Once successful, in-house fabrication of a disk gain medium can open a route of technology transfer to develop laser systems using other gain media such as Tm:YLF or Ho:YLF towards miscellaneous applications in the industry as well as high-field science.

When: Monday, **28/01/2019 at 14:00**

Where: Seminar room, HiLASE Centre

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