Workshop of Consortium for Photon Science and Technology

http://www.c-phost.jp/

Seminar room 201, IMS Main Office Building, Okazaki, Aichi, Japan,
September 11 (Tuesday), 2012

Workshop Organizers;
Takunori Taira, and Takao Fuji, Laser Research Center for Molecular Science, Institute for Molecular Science (IMS), 38 Nishigonaka, Myodaiji, Okazaki, 444-8585, Japan

Cooperated by;
Laser Society of Japan: http://www.lsj.or.jp/
Aichi Science & Technology Foundation: http://www.astf.or.jp

Program

"Micro Solid-State Photonics toward Giant Micro-Photonics"

15:00-15:20 Opening Remarks
T. Taira (IMS, Japan)

15:20-16:20 Cryogenic Yb-doped lasers for efficient nanosecond, picosecond, and femtosecond sources
T.Y. Fan (MIT Lincoln Laboratory, USA)

16:20-16:40 Coffee Break

16:40-17:40 Direct writing of 3D microfluidic and photonic circuits in glass with ultrafast laser pulses
Y. Cheng (Shanghai Institute of Optics and Fine Mechanics, CAS)

17:40-17:50 Closing Remarks
T. Fuji (IMS, Japan)

Cryogenic Yb-Doped Lasers for Efficient Nanosecond, Picosecond, and Femtosecond Sources*

T. Y. Fan

MIT Lincoln Laboratory, 244 Wood Street, Lexington, MA 02420 USA

Operation of lasers at cryogenic temperatures has been used since the very earliest days of laser development. Generally, operation at low temperatures has been viewed as an undesirable and impractical means to improve laser performance. However, many of the fundamental laser materials properties (thermal conductivity, thermal expansion, dn/dT, saturation intensity and fluence) improve significantly as the temperature decreases. Additionally, many rare-earth-ion-doped solid-state lasers that are quasi-three-level lasers at 300 K become 4-level lasers at cryogenic temperature, leading to more efficient laser operation. The overhead associated with cryogenic cooling has been mitigated over time as cryogenics have become increasingly ubiquitous.

Recent laser demonstrations have taken advantage of the improved properties to scale the power of relatively simple end-pumped lasers to 100's of W of output power and provide performance that is not possible with conventional room-temperature lasers. The performance improved performance is particularly of interest for laser systems that need both high average and high peak powers simultaneously. I provide an overview of cryogenic solid-state lasers, discuss recent demonstrations, and give a perspective on the future of this technology.

*This work was sponsored by the Defense Advanced Projects Research Agency under Air Force Contract FA8721-05-C-0002. Opinions, interpretations, conclusions, and recommendations are those of the authors and are not necessarily endorsed by the United States Government.

Direct writing of 3D microfluidic and photonic circuits in glass with ultrafast laser pulses

Y. Cheng
Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, No. 390, Qinghe Road, Jiading, Shanghai 201800, China

Integrated optofluidic devices or microsystems are highly functional miniaturized devices composed of microfluidic and micro-optical components synergistically combined with each other. They have found important applications in chemical sensing, biosensing, and reconfigurable photonics. Femtosecond laser direct writing is a promising technique for fabricating optofluidic devices since it can modify the interior of glass in a spatially selective manner, enabling fabrication of not only optical components such as optical waveguides, 3D free-space micro-optics, and high-Q micro-optical cavities, but also functional 3D microfluidic structures of arbitrary geometries. The unique capability of femtosecond laser direct writing for simultaneously creating microfluidic and optical circuits allows integration of microoptics and microfluidics with extreme flexibility and simplicity. In this talk, we will review the latest progress we made in this research field.