MICRONOVA
CENTRE FOR MICRO- AND NANOTECHNOLOGY
TKK – HELSINKI UNIVERSITY OF TECHNOLOGY

# LASER PHYSICS AND APPLIED PHOTONICS

## OPTICS AND MOLECULAR MATERIALS

## NANO-OPTICS AND LASER PHYSICS GROUP

We study various topics in the fields of laser physics, nonlinear optics, and nonlinear fiber optics. In laser physics the main interests have been in developing miniature diode pumped passively Q-switched solid state lasers that offer cost effective pulsed laser sources for applications in nonlinear optics and fiber optics. These lasers have been used to pump photonic crystal fibers in order to create wide band supercontinuum light, to pump an evanescent-wave pumped cylindrical microcavity laser, and to create visible wavelengths by frequency doubling. We have also studied nematic liquid crystals to perform laser beam shaping exploiting the high nonlinearity of these crystals. We have built lasers for various wavelengths from near-IR to blue. The supercontinuum sources cover wavelengths from 0.4 to 2 μm.

A new spin-off company Arctic Photonics Oy has been started in 2005.

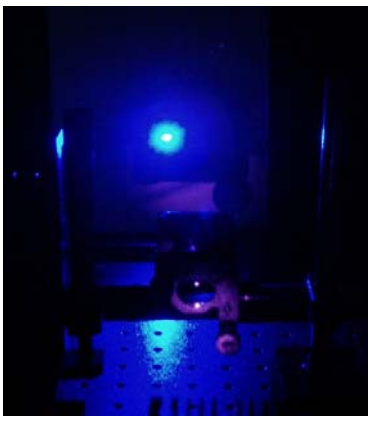

*Figure 1. Frequency doupled Nd:YAG laser at 473 nm.*

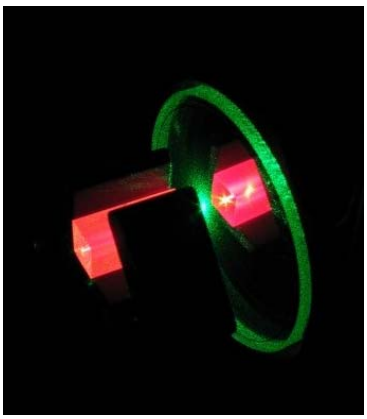

*Figure 2. A picture of a Titanium Sapphire crystal pumped with green laser. light.*

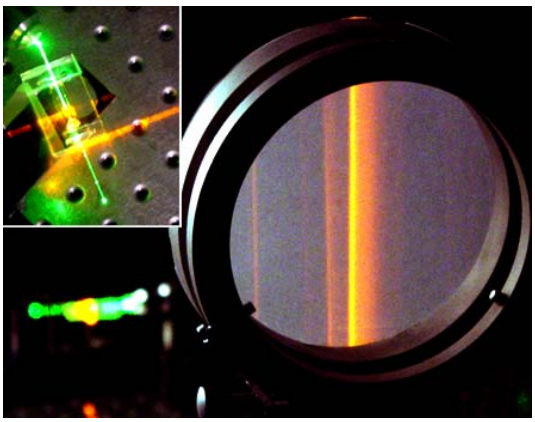

*Figure 3. A picture of an evanescent-wave pumped microcavity laser and its disk-like output radiation.*

**Funding:**

Academy of Finland, TULE-project
Graduate School of Modern Optics and Photonics
Graduate School of Electrical and Communications Engineering

**Industrial Partners:**

Arctic Photonics Oy, Crystal Fibre A/S

**Contacts and Further Information:**

| | | |
|---|---|---|
| Dr. Scott Buchter | +358 9 451 6132 | Scott@focus.hut.fi |
| Dr. Andrej Shevchenko | +358 9 451 3691 | Andrej@focus.hut.fi |
| Dr. Timo Kajava | +358 9 451 3165 | Timo.Kajava@tkk.fi |
| Antti Hakola | +358 9 451 3165 | Antti.Hakola@tkk.fi |
| Ossi Kimmelma | +358 9 451 2339 | Ossi.Kimmelma@tkk.fi |
| Esa Räikkönen | +358 9 451 4492 | Esa.Raikkonen@tkk.fi |

http://omm.tkk.fi

**Recent Publications:**

1. A. Hakola, A. Shevchenko, S. C. Buchter, M. Kaivola, and N. V. Tabiryan, *Creation of a narrow Bessel-like laser beam using a nematic liquid crystal,* JOSA B, Accepted for publication.
2. A. Shevchenko, K. Lindfors, S.C. Buchter, and M. Kaivola, *Evanescent-wave pumped cylindrical microcavity laser with intense output radiation,* Optics Communications, **245**, 349-353 (2005).
3. A. Shevchenko, S.C. Buchter, N. V. Tabiryan, and M. Kaivola, *Creation of a hollow laser beam using self-phase modulation ina nematic liquid crystal,* Optics Communications **232**, 77-82 (2004).
4. A. Shevchenko, S.C. Buchter, N. V. Tabiryan, and M. Kaivola, *Self-focusing in a nematic liquid crystal for measurements of wavefront distortions, Optics Communications* **232***, 439-442 (2004).*
5. A. Hakola, S. C. Buchter, T. Kajava, H. Elfström, J. Simonen, P. Pääkkönen, and J. Turunen, *Bessel-Gauss output beam from a diode-pumped Nd:YAG laser*, Opt. Commun. **238**, 335 (2004).

**Patents**

S. C. Buchter, H. Ludvigsen, and M. Kaivola, *Method of generating supercontinuum optical radiation, supercontinuum optical radiation source, and use thereof,* International patent application WO2005071483.