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Extreme Photonics Seminar

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Title: Laser researches in ILS/UEC for new generation coherent sources

新世代コヒーレント光源を目指した電通大レーザー研におけるレーザー研究

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I have been engaged in the basic research of fiber lasers and solid-state lasers for next generation. Power scaling is the most important subject and has been challenged by various approaches. Coherent laser arrays, in which multiple lasers are phase-locked and their beams are combined, has been investigated and the scaling limit in passive phase-locking of discrete lasers was established. To overcome this limit we are now exploring phase locked multicore fiber lasers in which multiple gain cores are built in a single fiber format. Rare-earth doped photonic crystal fibers, mitigating the nonlinearity by large mode areas, are also investigated and high power femtosecond pulse lasers and multicore fiber lasers have been demonstrated.

We are also pioneering new fiber lasers through precise control of the gain spectra by photonic bandgap fibers, in which core guidance is obtained only at specific wavelengths determined by the fine structure in the cladding. By inhibiting amplified spontaneous emission at high-gain wavelengths, high-power operation can be expected at previously inaccessible wavelengths. High peak-power pulsed fiber lasers are also the target by suppressing stimulated Raman scattering.

Solid-state lasers are investigated especially for ultrashort pulse sources in our group. The transparent ceramic technology is creating new laser materials. Yb-doped sesquioxides, which have higher thermal conductivities and broader gain bandwidths than Yb:YAG, have dramatically increased the available power from sub-100 fs Yb lasers. The conditions of Kerr-lens mode locking, the key to obtain shorter pulses than the gain bandwidth limitation, were established in low beam-quality laser-diode direct pumping. Composite ceramics and new disordered materials are also being explored for broadening the gain bandwidth.

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