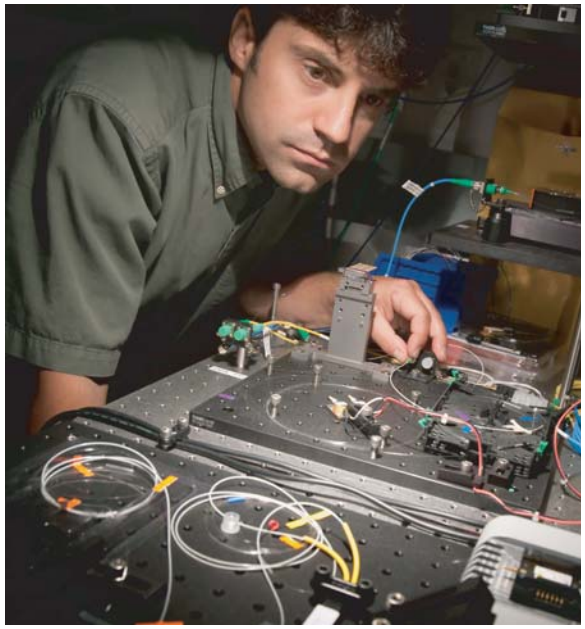
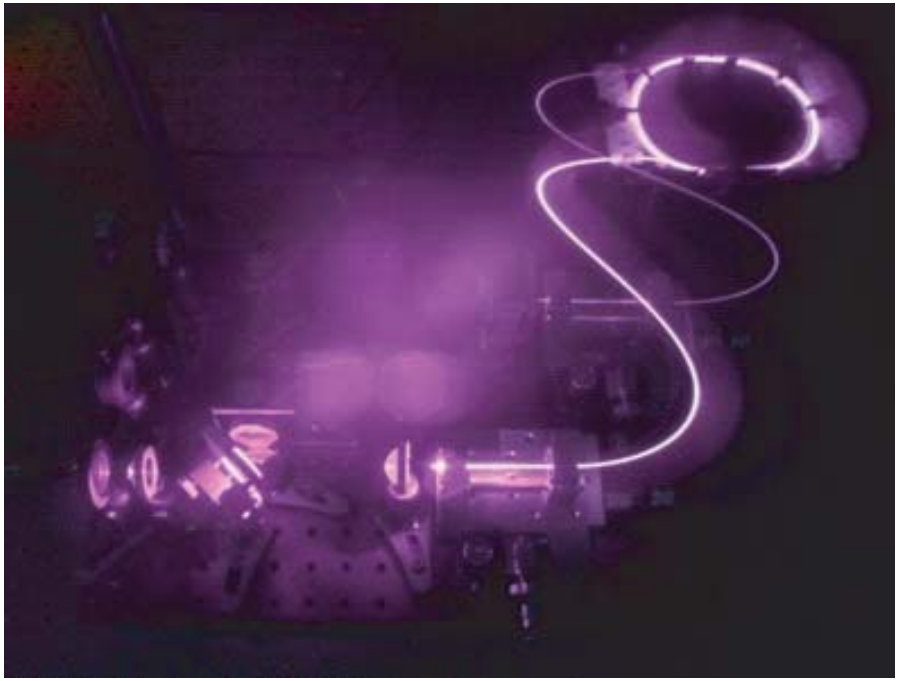
The Institute of OPTICS

Colloquium

UNIVERSITY of ROCHESTER

Spatial Beam Purification in High-Power Fiber Lasers using Gain Filtering





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In this presentation, we explain the concept of gain filtering, its theoretical modeling and experimental demonstration.

3:00 pm, Monday, Jan 25, 2010
Sloan Auditorium, Goergen Hall
Refreshments Served

Spatial Beam Purification in High-Power Fiber Lasers using Gain Filtering

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Abstract:

Scaling fiber lasers to higher output powers is limited by the onset of nonlinear effects and damage. Both of these problems can be mitigated by increasing the fiber core diameter, resulting in a larger mode and thus reduced intensity. However such fibers tend to operate in the multi-mode regime. Many loss filtering techniques have been applied in order to eliminate the undesired modes from the output of the fiber. Such techniques are ultimately limited when scaling to larger core diameters, which places a limitation on either the modal discrimination or the laser efficiency. As such, commercial high-power fiber laser systems are limited to fibers with 25-um core diameter. In this presentation, we explain the concept of gain filtering, whereby gain is preferentially given to the desired mode, resulting in lossless mode filtering. Theoretical modeling is used to reveal the underlying physics of the concept. Numerical simulations predict excellent beam quality and show that the technique is robust, allowing the scaling of fiber core to 100-um diameter with power levels beyond the kW-level. We also present the first direct experimental demonstration of the gain filtering concept. Comparison of conventional and gain-filtered fiber lasers shows a drastic improvement in beam quality using gain filtering, resulting in near diffraction-limited operation at all power levels.

Biography:

John R. Marciante received the B.S. degree in Engineering Physics from the University of Illinois at Urbana-Champaign in 1991 and the M.S. and Ph.D. degrees, both in Optics, from the University of Rochester, in 1992 and 1997, respectively. He worked for the Air Force Research Laboratory from 1991-2001, when he joined Corning Rochester Photonics Corporation. Since 2003, he has been with the University of Rochester, Laboratory for Laser Energetics, earning a joint appointment as Associate Professor of Optics at the Institute of Optics in 2006. Prof. Marciante has served two terms as Topical Editor for the Journal of the Optical Society of America B, with positions as Adjunct Professor at the University of New Mexico, Electrical and Computer Engineering Department, and as Chairman for the IEEE/LEOS Albuquerque Chapter. He is currently the Chairman of the Fiber Modeling and Fabrication Technical Group of the Optical Society of America. His research interests are focused on large-mode-area fibers, high-energy fiber amplifiers, single-frequency fiber lasers, all-fiber optical components, and precision fiber optic systems.