International Scientific Conference on

LASERS, OPTICS, PHOTONICS AND SENSORS

Optical Pumping and Reduction of Droop in Interband Cascade Lasers

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2018: Outstanding Faculty Award
Chair, Congressional Visits Day
subcommittee

Lasers comprised of antimonide-based semiconductor materials are designed to emit efficiently in the 3–6 micrometer wavelength range, an atmospheric transmission window that is eye safe and in which chemical sensitivities are 100–10,000 times better than at shorter wavelengths. In particular, the interband cascade laser employs repeated stages to yield multiple photons per injected electron, as compared with a single photon per injected electron in conventional quantum well lasers. However, even with the significant advances achieved utilizing wave function engineering in these semiconductor heterostructures, declining efficiency with increasing current (droop) at high temperatures limits the power output of these lasers. Optical pumping has been used to demonstrate lasing in interband cascade lasers, and this excitation technique is being applied to isolate efficiency limiting mechanisms and subsequently improve future laser designs. Integration of graphene layers with high electrical, optical, and thermal conductivity on gallium antimonide semiconductor surfaces also will be presented, with the goal of applying these transparent contact layers to further enhance efficiency, as well as to provide a deeper understanding of the integration of 2D and 3D materials.

Biography

Linda Olafsen earned an A.B. in Physics at Princeton University. She then went to graduate school in Physics at Duke University and received her Master's degree in 1994 and her Ph.D. in 1997. Dr. Olafsen accepted a National Research Council postdoctoral research associateship at Naval Research Laboratory in Washington, D.C. for two years before taking a faculty position at the University of Kansas in 1999, first as an Assistant Professor, receiving an Office of Naval Research Young Investigator Award in 2001, and being promoted to Associate Professor in 2005. She joined the faculty at Baylor University as an Associate Professor of Physics in 2006, and then as an Associate Professor of Electrical and Computer Engineering in 2015. She was recognized in 2018 with an Outstanding Faculty Award for Teaching at Baylor University. She is a member of the IEEE (senior member), SPIE, the American Physical Society (lifetime member), the Directed Energy Professional Society, and the Materials Research Society. She is on the editorial board of the MRS Bulletin, chairs the MRS Bulletin book review board, and has served as a member and chair of the Congressional Visits Day subcommittee, organizing visits to Washington, DC to speak with members of Congress about the impact of federal funding of research. Her research is focused on the development of efficient mid-infrared semiconductor lasers at or above room temperature, as well as the application of materials and infrared sensing to biomedical devices and system

KEYNOTE SPEAKER