Solid State Technology and Devices Seminar

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High Power Diffraction-Limited Tapered Diode Lasers

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Abstract: Broad area diode lasers operate with high power and efficiency but suffer from poor beam quality. These devices are incoherent, multimode sources that cannot be focused effectively on a distant target. Nearly diffraction-limited output is critical for applications including directed energy, wireless power beaming, and automotive LIDAR. These applications are presently dominated by diode-pumped laser architectures which rely on the use of “brightness converters”; in this configuration, the light from diode lasers is used to pump another laser medium with high quality single mode output, such as rare earth doped solid-state crystals or glass fibers. These brightness converters add cost and complexity and sacrifice efficiency, wasting 50% or more of the injected diode laser energy by turning it into heat. Recent advancements in diffraction-limited output from tapered diode lasers represent a disruptive technology breakthrough that is poised to revolutionize the laser industry by eliminating the need for the brightness converter. We have demonstrated a new world record of >3 W nearly diffraction-limited output power from a 1550 nm InP edge-emitting tapered diode laser. These devices are operated in continuous wave (CW) mode at room temperature. Our GaAs tapered lasers deliver >9 W output power at 885 nm and 980 nm. These results are enabled by a novel structured contact which permits geometric scaling of the chip dimensions while preserving beam quality.

Bio: Dr. Jenna Campbell is the Director of High Power Laser Engineering at Freedom Photonics, a small business in Santa Barbara, California that specializes in the design and manufacturing of high performance semiconductor lasers and photonic components. Over the past few years, her team has been developing world-class high power lasers, including single mode diode lasers, tapered amplifiers and lasers, and high power fiber-coupled modules. Prior to joining Freedom Photonics, she completed her PhD in Physics at the University of California Santa Barbara, where her experimental research focused on photon—spin interactions of embedded quantum dots in photonic crystal microcavities. Dr. Campbell is an active member of the photonics community and has authored or co-authored >40 conference papers and peer-reviewed articles.