Contribution ID: **305** Type: **talk**

High efficiency, diode pumped Petawatt lasers for the next generation particle accelerators and secondary sources

Monday, September 25, 2017 9:20 AM (40 minutes)

Large laser systems that deliver optical pulses with peak powers exceeding one Petawatt have been constructed at dozens of research facilities worldwide and have fostered research in High-Energy-Density Science, High-Field and nonlinear physics. The high intensities exceeding 1018W/cm2 allow for efficiently driving secondary sources, specifically laser plasma accelerators. The feasibility of numerous applications with transformational character has been demonstrated, while the applicability relies on the laser driver repetition rate and the associated secondary source brightness and luminosity. Extending from the recently demonstrated High repetition rate Advanced Petawatt Laser System (HAPLS) that can deliver Petawatt pulses with luminosity MJ/hour, LLNL has developed several scalable, diode-pumped solid-state laser concepts for single aperture, ultrahigh average power lasers that will enable future applications of secondary sources and laser-matter interaction for the scientific, industrial, and government communities. These new high average power systems are designed to produce up to 300kW average power and petawatt-class peak powers, and emphasize efficiency through direct diode pumping of the amplifier medium.
This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. Lawrence Livermore National Security, LLC

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Session Classification: Plenary 1

Track Classification: Invited Plenary Talk