RY20-15

1. Title: Novel intracavity elements for high peak power semiconductor lasers

2. Individual Sponsor:
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3. Academic Area/Field and Education Level: Experimental optics, electro-optics, physics, electrical engineering (MS or PhD level degree program)

4. **Objective:** Develop novel fast electro-optic structures capable of generating high peak power semiconductor lasers with pulse widths in the nanosecond range and microjoule level pulse energies.

5. Description: High peak powers can be achieved in semiconductor lasers through several methods. Cavity dumping is one technique which has been implemented in vertical external-cavity surface-emitting lasers (VECSELs) allowing kilowatt peak powers and microjoule pulses in the near infrared (NIR). Extending this capability or alternative techniques to the short-wave infrared (SWIR) has applications in LIDAR and active hyperspectral imaging. The characteristics of the semiconductor gain medium can be designed to allow for extension to longer wavelength but the intracavity optics have more limitations than in the NIR. This is the case for saturable absorbers for mode-locked semiconductor lasers and for Pockels cells in cavity dumped semiconductor lasers. Implementation of alternative intracavity optics such as structures based on phase change materials, nonlinear optics, and other optical switches in a compact form and requiring low power would enable new sead laser for supercontinuum sources or pulse-on-demand applications. Consideration must be given to the minimizing the loss of the intracavity element without diminishing the pulse characteristics. Research for this topic includes simulation of the intracavity element, laser simulation, laser demonstration, and application based demonstrations.

6: Research Classification/Restriction: Unclassified, restricted to US Citizens

7. Eligible Research Institutions:
Univ. of Dayton, Wright State Univ., Univ. of Cincinnati, Ohio State Univ., Air Force Institute of Technology, University of Toledo, and Case Western Reserve University.