1. **Research Title:** Novel Semiconductor Laser Development
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level**

Physics/Optics/Electro-Optics/Electrical Engineering and Computer Science (MS or PhD level)

4. **Objectives:** Develop models and/or implement techniques for novel semiconductor laser material and/or cavity development that enable improved output power, beam quality, efficiency, and/or stability.

5. **Description:** Semiconductor lasers are ubiquitous in our daily lives, primarily due to their compact size, inexpensive manufacturing platform, high efficiency, and broad spectral access. Applications that utilize these lasers require highly stabilized lasers, high output power, and/or highly efficient lasers. In order to obtain lasing modes with a high degree of temporal and spatial coherence, novel laser cavities must be designed and fabricated that increase intracavity power while maintaining single mode output. Both surface- and edge-emitting geometries can be engineered for improved performance with appropriate symmetry and modal limiting considerations. This may require new material growth techniques and/or new fabrication techniques to be applied to a particular material system. Understanding of the limitations of the designed device through simulation and modelling and/or experimental fabrication and testing is required before these techniques are developed for application specific devices.

6. **Research Classification/Restrictions:** Unclassified

7. **Eligible Research Institutions:** All

8. **PA Approval #:** AFRL-2025-3405