1. **Research Title:** Coupled Semiconductor Laser Arrays

2. **Individual Sponsor:**

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

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

4. **Objectives:** Develop models and/or implement techniques for stabilized semiconductor coupled laser arrays that utilize symmetry constraints to improve 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 more efficient lasers. In order to obtain lasing modes with a high degree of temporal and spatial coherence, laser cavities have to be designed with symmetry considerations in mind, which evolved recently to include supersymmetry (SUSY) and topological concepts. These advances provide paths to unimodal power scaling and feedback-insensitive semiconductor lasers resilient to defects, two critical features for effective and highly compact optical systems. These operating principles rely on arrays of coupled resonators with an overall cavity symmetry that allows for the control and manipulation of fundamental "super modes". Understanding of the limitations of these devices through simulation and modelling and/or experimental fabrication and testing is required before these techniques are developed for applications.

6. **Research Classification/Restrictions:** Not Classified/Not Restricted

7. **Eligible Research Institutions:** All

Keyword: Semiconductor Lasers, SUSY, Topological Lasers, Photonic Crystal Lasers

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