1. **Research Title:** Topological Laser Arrays

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Optics, Physics, Electro-Optics, Electrical Engineering/MSc or PhD

4. **Objectives:** Perform optical characterization of ring laser arrays to identify signatures of topological, bulk and trivial modes, in order to tune device process development for coherent, power scaling lasers. Model topological arrays and assess the effects of disorder, cavity shape, coupling to waveguides.

5. **Description:** Topology emerged as a powerful tool to enforce coherence in microlaser arrays. By engineering the couplings between neighboring microlasers, it has been demonstrated that large numbers of elements can lase in modes resilient to disorder and with powers scalable with the device size. New topological cavity shapes are being proposed that go beyond this linear scalling. This features are attractive in standard semiconductor materials compatible with integrated silicon photonics for communications and sensing. The onset of topological behavior and the stability of emission depend on the level of fabrication non-uniformities in the array, array size and shape, and thermal effects. The goal of this project is to close the loop between modeling and device assessment via optical, electrical and thermal characterization. Characterization entails analyzing single element lasing properties (threshold, slope efficiency, stability), two-element coupling (mode splitting), and then mapping of site properties inside full arrays. Mode splitting, resonance and Q-factor maps extracted from spectral measurements will be fed into basic models that account for disorder and inform process design.

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

7. **Eligible Research Institutions:** All

Keywords: Lasers, Photonics, Topology, Optical Characterization

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