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Nanopatterned Phase-Change Materials for High-Speed, Continuous Phase Modulation

1. Research Title: Nanopatterned Phase-Change Materials for High-Speed, Continuous Phase Modulation.

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

4. Objectives: The objectives of this research are to develop techniques for improving the performance of phase change material (PCM) based photonic/optical devices with high speed operation and continuous phase response.

5. Description: Phase change materials alter their optical, dielectric, and electrical properties using external excitations in the form of optical, electrical or thermal stimuli. PCMs are currently heavily studied due to their usefulness in electronic memory and programmable optical and material properties. This unique aspect of PCMs can lead to a new class of photonic/optical devices, e.g. modulators, filters, switches, couplers, sources, detectors, and beam-shapers/steerers. However, although the potential of PCMs is well recognized, the ultimate limits on their performance is less well understood. One concern is the limitation of speed, as it is desirable for any optical operation to take place within the sub-nanosecond regime. The other concern is the binary/discrete nature of the phase transition, which does not lend itself to arbitrary phase modulation from 0 to 2π, a requirement for effective light modulation. This project involves nanopatterning of the PCMs to address both problems, and come up with novel structures to both improve the speed and ensure an effectively continuous phase response of the PCMs. One aspect of the project is thermal in nature (heat transport), while the other is photonic-based (optical properties).

6. Research Classification/Restriction: Not Classified/Not restricted

7. Eligible Research Institutions

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