Phase 2 Project Summary

Firm: Luminit, LLC
Contract Number: NNX-10-C-A56C
Project Title: Integrated Spatial Filter Array

Identification and Significance of Innovation: (*Limit 200 words or 2,000 characters whichever is less*)

Luminit is developing an innovative Integrated Spatial Filter Array to address NASA's Terrestrial Planet Finder (TPF) mission for detection of earth-like planets, climates, habitability and life beyond our solar system. iSFA is based on planar lightwave circuit (PLC) technology. The advantage of iSFA compared to current fiber SFA technology is that it eliminates the need to precisely place and align individual fibers. The PLC array technology enables development and fabrication of a 2-dimensional (2D) iSFA prototype with a 30×30 or larger single-mode PLC array aligned with a pair of micro lens arrays at the input and output side.

Technical Objectives and Work Plan: (*Limit 200 words or 2,000 characters whichever is less*)
The goal of Phase II was to further develop the integrated Spatial Filter Array (iSFA) technology proven feasible in Phase I, and to develop a full-scale 2D iSFA prototype to benefit NASA's TPF mission. To reach this goal, we established the following technical objectives.

Objective 1. Optimization of Phase I iSFA design, including single mode PLC waveguide parameters, mode profiles and coupling efficiency with lenslet arrays.
Objective 2. Fabrication of PLC arrays, using state-of-the-art photonic fabrication processes.
Objective 3 Assembly and packaging of a prototype iSFA, including a 2D PLC array and input and output lenslet arrays.
Objective 4. Testing and evaluation of the prototype iSFA.

To achieve these objectives, Luminit defined the following tasks:

Task 1. Optimize iSFA Design
Task 2. Select and Acquire Lenslet Arrays
Task 3. Test and Evaluate Lenslet Arrays
Task 4. Optimize Waveguide Array Parameters
Task 5. Design Waveguide Array Masks
Task 6. Prepare Statement of Work
Task 7. Fabricate Waveguide Arrays
Task 8. Polish Waveguide Array Chips
Task 9. Assemble Waveguide Arrays
Task 10. Integrate Lenslet Arrays
Task 11. Test Prototype iSFA
Task 12. Package iSFA
Task 13. Prepare and Conduct Performance Test
Task 14. Commercialize iSFA
Task 15. Prepare and Submit Reports

Technical Accomplishments: (*Limit 200 words or 2,000 characters whichever is less*)

During Phase II, Luminit successfully assembled a 35×30 PLC array-based iSFA prototype with ~1,000 single mode PLC waveguides operating in the 500-750 nm spectral range. This objective was achieved by:

- Designing, modeling, simulating, and optimizing single mode PLC waveguides,
- Designing, simulating, and optimizing microlens arrays,
- Fabricating PLC waveguides and microlens arrays,
- Assembling, packaging, and testing a 2D PLC array and iSFA prototype.

NASA Application(s): (*Limit 100 words or 1,000 characters whichever is less*)

NASA's applications include amplitude and wavefront control in high contrast-nulling coronagraph imaging for detection of earth-like planets, climates, habitability, and life beyond our solar system.

Non-NASA Commercial Application(s): (*Limit 200 words or 2,000 characters whichever is less*)

Commercial applications of iSFA include synthetic aperture LADAR, coherent laser beam combining, wavefront amplitude, and phase control, and coupling with arrayed waveguide gratings (AWG), as well as optical add-drop multiplexers (OADM), and optical cross-connect switches in high-speed optical networks.

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