Integrated Omni-Directional Optical Phased Array Transceivers with Sub-Wavelength Element Spacing and Automatic Beam-Alignment

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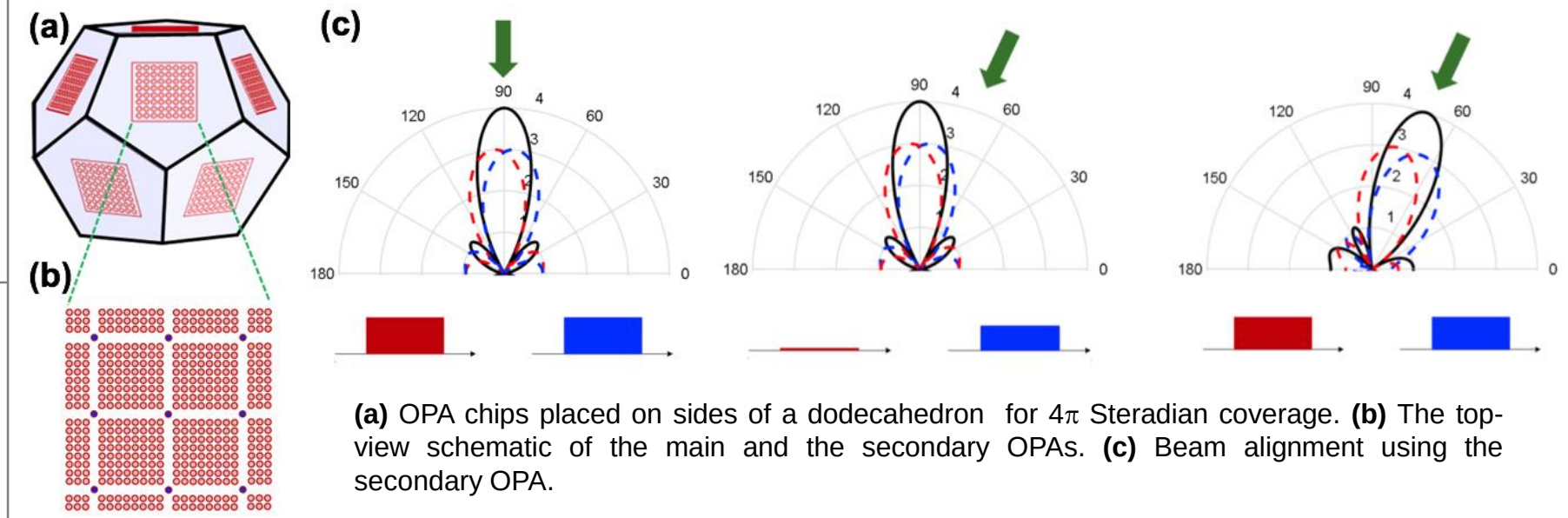
Research Objectives

- Implementation of integrated 2D-OPAs with large number of elements & sub-wavelength spacing
- 4π Steradian steering and tracking coverage
- Large field-of-regard and short tracking time
- 0.1-10 Gbps variable data-rate
- Ultra compact
- Low power consumption and cost



(a) OPA chips placed on sides of a dodecahedron for 4π Steradian coverage. **(b)** The top-view schematic of the main and the secondary OPAs. **(c)** Beam alignment using the secondary OPA.

Approach & Methods

- Monolithic integrations on CMOS SOI
- Placing 12 OPA chips on sides of a pentagonal dodecahedron to achieve 4π Steradian coverage
- Use of secondary OPA to perform real-time tracking with uninterrupted communication
- Coarse and fine resolution beam tracking

Potential Impact

- The proposed OPA technology significantly reduces the mass, power consumption, and volume of free-space optical communication systems while providing high bandwidth and data-rate, fast tracking and full space coverage and hence greatly reduces the cost and increases the reliability for space deployment and contributes to future satellite optical omni-directional communication and Optical-Multiple-Access capabilities.