Experimental Demonstration of In-Plane Negative-Angle Refraction with an Array of Silicon Nanoposts

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Abstract

Controlling an optical beam is fundamental in optics.. Recently, unique manipulation of optical wavefronts has been successfully demonstrated by metasurfaces. However, the artificially engineered nanostructures have thus far been limited to operate on light beams propagating out-of-plane. The in-plane operation is critical for on-chip photonic applications. Here, we demonstrate an anomalous negative-angle refraction of a light beam propagating along the plane, by designing a thin dielectric array of silicon nanoposts. The circularly polarized dipoles induced by the high-permittivity nanoposts at the scattering resonance significantly shape the wavefrorit of the light beam and bend it anomalously. The unique capability of a thin line of the nanoposts for manipulating in-plane wavefronts makes the device extremely compact. The low loss all-dielectric structure is compatible with complementary metal-oxide semiconductor technologies, offering an effective solution for in-plane beam steering and routing for on-chip photonics.

Keywords

Author Keywords: Negative-angle refraction; silicon nanoposts; circularly polarized dipoles; resonant particle; on-chip beam steering nanophotonics

KeyWords Plus: PHASE DISCONTINUITIES; LIGHT-PROPAGATION; REFLECTION; METASURFACES; SURFACES

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