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3D printed optics achieves broadband structured light

Structured light has gained in popularity of late, fueled by a toolbox for arbitrary control of light's many degrees of freedom. Although this toolbox is very sophisticated and diverse, it is still primarily centered on single wavelength digitally controlled structured light, only recently expanding into broadband structured light modes. Here, tools are combined from Fourier optics with recent advances in grayscale 3D nano-printing of optical materials to design and fabricate micro-optical elements for the creation of broadband structured light beams by phase-only and full complex amplitude modulation. Importantly, this approach allows to fabricate a single device at a design wavelength and later use it for non-design wavelength operation, as well as multiple wavelengths simultaneously, which is demonstrate across ≈200 nm bandwidth. A myriad of optics is created to produce orbital angular momentum, Hermite–Gaussian, and Laguerre–Gaussian beams, with measured purities in the 94% – 100% range, for non-design wavelengths. This work provides a compact, simple and cost-efficient tool for control of the spatial-spectrum of structured light.

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