Simulation and Generation of Fiber Optic One-dimensional Airy-like Beam

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Laser beam shaping techniques has attracted attention of many scientists in recent decades and properties of these beam is used in various fields. Among those special beams, Airy beam, whose intensity distribution is proportional to the square of Airy function, has interesting characteristics, like self-healing property, non-diffractive nature, and self-accelerating beam trajectory, leading the recent trends on beam shaping. This beam is typically generated by high cost components such as the spatial light modulator or meta-material lens. Instead of the bulky and expensive optical devices, fiber optics can be an alternative method for beam shaping technologies by interdisciplinary researchers. Following this current trend, we fabricated the component then simulated and experimented on it.

To prepare the all-fiber Airy-like beam generator, the single mode fiber (SMF), 250μm of the coreless silica fiber (CSF), and 70μm of graded index fiber (GRIN fiber) should be spliced. Finally, the 200μm radius cylindrical lens is implemented with an offset, fixated by optical adhesive of refractive index 1.48.

We got the figures of beam profile by translating the objective-CMOS sensor assembly along the z axis, the peak positions for several plane were measured and plotted. The curved trajectories were demonstrated, which is the unique characteristics of the Airy-like beam generator. And we also experimented that along its main beam, the polystyrene bead was optically transported by scattering force, which also support that the Airy like beam is generated.