Propagation of Diffraction-Free Truncated Airy Beams In Unbiased Photorefractive Media

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Recently, a new type of quasi-diffraction free waveform called an Airy beam has been observed to successfully propagate in free space without spreading over long distances[1]. Despite having been predicted over thirty years ago, few studies observing Airy beams in practice have been conducted. We seek to verify earlier predictions put forth by Christodoulides and Coskun[2] that a truncated Airy beam will propagate entirely diffraction-free through an unbiased photorefractive crystal, specifically strontium barium niobate. In order to create a truncated Airy beam, we take advantage of the fact that the Fourier transform of such a beam is equivalent to a Gaussian beam imprinted with cubic phase. We collimate a green helium-neon laser beam before using a spatial-light modulator to modulate the beam with cubic phase, then after scaling the resulting beam to an appropriate size, Fourier transform the beam by sending it through a cylindrical lens; the photorefractive crystal is placed one focal length away from the Fourier transform lens so that the truncated Airy beam may travel through the crystal. The propagation of the wave packet through the photorefractive media is observed by imaging the front and back faces of the crystal on a carefully aligned CCD camera through a 5x microscope objective.

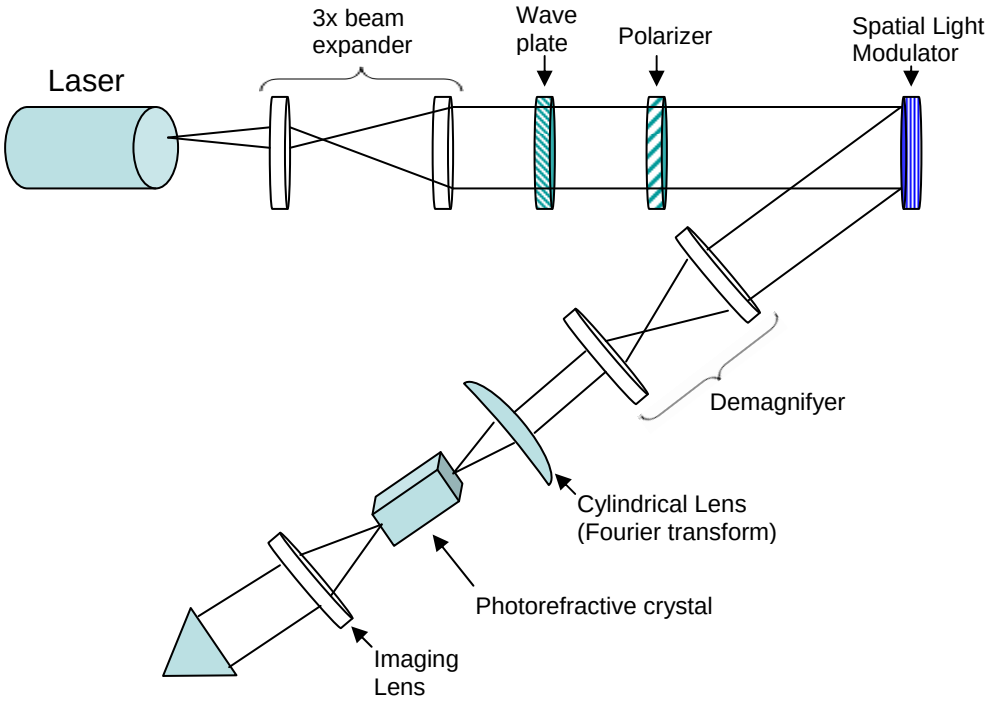

Figure 1: Setup for creation of Airy beams and observation of their propagation through unbiased photorefractive media.

[1] G.A. Siviloglou, J.Broky, A. Dogariu, and D.N. Christodoulides. “Observation of Accelerating Airy Beams”, *Phys. Rev. Lett.* **99**, 2139011-2139014 (2007).

[2] D.N. Christodoulides and T.H. Coskun. “Diffraction-free planar beams in unbiased photorefractive media”, *Optics Lett.* **21.18**, 1460-1462 (1996).