Title:	Generation & Characterization of Dark- Hollow and Bessel-Gauss Beams Using Spatial Light Modulator
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Abstract:	Here in this thesis, we present both theoretically as well as experimentally the transformation of a Gaussian beam into a Bessel-Gauss and Dark Hollow (Annular) beams by a phase-only liquid crystal spatial light modulator (LC-SLM) which is based on the reflective beam shaping method. The input Gaussian beam is shaped in the first order of diffraction in the far-field using a computer-generated hologram (CGH) on SLM. We demonstrate experimentally the generation of Bessel modes and Dark Hollow beam and study their characteristics of propagation in free space and using a focusing lens. Bessel- Gauss beams are formed to propagate plane waves with a conical phase structure and possess remarkable characteristics: they travel without spreading and revert to their original phase and amplitude after passing through an impediment. We compared the process of generating Bessel-Gauss Beam using different types of CGH like Axicon phase only and a diffraction grating. Higher-order modes are generated by implementing the helical phase along with the Axicon phase. The generation and propagation properties are studied with different order of beam and cone angle of the Axicon phase. An interesting feature of the Gouy phase of Bessel-Gauss beams is studied using an interferometry setup. The interference patterns were recorded at various propagation distances and exhibit spatial periodicity, consistent with the period predicted by the linear rise in the Gouy phase shift of the generated Bessel-Gauss beams. We also studied the Dark hollow beams generated by SLM using CGH of the obstruction of different sizes. The propagation properties of the generated beam are studied for different obstruction sizes. The modes have been used to manipulate microparticles, create atomic dipole traps, and guide atomic particles. Due to the orbital angular momentum carried by high-order Bessel-Gauss beams, they have been employed as the foundation for information encoding in both the classical and quantum regimes.
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