Photonic jets generated by a spherical particle excited by a shaped beam

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Photonic jets (PJs) are narrow and elongated spots which have a subwavelength beam waist and propagate with little divergence for several wavelengths. The feasibility of using a photonic jet to design super-resolution optical microscopy [1], tools for precision cell surgery and tumor detection [2], applications in optical tweezers [3] as well as to develop optical data storage devices with ultrahigh density of information recording and technologies of direct write nano-patterning [4] makes the photonic jet a hot research spot in recent years.

The key parameters of PJs (transverse dimension, length, peak and intensity) formed in the vicinity of homogeneous dielectric microspheres and microcylinders under exposure of plane wave radiation has been thoroughly studied. These studies have shown that both the PJs shape and intensity depend significantly on the size and optical properties of a generating particle. However, there is limited studies on the investigation of the properties of a PJ excited by a shaped beam. As we realized that by the use of sharply focused laser beams or structured beams, where additional localization of a photonic stream and its effective volume reduction can be achieved, the properties of a PJ would be changed and some features will be enhanced.

In this talk we will report our recent work on the investigation of PJ generated by spherical particles excited by shaped beams. The tunable of PJs parameters brought by structured beams, including Bessel beam, Gaussian beam, and by properties of particles are discussed. Numerical results concerning the position of maximal intensity, longitudinal and transversal dimensions of the PJs, and its peak intensity will be presented.

References

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