Acoustic radiation force exerted by a subwavelength focused beam

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Subwavelength focused beams arise in the plane wave scattering in the nearfield of the sphere shadow side. Due to the small waist and divergence, these kinds of beams are attractive for high resolution microscopy techniques for imaging and particle manipulation applications. A similar phenomenon was shown in the field of optics. This phenomenon is called "photonic jets". In this work, we investigate the acoustic radiation force generated by a subwavelength focused beam on fluid and polymer microparticles. The beam was generated by a Rexolite sphere with 4.07λ-radius (Mie Regime), placed in the wavepath of an incident traveling plane wave. Using the finite element method (FEM), we perform numerical simulations of the acoustic radiation force acting on microparticles immersed in water at room temperature. We found that the acoustic forces acting on these small particles depend strongly on the contrast factor of the particle, as well as on the intensity and the beam width of the beam. In our simulations, benzeno and soft rubber (Rayleigh Regime) were trapped in spot region of the focused beam. Secondary radiation force between two droplets of benzeno were analyzed. In conclusion, our results may foster a design of a single beam acoustic tweezer working beyond the diffraction limit. This result can be a useful tool to particle manipulation problems.

Keywords: Acoustic scattering, acoustic radiation force, particle manipulation.