**Photophoresis-based Laser Guiding of Airborne Microparticles Using Structured Laser Beams**

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**Abstract:**

The creation of the optical tweezer was one of the most significant events of the 20th century and provided scientists and researchers in various fields with a unique non-invasive method of three-dimensional trapping and guiding of nano- and micro-objects in a liquid medium or vacuum. In the last decade, active research has been conducted in the field of development of optical traps operating in air, allowing the manipulation and analysis of various aerosol airborne light-absorbing particles. An important feature of the manipulation of light-absorbing particles in the air is that with this method of trapping, the action of radiation pressure becomes almost imperceptible compared with the photophoretic forces resulting from momentum transfer between particles and surrounding gas molecules. It is well-known that the use of tightly focused Gaussian beams perfectly solves the problem of laser trapping and confinement of the nano- and micro-objects, both in liquid and gaseous media. However, the use of various so-called structured laser beams, which have become widespread in many areas of optics and photonics in recent decades, allows one to realize various types of manipulation with the trapped particles, including their rotation and three-dimensional guiding. Here, we investigate passive and active laser guiding of airborne light-absorbing particles using different structured laser beams – superpositions of optical vortex (OV) beams, circular Airy beams (CAiBs), and conventional two-dimensional Airy beams (AiBs). While superpositions of OV beams and CAiBs can be used for the generation of self-healing bottle beams, AiBs allow one to create curved light channels for passive guiding of the trapped particles along the accelerating trajectories. The unique properties of these beams, namely propagation along accelerating trajectories, self-healing, and auto-focusing properties allow one to use them for manipulation of airborne particles hidden behind obstacles. The experimental results demonstrate the possibility of a controlled three-dimensional movement of the agglomerations of carbon nanoparticles.

**Biography:**

Alexey Porfirev is a senior researcher in the Intelligent Video Data Analysis Laboratory of Image Processing Systems Institute of RAS—Branch of the FSRC “Crystallography and Photonics” RAS (Russia). He received his master’s degree from Samara National Research University (2010) and his Ph.D. in Optics from Samara National Research University (2013). Her primary research interests are in the field of diffractive optics, laser manipulation, and structured laser beam shaping.