# Optical guiding of microparticles with snake-like beams

**Yansheng Liang, Baoli Yao, Ming Lei[a)]**
**State Key Laboratory of Transient Optics and Photonics, Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Sciences, Xi'an 710119, China**
**[a)] E-mail: leiming@opt.ac.cn**

**Keywords:** Optical trapping; Axial-plane optical trapping; Axial-plane imaging

Optical guiding is playing an increasingly important role in life sciences for specific particles transportation and sorting. Shaping of various novel beams is crucial for the applications of optical guiding. In this letter, we report a new kind of optical beams, namely snake-like beams, for optical guiding. To create such beams, we proposed an axial-plane Gerchberg-Saxton (AP-GS) iterative algorithm. We further develop a technique of simultaneous manipulating and imaging of particles in the axial plane for study of the optical guiding dynamics of snake-like beams. With this technique, we demonstrate the optical guiding of 4 μm polystyrene microbeads using various designed snake-like beams. We achieve a guiding distance of over 100 μm and maximal lateral deviation of 20 μm with four turns during the guiding process under the focusing numerical aperture of 0.95. This technique may provide a new tool for the research in microfluidics, colloidal chemistry, biomedicine, etc.

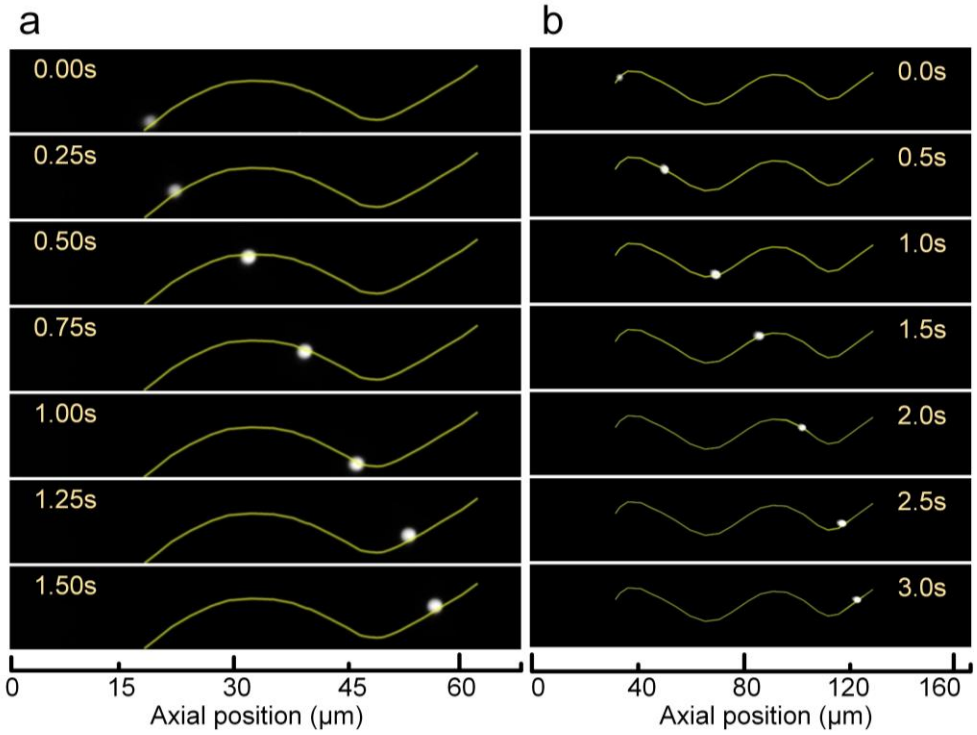


Figure 1. Optical guiding of 4 μm polystyrene microbeads with the proposed snake-like beams. (a) Optical guiding results with a single-S snake beam. (b) Optical guiding results with a double-S snake-like beam. Position of z=0 μm indicates the focal plane of trapping objective and the bottom of the square microtube. The yellow curves indicate the paths of snake-like beams.

## Reference:

[1] A. Curran, S. Tuohy, D. G. A. L. Aarts, et al, "Decoupled and simultaneous three-dimensional imaging and optical manipulation through a single objective," Optica, **1**(4): 223-226 (2014).

[2] G. Thalhammer, R. Steiger, and Bernet S, et al, "Optical macro-tweezers: trapping of highly motile micro-organisms," J. Opt., **13**(4): 044024 (2011).