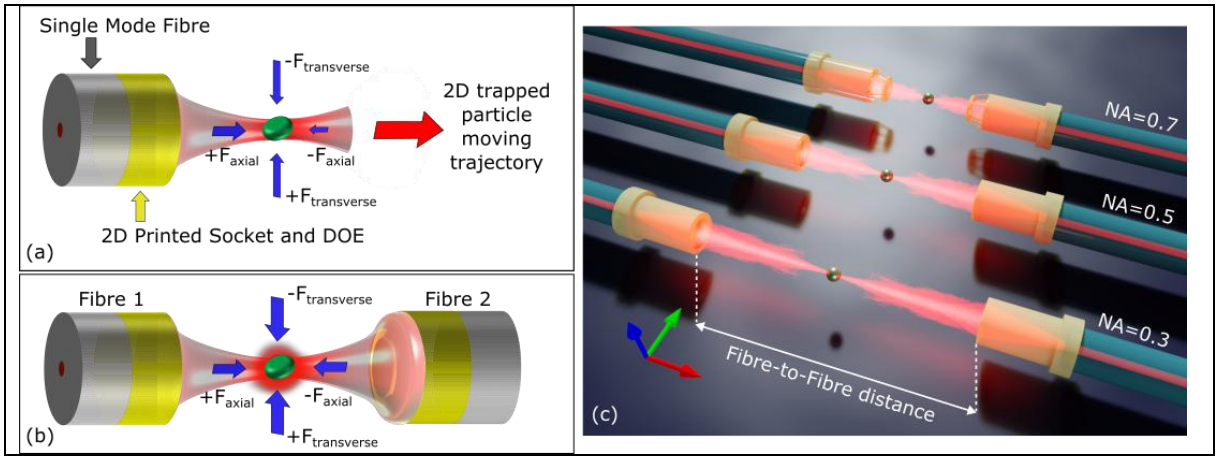
Bsc/MSc Thesis: Lab on a chip: Optical Trapping of Blood Cells on a Chip

Optical trapping was first developed by Ashkin in 1987 [1] which gave him a Nobel prize in physics last year. Since its initial discovery, this process has had many developments in terms of technology which opened many applications in biology, biophysics, medicine, atom trapping, nanotechnology etc.

One of the key improvements in current research is to miniaturize the trapping setup so that instead of bulky microscope objectives, smaller components can be used. In this process we are using two optical fibres with 3D printed focusing lenses in a counter propagating arrangement. The two beams facing each other create a trap in the middle, at a fibre-to-fibre distance twice the focal length of the fibre.



Reference

Ashkin, Arthur, and James M. Dziedzic. "Optical trapping and manipulation of viruses and bacteria." *Science* 235 (1987) 1517

Your task:

So far, the trapping is performed in an experimental setup in which fibres are held by a fibre holder in a custom made fluidic chamber. To have a more robust optical trapping system, we would like to make a glass chip which contains the fibres and a fluidic chamber. Your task is to create a glass chip with V-grooves and fluidic chamber (with 3D printing) and mount the fibres on the chip at the correct fibre-to-fibre distance so that an optical trap is created in the middle. Once the chip is ready, you should be testing it for cell trapping, using live cells such as yeast cell or blood cell.
This would constitute the first lab on a chip for trapping of red blood cells!

Required skills:

- Interest in optics
- Interest in experiment-computer interaction (Labview)
- Hands-on and practical attitude

Contact:

If you are interested please contact:

- Dr. Asa Asadollahbaik (a.asadollahbaik@pi4.uni-stuttgart.de)
- Prof. Harald Giessen (h.giessen@pi4.uni-stuttgart.de)