Title	# An optically driven pump for microfluidics
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Abstract	We demonstrate a method for generating flow within a microfluidic channel using an optically driven pump. The pump consists of two counter rotating birefringent vaterite particles trapped within a microfluidic channel and driven using optical tweezers. The transfer of spin angular momentum from a circularly polarised laser beam rotates the particles at up to 10 Hz. We show the that the pump is able to displace fluid in microchannels, with flow rates of up to 200 $\mu m^3 s^{-1}$ (200 fL s^{-1}). The direction of fluid pumping can be reversed by altering the sense of the rotation of the vaterite beads. We also incorporate a novel optical sensing method, based upon an additional probe particle, trapped within separate optical tweezers, enabling us to map the magnitude and direction of fluid flow within the channel. The techniques described in the paper have potential to be extended to drive an integrated lab-on-chip device, where pumping, flow measurement and optical sensing could all be achieved by structuring a single laser beam.
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