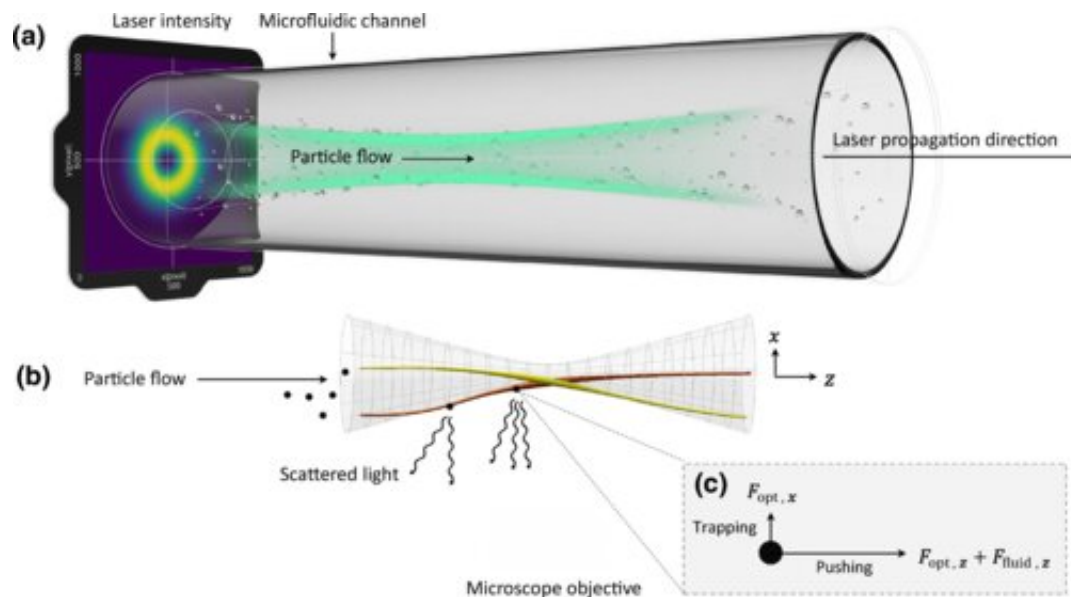


Optofluidic force induction allows for real-time nanoparticle characterization

September 9 2022, by Bob Yirka



Schematics of the optofluidic force induction (OF2i) scheme. (a) Particles are immersed in a fluid and are pumped through a microfluidic channel. A weakly focused Laguerre-Gaussian laser beam with an OAM propagates in the same direction as the particle flow, and exerts optical forces on the nanoparticles. By monitoring the light scattered by the particles through a microscope objective, one obtains information about the scattering cross sections and via particle tracking the velocities of the individual particles. (b) Simulated trajectories for two selected particles. Because of the OAM particles move along spiral-shaped trajectories, thus suppressing collisions and particle blockage in the focus region. (c) The optical force $F_{opt,z}$ and the fluidic force $F_{fluid,z}$ acting on a particle control the flow in the propagation direction z , the optical force $F_{opt,x}$ provides optical 2D trapping in the transverse direction x (the trapping force along y is not shown). Credit: *Physical Review Applied* (2022). DOI: 10.1103/PhysRevApplied.18.024056

A team of researchers at Brave Analytics GmbH, working with a colleague from the Gottfried Schatz Research Center and another from the Institute of Physics, all in Austria, has developed a device that is capable of conducting real-time nanoparticle characterization. The group published their work in the journal *Physical Review Applied*.

Over the past several decades, product engineers have increasingly added nanoparticles to products to give them desired qualities—to thicken or color paints, for example. The types of nanoparticles used depend on many factors, such as their composition and shape, which are generally easily determined. The size of the nanoparticles is also important to ensure consistency, but figuring out how big they are has proven to be more challenging. One approach called dynamic light scattering has been found to work well, but only with tiny nanoparticles. In this new effort, the researchers created a device that can be used to determine the size of larger nanoparticles.

The new device is based on optofluidic force induction (OF2i). It consists of a clear cylinder and a [laser beam](#). In use, the cylinder is filled with water into which sample nanoparticles have been added—in this case, tiny bits of polystyrene. The laser is fired in a way that allows the light to travel in a spiral through the water, forming a water vortex.

The [laser light](#) is used in two ways: to push the nanoparticles through the water and to track their motion. In such a setup, the amount of acceleration experienced by a given nanoparticle will depend on its size. The researchers suggest it is similar to a sailboat. Two boats of the same size experiencing the same force of wind will be pushed at different speeds if they have differently sized sails. And because the laser forms a vortex, the nanoparticles travel in a spiral, making collisions less likely.

The light scattered after bouncing off of the nanoparticle can then be viewed with a time-lapse microscope, which can reveal the paths taken by the individual nanoparticles. Analysis of the shape of such trajectories can be used to determine changes in velocity due to the force exerted by the [laser](#) and in so doing reveal the size of the nanoparticles. Testing showed the device capable of measuring [nanoparticles](#) in the range of 200 to 900 nm.

More information: Marko Šimić et al, Real-Time Nanoparticle Characterization Through Optofluidic Force Induction, *Physical Review Applied* (2022). [DOI: 10.1103/PhysRevApplied.18.024056](https://doi.org/10.1103/PhysRevApplied.18.024056)

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