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Supplementary Materials for

Nanometer-precision linear sorting with synchronized optofluidic dual barriers

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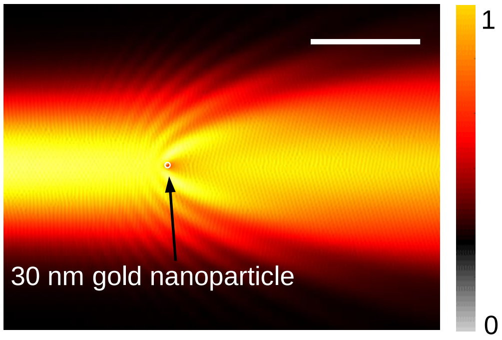
This PDF file includes:

Supplementary Materials and Methods



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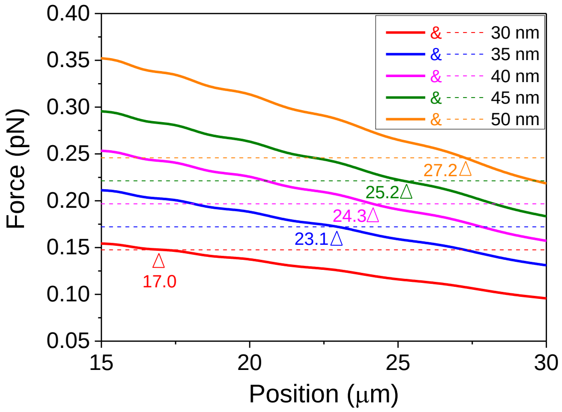

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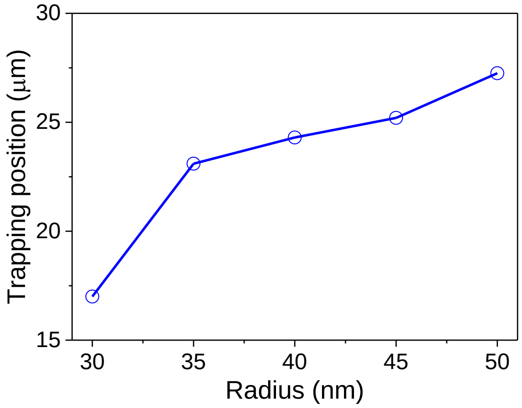

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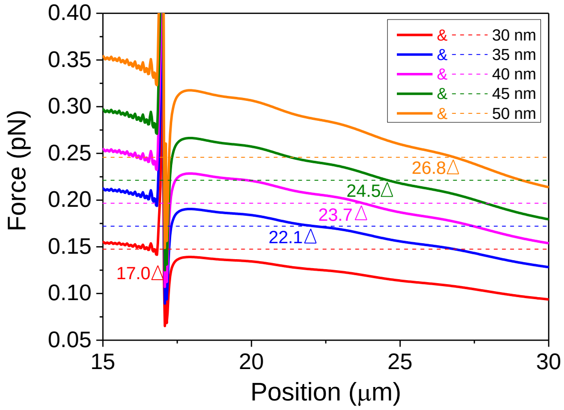

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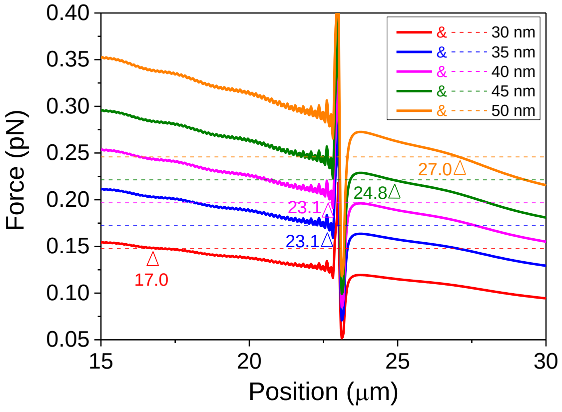
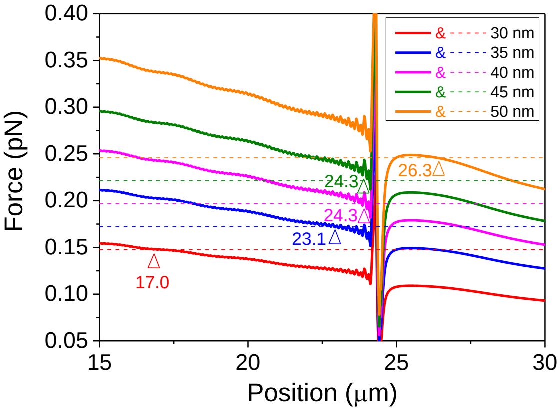
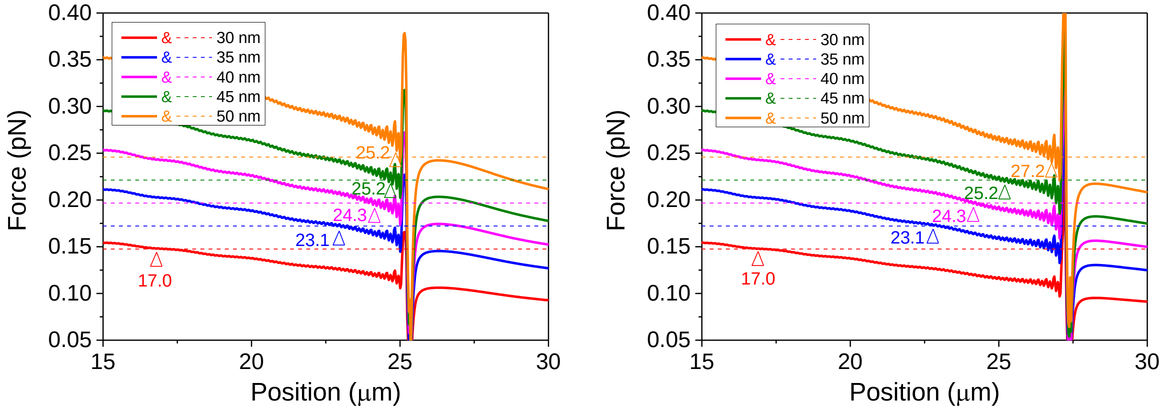


(e)



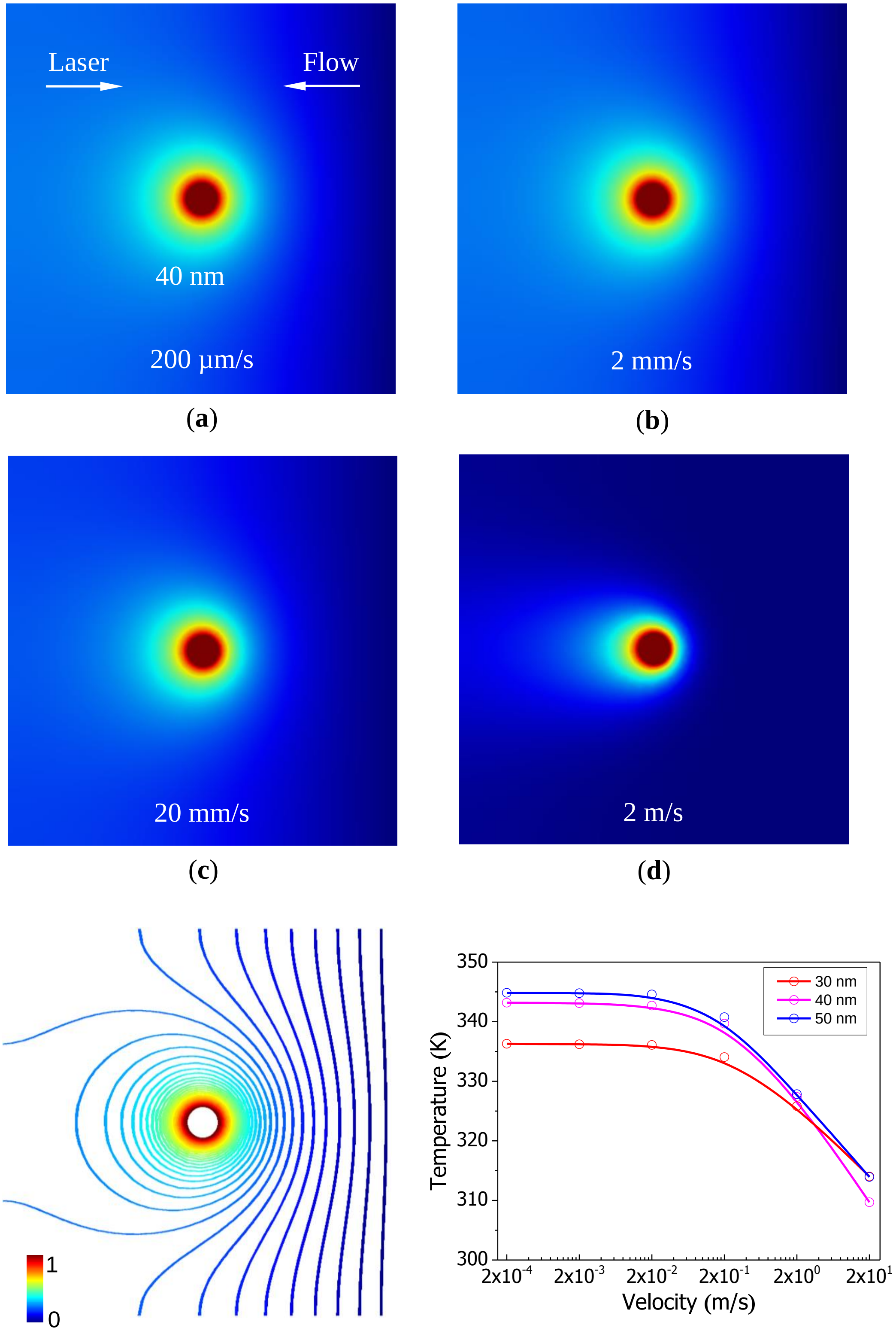
(f)



(**g**) (**h**)

fig. S1. Sorting of gold nanoparticles using conventional optical chromatography. (**a**) Simulation of particle trapped in a Gaussian beam (NA 0.12). Scale bar equals to 2 μm. (**b**) and (**c**) Simulation of trapping positions of 30, 35, 40, 45 and 50 nm gold nanoparticles when the influence of light field by the nanoparticles is not considered. Trapping positions of 30, 35, 40, 45 and 50 nm gold nanoparticles when the light field is influenced by the (**d**) 30, (**e**) 35, (**f**) 40, (**g**) 45 and (**h**) 50 nm gold nanoparticles.

As shown in fig. S1(b) and (c), the minimum separation distance between 30−50 nm gold nanoparticles is only 0.9 μm even if the influence of light by the nanoparticles is not considered. The pre-trapped gold nanoparticle absorbs light and causes a shadow after itself, which affects the further trapping of nanoparticles with larger size. Larger nanoparticles will easily aggregate with the pre-trapped smaller nanoparticles. Even if the larger particle is pre-trapped in the light field, e.g. 50 nm gold nanoparticle, the smaller one will pass through the larger one and be trapped on the left as shown in fig. S1(h). Then, the trapped smaller nanoparticle, e.g. 30 nm gold nanoparticle, will also absorb and disturb the light field. As a result, no matter what size of the nanoparticle is trapped initially, the larger particle will tend to aggregate with the smaller one because of the absorption of light by the smaller nanoparticle.



Laser
Flow
40 nm
200 µm/s
2 mm/s
20 mm/s
2 m/s
1
0
350
340
330
320
310
300
Temperature (K)
2x10^{-4}
2x10^{-3}
2x10^{-2}
2x10^{-1}
2x10^{0}
2x10^{1}
Velocity (m/s)
30 nm
40 nm
50 nm

(a) **(b)**

(c) **(d)**

(e) **(f)**

fig. S2. Simulation of temperature on gold nanoparticles in the flow stream. Temperature distribution surrounding 40 nm gold nanoparticles when the flow velocity is (**a**) 200 µm/s, (**b**) 2 mm/s, (**c**) 20 mm/s and (**d**) 2 m/s. (**e**) Contour of temperature distribution when the flow velocity is 200 µm/s. (**f**) Simulated temperatures on different gold nanoparticles with different velocities.

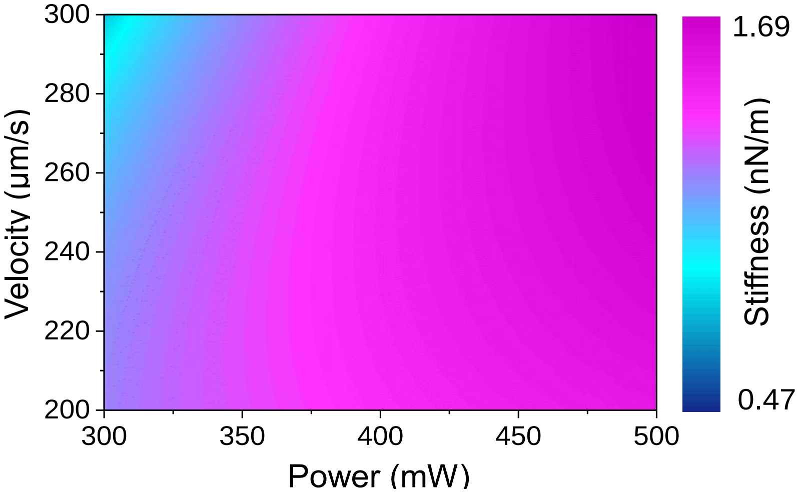


fig. S3. Tuning of trapping stiffness by coordinating laser power and flow velocity.

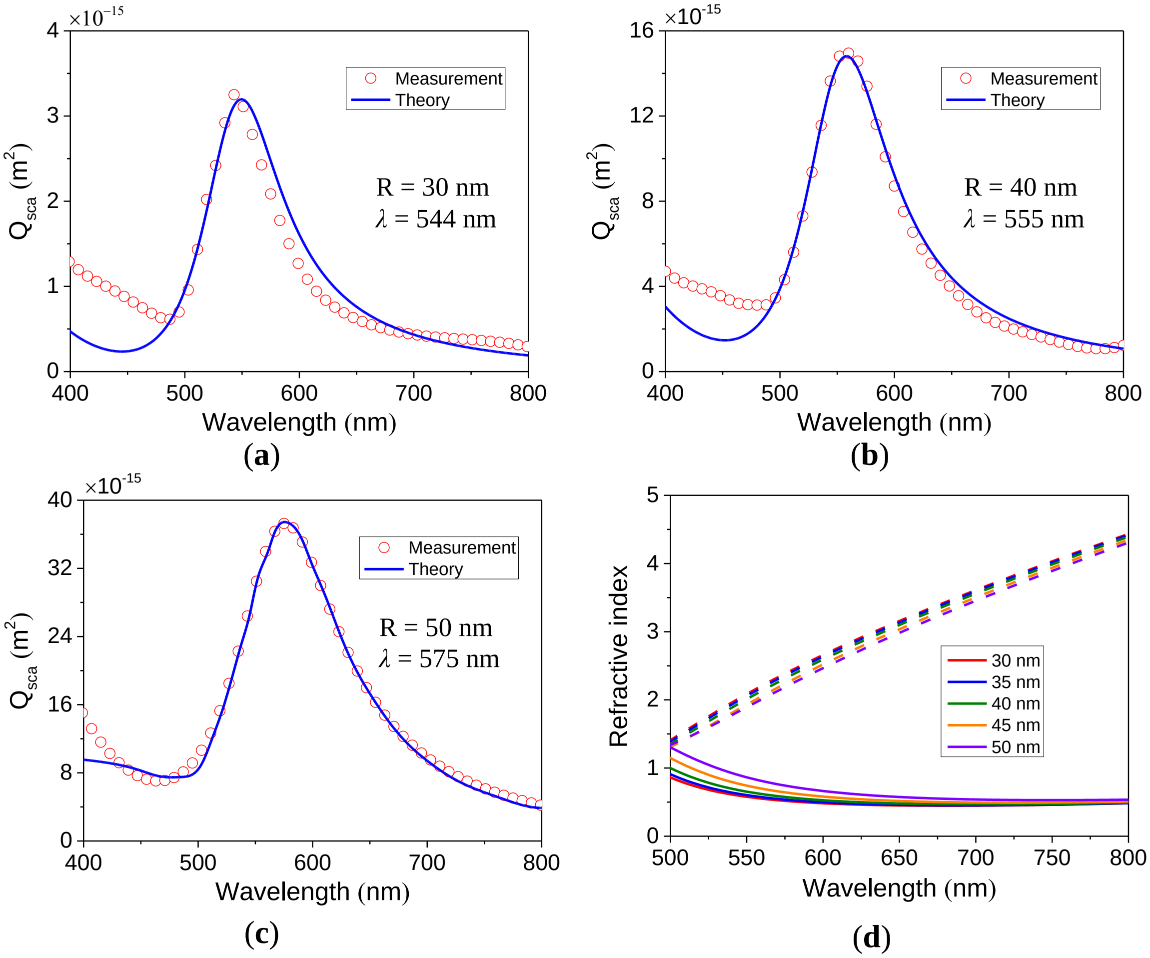


fig. S4. Determination of the refractive indices by fitting the spectra. Fitting of the optical scattering spectra of the nanoparticles with radii of (**a**) 30 nm, (**b**) 40 nm and (**c**) 50 nm using the Drude and Rayleigh theories. (**d**) Calculated refractive indices as a function of the wavelength.

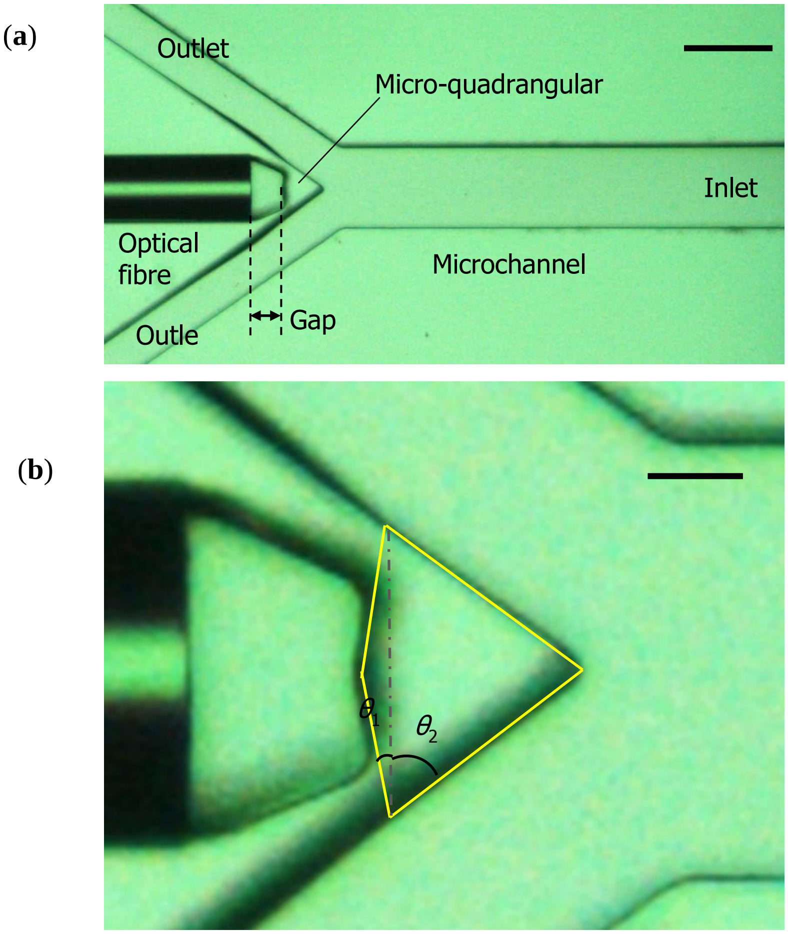
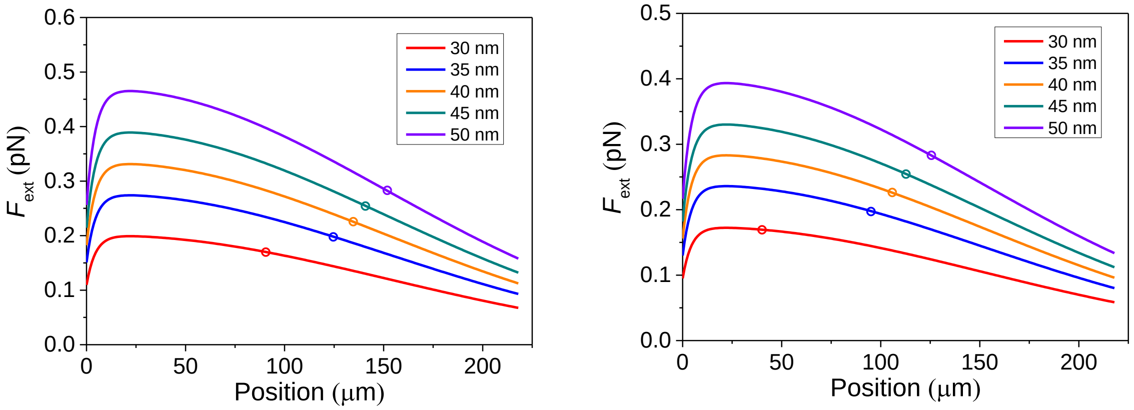


fig. S5. Micrograph of the optofluidic chip. (**a**) Optofluidic chip was made of PDMS using standard soft-lithography processes. The micro-quadrangular lens is illuminated by the Gaussian beam from the optical fibre. Scale bar, 100 µm. (**b**) Micro-quadrangular lens is equivalent to the combination of two prisms with open angles of θ_1 and θ_2. Scale bar, 20 µm.



(**a**) (**b**)

fig. S6. Calculation of optical extinction forces in water. Calculation of optical extinction forces in water using (**a**) Minkowski and (**b**) Maxwell stress tensors.