INSTITUTE OF SCIENTIFIC INSTRUMENTS

The Czech Academy of Sciences

Optical levitation of nanoparticles in vacuum

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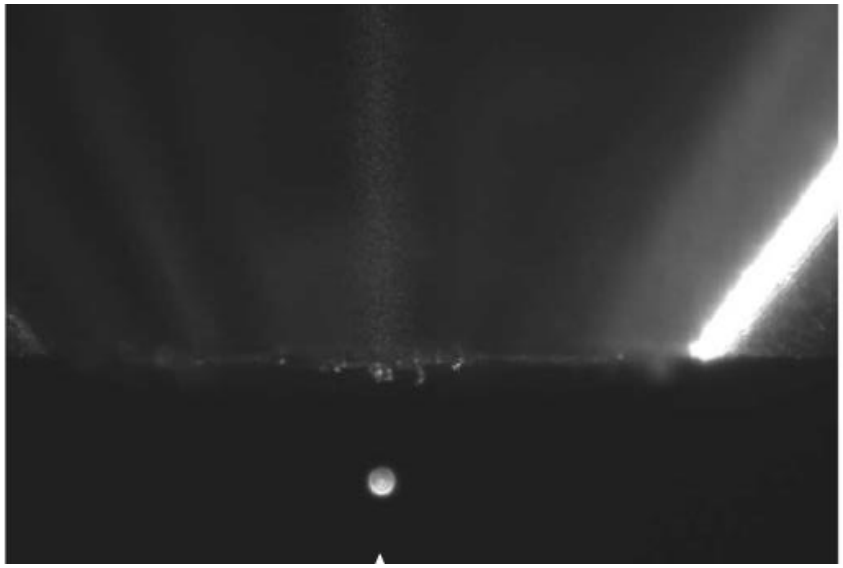
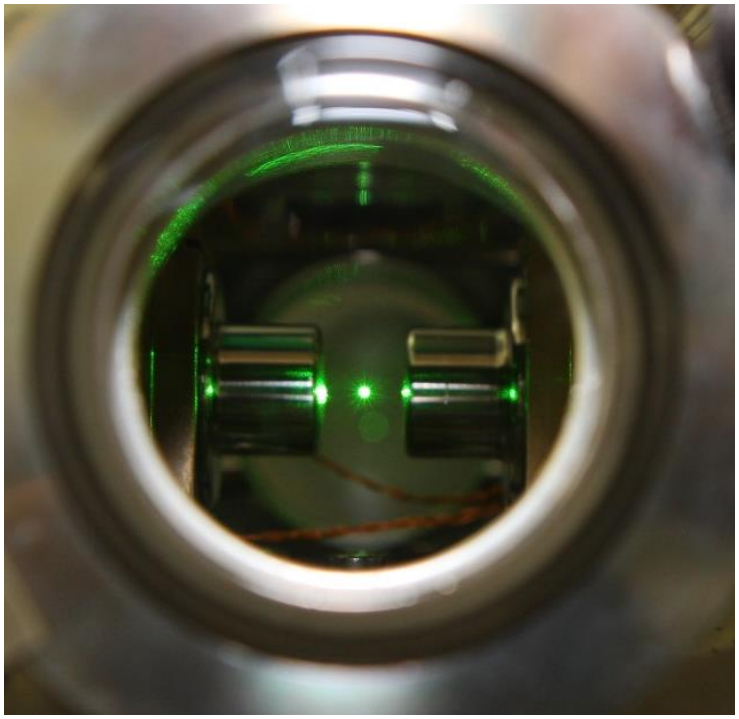
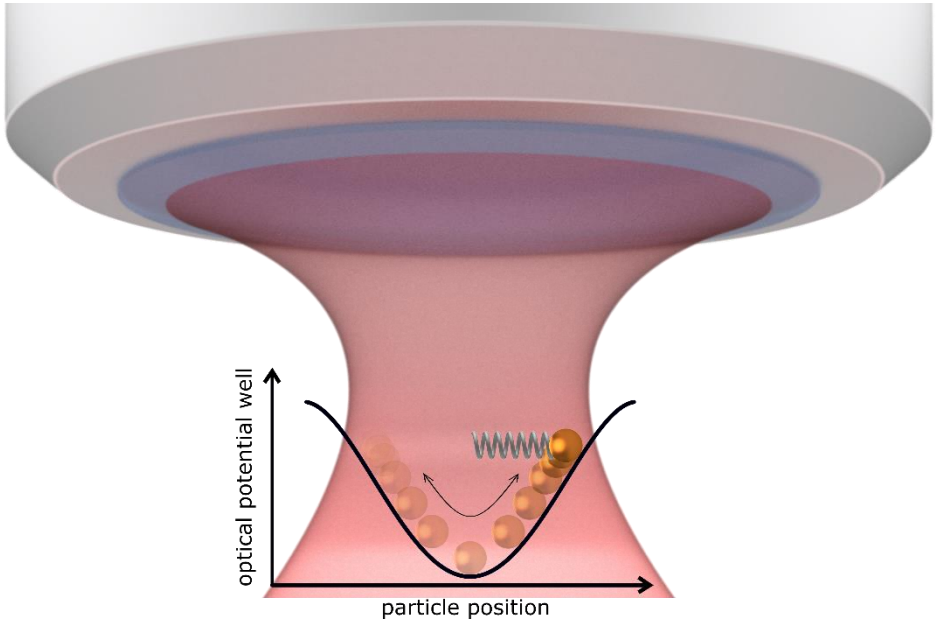
Optical trapping/levitation main features





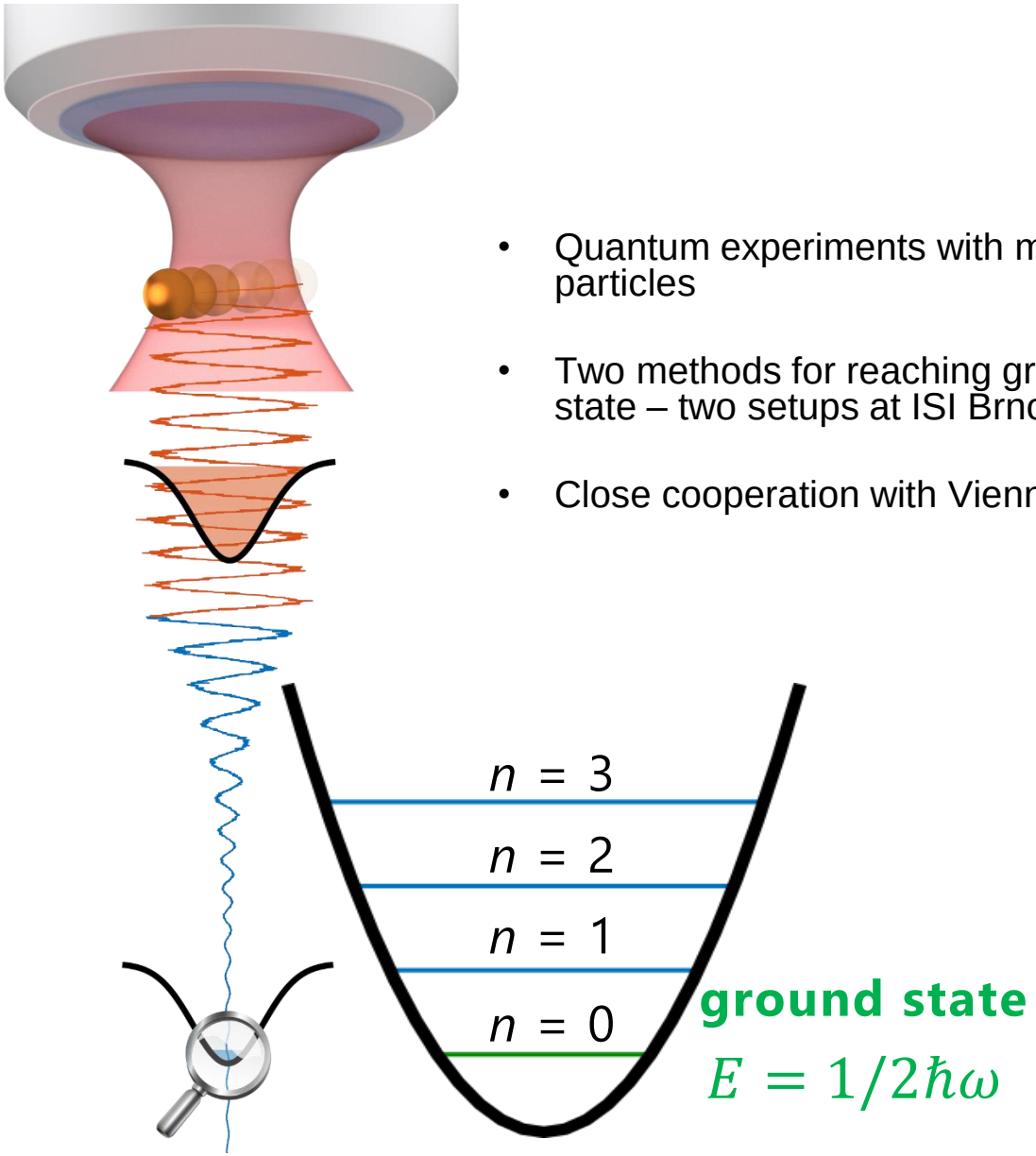


Mechanical oscillator

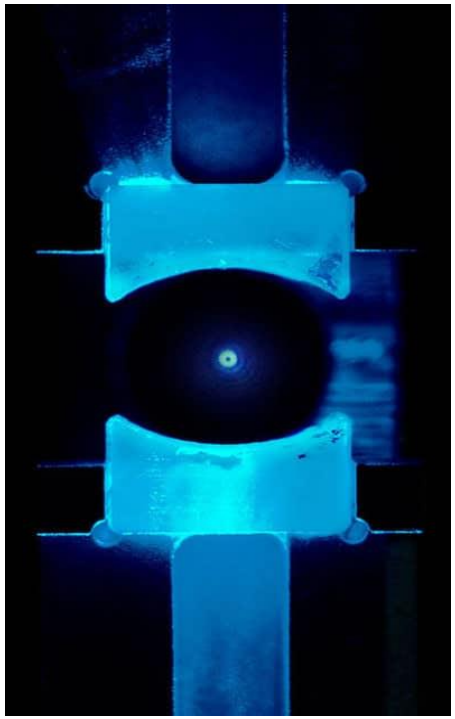
$$m\ddot{x}(t) + \gamma\dot{x}(t) - F(x(t)) = \xi(t)$$

- Control all parameters of the equation of motion
- Shaping of potential (force field)

Cooling to the quantum ground state

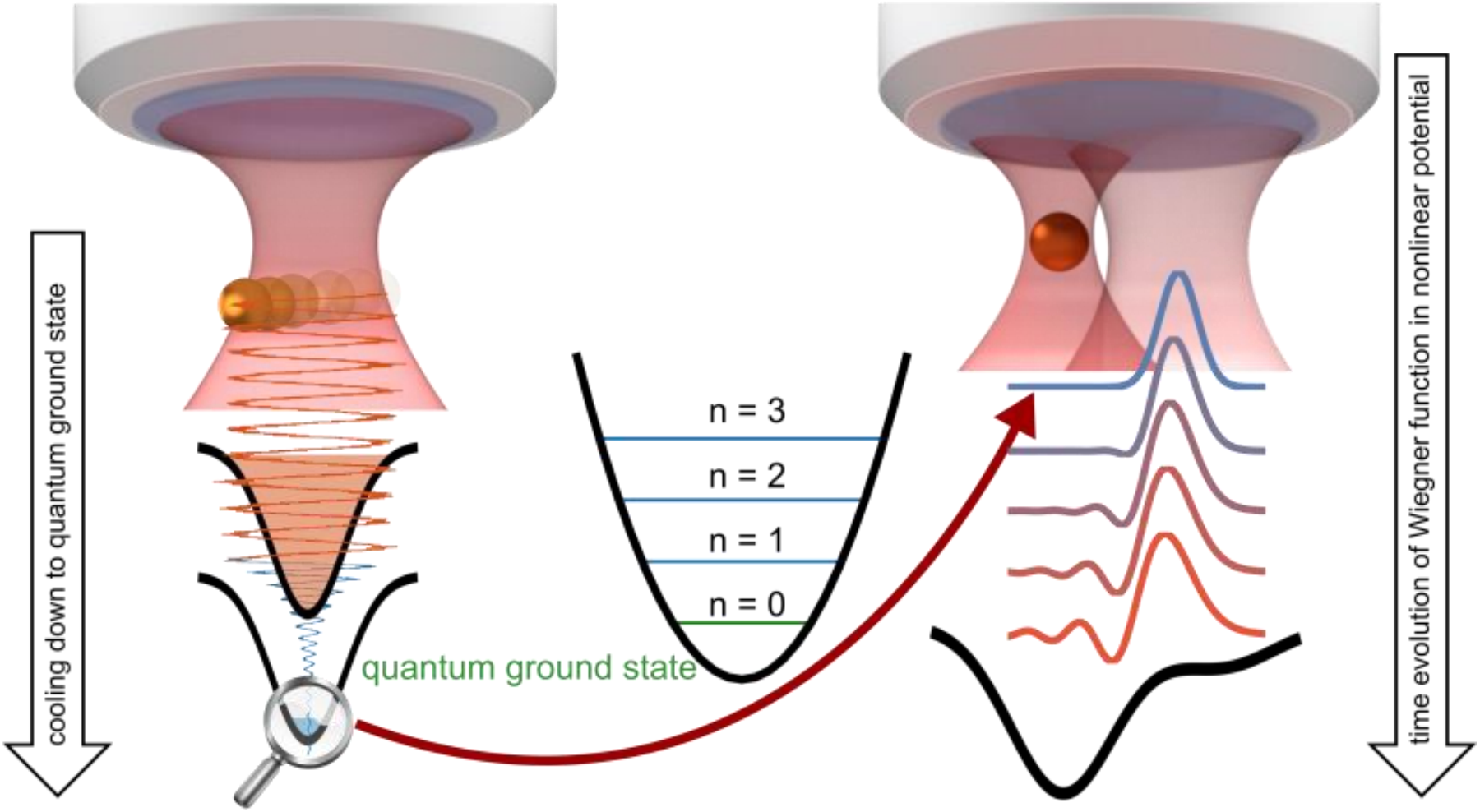


- Quantum experiments with massive particles
- Two methods for reaching ground state – two setups at ISI Brno
- Close cooperation with Vienna group

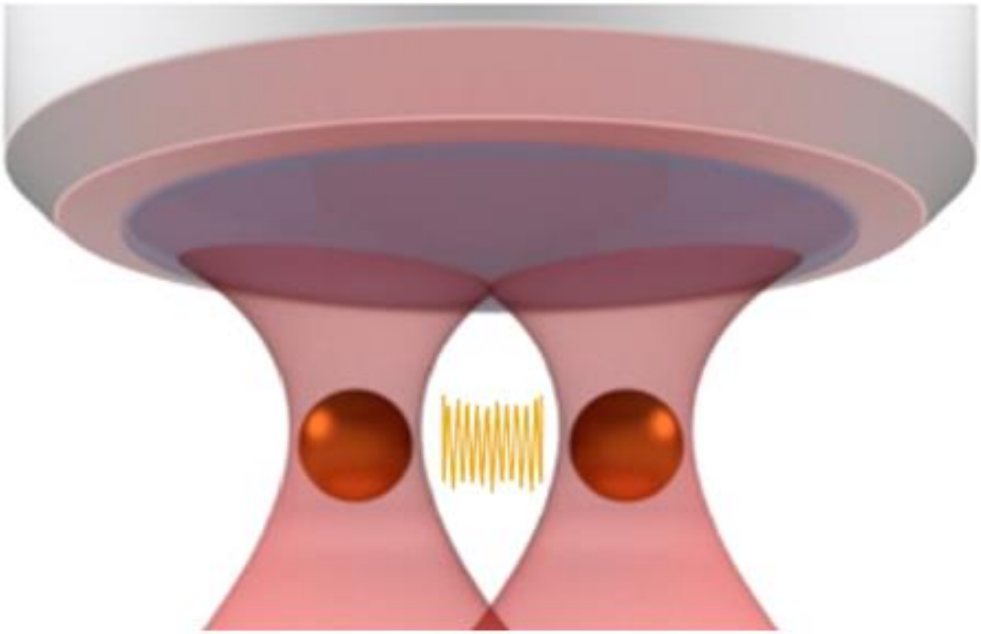


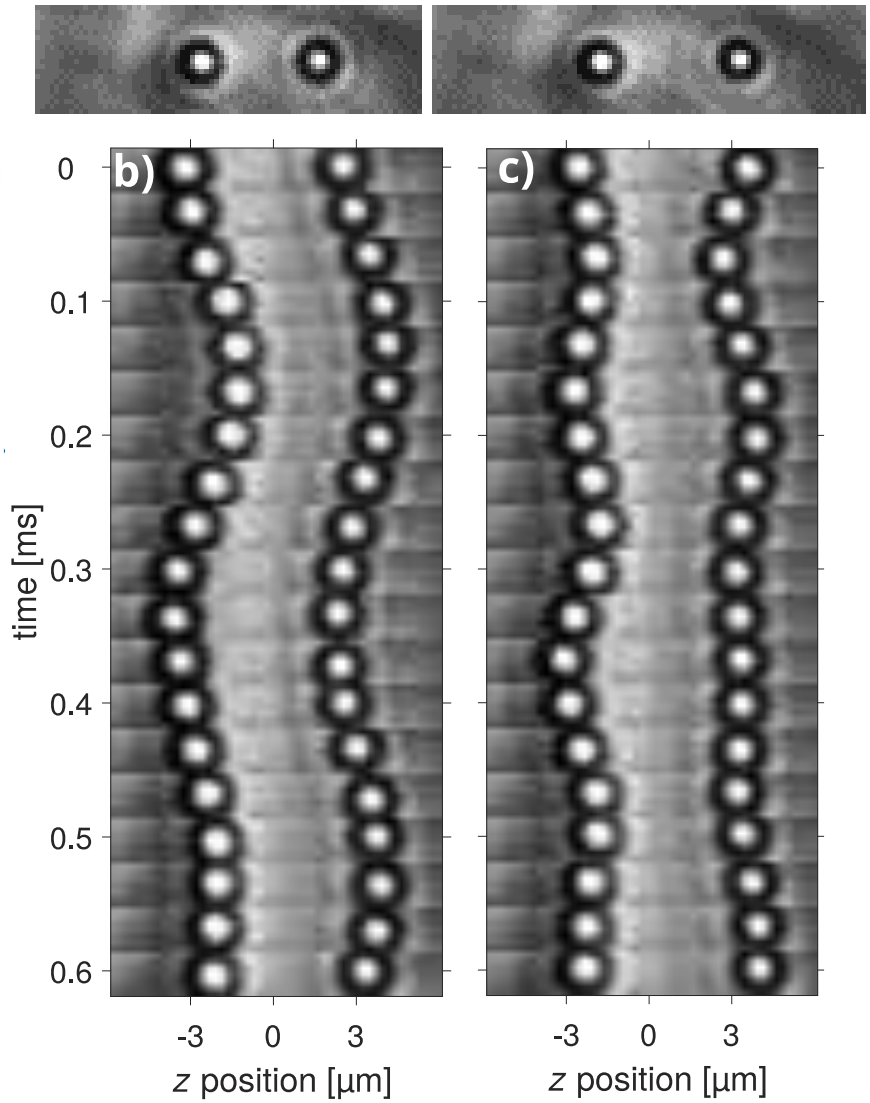
F. Tebbenjohanns *et al.* PRL 2020
U. Delic et al, Science 2020
L. Magrini *et al. Nature* 2021
F. Tebbenjohanns *et al. Nature* 2021

Non-linear quantum experiments



Optical binding and Quantum entanglement





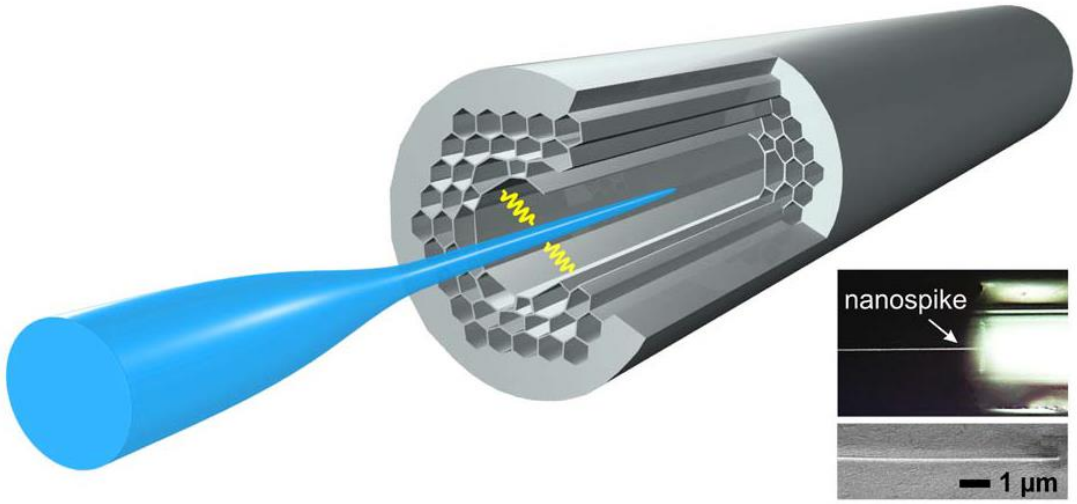
- Quantum entanglement
- Massive particles – Quantum Gravity

Svak et al. Optica 2021

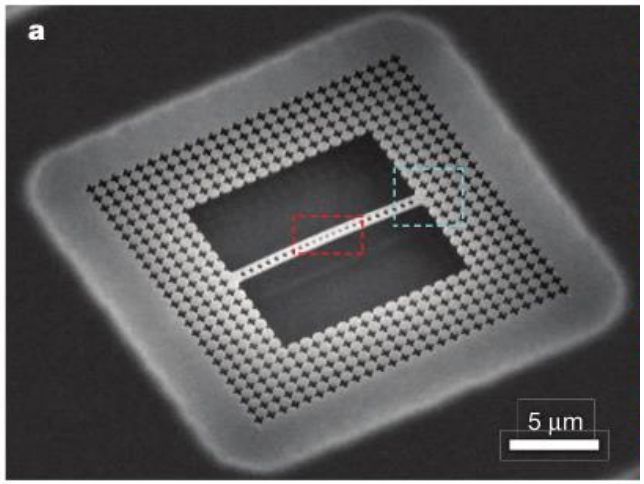
Levitation on a Chip

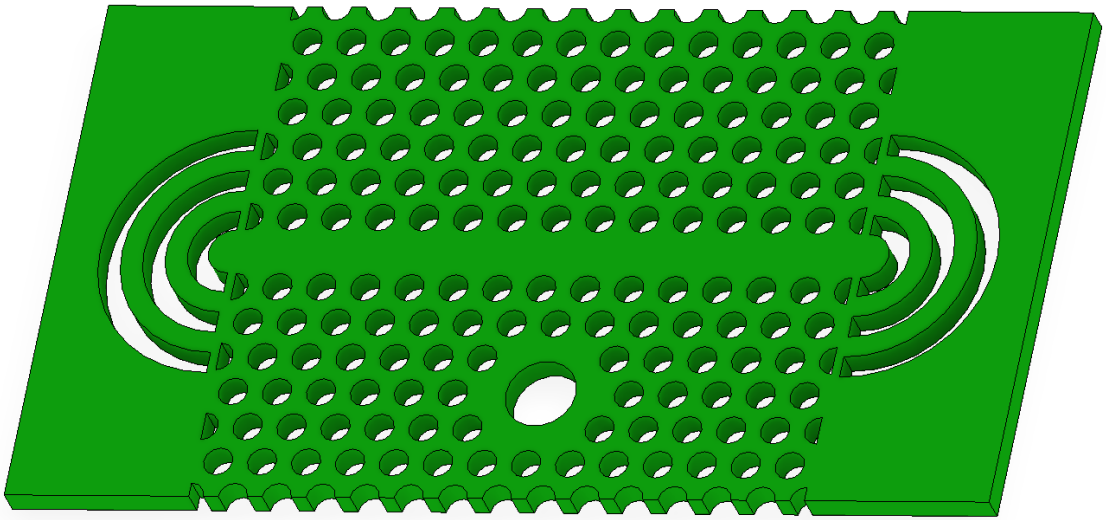
- Industry applications
- Ultra-sensitive force detectors
- Biological applications

Photonic crystal fiber



Photonic crystal cavity





Institute of Scientific Instruments of CAS

- Theoretical + experimental work
- Excellent laboratory equipment
- Paid summer internships
- Research at ISI, study at MUNI