Microscopy with tuned optical momentum transfer

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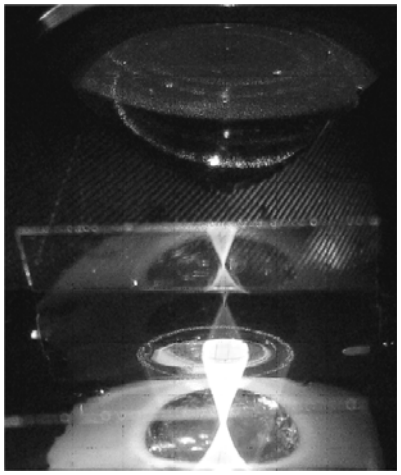
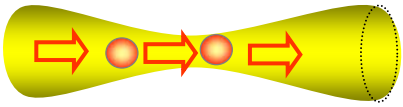
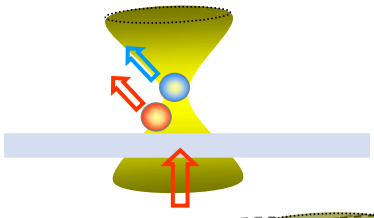
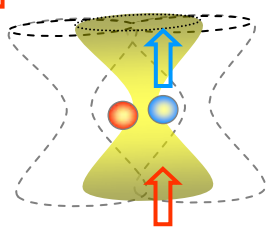
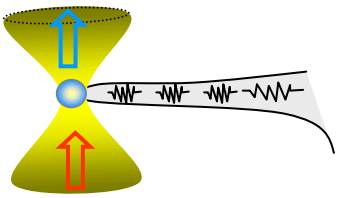
Do you like internet shopping or would you like to touch your new pullover, before you buy it ? Can a researcher be satisfied by just seeing his specimen on the monitor or would he gain more information by measring the mechanical properties of cells, organelles, molecules or various surfaces ? Likely this is not a matter of taste ! No living object can be understood without understanding its mechanics. Ways to address this aim will only lead over modified microscopy techniques.











The usage of optical traps combined with arbitrary microscopy methods has two decisive advantages especially in biology: First, rare events can be turned into frequent events by bringing e.g. interaction partners into close proximity to each other. Second, the mechanical properties of soft matter systems can be investigated very carefully. New insights especially in cell biology are then enabled by ultra-fast tracking, i.e. by recording the relevant processes in a small volume at ultra-high speed and with nanometer precision.

In this talk I present and discuss various applications relevant to modern cell biology and nano-technology where optical momentum transfer of focused laser light has been optimized in time and space. This comprises minimization of momentum transfer to reduce optical scattering, temporal oscillations of optical forces or optical momentum transfer from one particle to another. By additional exploitation of thermal energy fluctuations from the local environment on very short time scales, we can unravel new processes relevant in cell biology, which cannot be accessed by passive microscopical or nanocopical observation.

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