IMAGING INTERACTIONS WITH PHOTONIC FORCE MICROSCOPY

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Modern microscopy seeks to resolve smallest structures. However, to conclude from structures to functions in a dynamic system, it is of equal relevance to measure the interactions between structures. Interaction is controlled to a large part by the thermal environment of the structures, offering them a broad spectrum of positions. This concept is exploited in photonic force microscopy: An optically trapped sphere with a diameter between 100 nm and 1µm fluctuates in its position as a function of the trapping parameters and the sphere's local environment. The position can be tracked interferometrically in the MHz range with a precision of 1 - 5 nm in three dimensions. The fluctuations are altered by external enthalpic or entropic forces acting on the sphere. This interaction can be visualized by recording the particle's three-dimensional trajectories. In contrast to optical tweezers, which are only able to measure forces in one direction, a photonic force microscope will also scan the complete interaction potential, from which small forces in any direction can be derived. In this talk I will present novel applications in biophysics, soft matter physics and nano biotechnology.

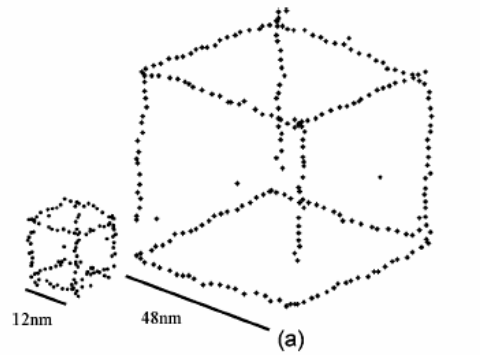

Figure: Detector response of a probe's three-dimensional position trace.

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