USE OF VERTICALLY ORIENTED MICRO-CANTILEVERS FOR THE MECHANICAL CHARACTERISATION OF MOLECULAR SYSTEMS

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1. Abstract

This year (2011) is the 25^{th} anniversary of Gerd Binnig, Calvin Quate and Christoph Gerber invention of the Atomic Force Microscope (AFM). In this period the AFM has proven to be an incredibly effective tool for the study of molecular systems such as proteins, single molecules and nanostructures. One area where the AFM has not made particular progress is the study of molecular forces parallel to an interface. In this field, optical and magnetic tweezers have proven to be much more suitable tools. Here, I will present a development of the AFM where extremely compliant micro-cantilevers are mounted vertically with respect to the sample plane (Figure 1). I will show how this change in orientation, combined with a new detection system, unlocks the use of micro-fabricated sensors for the study of bio-molecular machines such as Kinesin as well as other interesting molecular systems. On a more general note, I will conclude by showing how the use of new experimental protocols can significantly improve the effectiveness of probe microscopy without requiring substantial technological advances.

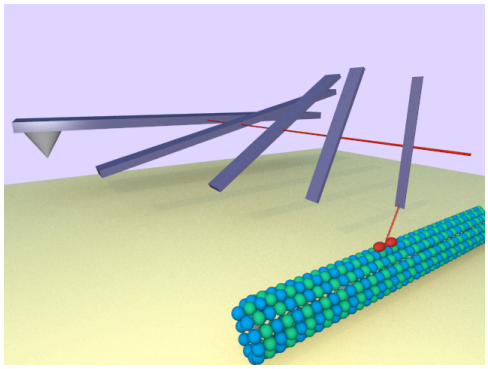

Figure 1. By rotating the axis of a conventional AFM cantilever by 90° it becomes possible to reduce its spring constant and size. The vertical geometry allows the measurement of in-plane forces as the ones generated by a bio-molecular motor processing on a filament (motor and filament are not to scale)