

Physics news on the Internet (based on electronic preprints)

1. Individual molecule study

The behaviour of individual polymer molecules is being studied by a Stanford research team led by S Chu. Previous work has mostly been limited to measuring average molecule characteristics, such as length, shape, etc., on the basis of which the continuum theory of polymers was developed. Ignorance of the role of individual molecule properties has often led to the misinterpretation of bulk experimental data over the last two decades, as exemplified by the disagreement between light reflection experiments and those with a polarized laser beam passing through a polymer. In their study of the DNA molecule, Chu and his collaborators discovered that even physically identical molecules may behave very differently when exposed to slightly different conditions. Fluorescent dye labelling enables the molecules to be viewed with an optical microscope showing that, initially coiled and folded, they unravel under the action of micro-current forces. This process varies from molecule to molecule both in duration and in the number and types of configurations, i.e., the various systems of knots and kinks it goes through. The great variation in molecule properties is attributed to tiny thermal fluctuations in their starting conditions. The finding emphasizes the role of random processes in physical and biological systems.

Source: <http://www-leland.stanford.edu/dept/news/newsfs.html>

2. Scanning polarization force microscope

The application of the conventional scanning tunneling microscope is limited to solid surfaces. Liquids are strongly distorted under the microscope's probe tip and thus far have only allowed optical microscopy. A technique developed by M Salmeron and his coworkers at Berkeley Lab adapts the scanning microscope for liquid surface observation. Firstly, unlike the usual practice, the probe tip is placed far away from the sample thus preventing distortion. The resulting resolution, although quite low (it is determined by the distance between the probe and the surface and is therefore a few tens of nanometers), still is thousands of times higher than that of the best optical microscopes. Secondly, instead of a conductor, an insulator is used as a sample. The measured quantity, further more, is not the current through the contact region but rather a static electric field, whose strength depends on the atomic dielectric properties in the near-tip region. Two electrodes are used: one is the tip and the other is placed beneath the sample. The displacements of the tip are monitored using the laser beam it reflects. The corrosion of an

aluminum surface by sulfuric acid, water absorption on an ionic crystal, and crystal dissolution processes have been studied with the new technique.

Source: <http://www.lbl.gov/Science-Articles/Research-News.html>

3. SN1987A supernova observations

The collision of the giant outburst of matter expanding from the SN1987A supernova in the Great Magellanic Cloud, with the gas ring that encircled the star prior the explosion has been observed using the Hubble Space Telescope. While most of the matter around the star is invisible, the shock-wave-heated portion of the ring becomes visible, thus providing another source of information about the state of the progenitor star before it exploded. The gas-dust ring, which is 20,000 years old, may have resulted from the ejection of matter by the progenitor star after it absorbed its companion. Further observations are needed to check this hypothesis.

Source: <http://www.stsci.edu/>

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