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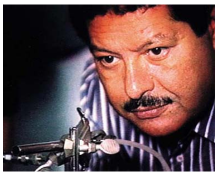

The Egyptian scientists Ahmes H. Zewail of the California Institute of Technology
weekly.ahram.org.eg

By: Gabriel Gache, Science News Editor

Nanoscopic Machines Triggered by Light

Optomechanic devices

The optomechanical phenomenon was discovered during a research conducted by Ahmes H. Zewail, form the California Institute of Technology, while studying needle-shaped nanocrystals, made of a organic compound named TCNQ, with an insertion of copper, that creates a quasi-one-dimensional semiconductor.The crystal presents microscopic fissures which can be commanded to open and close, with the help of light emitted by a laser. Zewail was able to successfully observe the effect, by observing the nanostructure while 'exercising', with the help of an ultrafast electron microscope (UEM). Zewail is quite renowned in the scientific community, as eight years ago, he received the Nobel Prize for Chemistry, after observing the motions of individual atoms during a chemical reaction, by using ultrafast laser techniques.The newly developed crystal is designed by using electron microscopy, which represents a technique of a combination of femtosecond optical systems, and high resolution electron microscope, resulting in a design that has a extremely high resolution in time and space. A femtosecond represents a billionth of a millionth of a second.The study on these crystals revealed that they stretch and become longer, as they are illuminated with a pulsing laser while under a microscope. When the illumination is being removed from the crystal, it contracts back to its original size. The effect of the laser on the structure became obvious when one of the needle-like crystals broke off when it was subjected to a strong laser pulse, creating cracks in the crystal as large as ten to one hundred nanometers. The cracks looked like they were disappearing, when under irradiation from the laser due to the fact that the crystal was stretching, and suffered a contraction back to its original shape by removing the irradiation source. The UEM analysis showed that the effect was indeed real and reversible.The effect can be explained by the fact that the negative ions in the TCNQ crystal were arranging themselves by positioning themselves in a more central area, thus the six-membered rings piled on top of each other, determining the structure to become longer, in the direction of the needle, as electrons received high amounts of energy in the form of light from the pulsing laser beam, and transferred part of it into uncharged TCNQ molecules. The uncharged molecules in the TCNQ, would no longer have a favorable arrangement, thus expanding more in space and caused the crystal to grow longer, effect greatly influenced by the amounts of energy applied to the crystal.The discovery of these effects on the TCNQ crystal, revealing the behavior of the nanoscopic matter in space and time, could open new possibilities in the study of material, nanotechnology and biology.