Youngõs double-slit experiment revisited on the atomic level

PIn Paris, October 1, 2013, groups from the òChimie-Physique Mati¯re et Rayonnementó Laboratory (UPMC-CNRS), together with SOLEIL Synchrotron, the University of Trieste (Italy) and Uppsala University (Sweden), showed that it is possible to obtain very accurately crucial information on the structure of molecules - such as the distance between the atoms that compose them, by repeating a famous optical experiment dating from 1801, this time on a microscopic scale. X-rays, electrons and atoms replace bulbs, visible light and slits. These results were recently published in PNAS.

This international group has shown that the emission of electrons from equivalent atoms in a molecule gives rise to phenomena similar to those observed in Young's double-slit interference experiment. This famous optical experiment dating back 200 years proved the wave nature of light. It consisted of making two beams of light issued from the same source interfere, by passing them through two close slits. On a screen placed in front of these slits a periodic pattern was observed with dark and illuminated areas, also called fringes, the distance between these fringes depending on the distance between the slits and the wavelength of the light.

Here, scientists have shown that the distance between two fringes (successive maxima or minima of the curves describing the relative number of electrons emitted from different equivalent atoms of the molecule) is directly correlated to the distance between the atoms from which the electrons are emitted, i.e. provides a kind of "ruler" to characterize distances on the atomic scale. The results obtained on very simple hydrocarbon molecules have been obtained using different types of chemical bonds and distances between atoms. This shows the importance of using this approach to access crucial structural information with great accuracy (interatomic distances, the structure of molecular orbitals, etc.), the basis of the structure of matter. In addition, the experimental and theoretical tools used in this study were relatively simple and easily accessible. This pioneering study was just a first step, as this method can be extended to complex systems such as proteins or nanoscopic objects, such as nanoparticles of all kinds, more and more present in our daily lives, especially in the cosmetics and textile industries.

*Re*ference : "From double-slit interference to structural information in simple hydrocarbons"
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