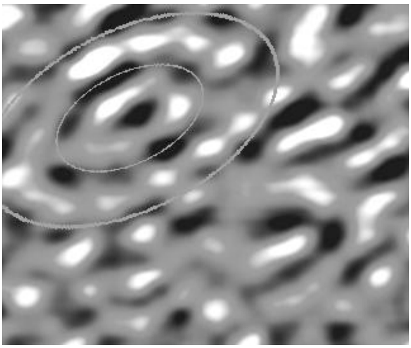
Nanoscale physics
The electron trajectory shifting effect

O.P. Kucherov, S.E. Lavrovsky

Institute of Structural Information Technology, Special Security Agency. St. Ivan Kudry, 22, Office 59, Kyiv, 01042, Ukraine

E-mail: O.Kucherov@i.ua

High-resolution (HR) TEM imaging requires very thin objects, where the amplitude remains essentially unchanged [1]. However, as was experimentally established by the authors [2], if the resolving power of the microscope is increased to 0.01 nm, then the amplitude change reaches 100% and individual atoms become visible. As it turned out later, this happens thanks to an electron trajectory shifting effect.



Based on the principle of superposition, the wave function of the system ***Ψ(q,p)*** represents the product of the wave function of electrons ***Ψq (q)*** of the sample and radiation ***Ψp (p)***:

$$\Psi(q,p)= \Psi q\ (q)\ \Psi p\ (p).$$

The authors integrated the wave functions of the electron beam and electron clouds of matter, and obtained a formula for an image of atoms and molecules:

$$I(x,y) = \sigma jnZ(x,y).$$

We have obtained a law: ***the dependence of the intensity of the electron beam of the quantum microscope is directly proportional to the thickness of the electron shell of an atom Z (x, y) at the point of the beam passage x, y***.

The gallery of the atomic world, obtained by using the electron trajectory shifting effect, is given. In particular, figure shows the amorphous carbon with the allotropic forms of carbon – nanotubes, which nanotechnology often use. Two, nested one into another, nanotubes with an average spacing of 0.12 nm is obtained by quantum microscope. Two closed lines separate the embedded nanotubes.

1. *Hettler S., Dries M., and al.* High-resolution transmission electron microscopy with an electrostatic Zach phase plate // New Journal of Physics, Volume 18, May 2016
2. *Kucherov O. P., Lavrovsky S.E.* Picoscope, as an instrument for molecules atomic structure study //Інформаційні технології та спеціальна безпека.-2016.-N1(002).-P. 73-79. http://science.wc.lt/gallery/maketn2.pdf