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Lectures, presentations etc. (Only for subscribers)

SPQEO Journal goes on the rubric "Lectures, presentations *etc*." to disseminate information about fundamentals of sciences close to SPQEO directions and areas. The lectures could be both interesting and useful for scientists, PhD students and other persons with an inquiring nature, who is working or studying not only in the area of semiconductor physics, but in solid state physics, chemistry, biology, and informatics, too.

This issue of SPQEO Journal continues the cycle of lectures of Prof. Vyacheslav Kochelap. This cycle is devoted to the one of actual directions in modern physics, namely nanophysics and nanoelectronics.

Lecture 3 from the cycle "Introduction to nanoelectronics and optoelectronics: Science, Nanotechnology, Engineering and Application" by Prof. Vyacheslav O. Kochelap

Here you can find the following:

3. Wave-particle duality from waves to particles
    - 3.1. Geometrical optics
    - 3.2. Wave quantization
    - 3.3. Electron interference

To estimate the particle wavelength and to understand the consequences of the uncertainty principle, let us assume that a free electron moves with a velocity of about 10^7 cm/s. The mass, momentum and wavevector of free electron is

$$\mathbf{m_0 = 9.11 \times 10^{-28}\ g;}$$
$$\mathbf{p_0 = m_0 v = 9 \times 10^{-21}\ g{\cdot}cm{\cdot}s^{-1},}$$
$$\mathbf{k_0 = p_0/\hbar = 8.7 \times 10^{6}\ cm^{-1}},$$

The de-Broglie wavelength of a free electron,

$$\boldsymbol{\lambda = 2\pi/k = 7.2 \times 10^{-7}\ \mathrm{cm} = 72\ \text{Å}.}$$

If we need to measure both the position and the momentum of the electron, and we impose the limit of 10 % accuracy on the value of its momentum, i.e.,
$p = 9 \times 10^{-22}$ g·cm·s^{-1} and k = 8.7×10^5 cm^{-1}, we cannot predict the position of this electron with an accuracy greater than

$$\mathbf{x = h/p_0 = 2/k_0 = 7.2 \times 10^{-6}\ cm = 720\ \text{Å}.}$$

This value is as much as ten times greater than the wavelength of the electron!

Lecture 4 from the cycle "Introduction to nanoelectronics: Science, Nanotechnology, Engineering and Application" by Prof. Vyacheslav O. Kochelap

Here you can find the following:

4. Materials for nanoelectronics
    - 4.1. Introduction
    - 4.2. Semiconductors
    - 4.3. Crystal lattices: bonding in crystals
    - 4.4. Electron energy band
    - 4.5. Semiconductor heterostructures
    - 4.6. Lattice matched and pseudomorphic heterostructures
    - 4.7. Inorganic-organic heterostructures
    - 4.8. Carbon nanomaterials: nanotubes and fullerene
    - 4.9. Closing remarks
    - 4.10. Problems

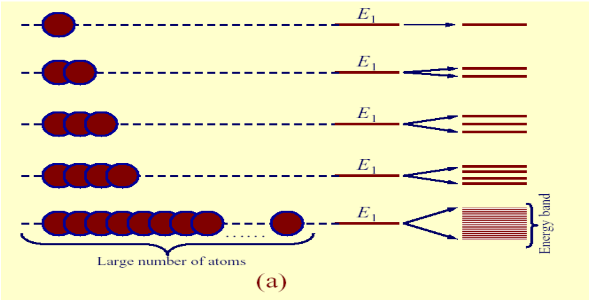

Fig. 1. Ground energy level E_1 of a single atom evolves into energy band when large number of single atoms is interacting with each other.

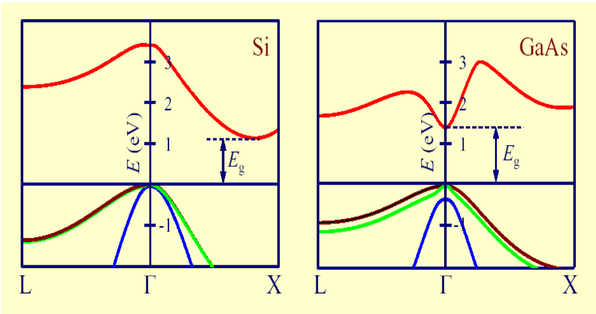

Fig. 2. Energy band for Si and Ge.

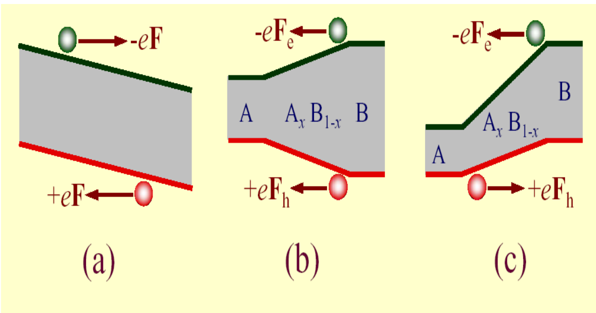

Fig. 3. Graded band materials.

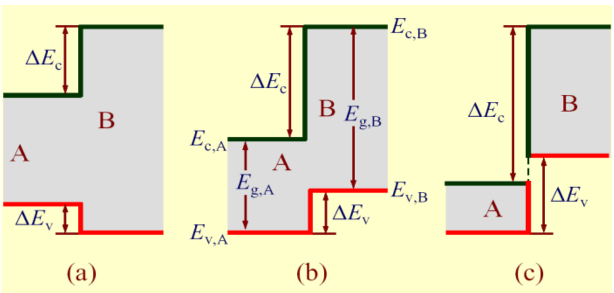

Fig. 4. Band-osets at heterojunction
of semiconductor heterostructures:
(a) type I heterostructure (GaAs/AlAs);
(b) type II heterostructure (Si/SiGe).
(c) a brokengap line-up (InAs/GaSb).

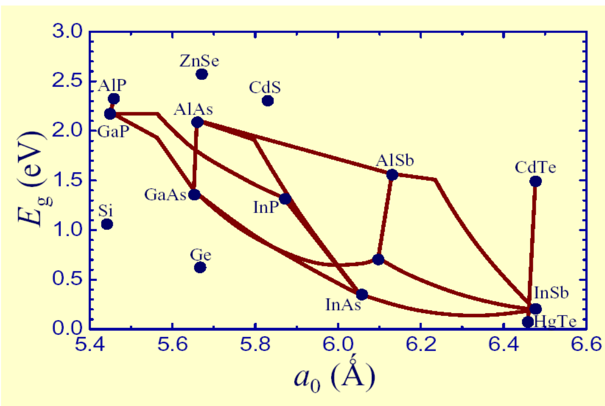

Fig. 5. Room temperature bandgaps E_g as functions of lattice constant a_0 for selected III-V and II-VI compounds as well as selected group IV materials and their alloys.

We are looking for feedback, new proposals for lectures, presentations, *etc*.