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The effect of stress on the optical properties semiconductor films

Abstract

Science and technology at the atomic scale of dimensions rely heavily on instruments built around beams of charged particles. For example, electron microscopes with spherical aberration correction can resolve single atoms at resolution around 0.06 nm. (The radius of the hydrogen atom is 0.053 nm). Electron energy loss spectroscopy probes energy levels of materials. The helium gas field ion microscope focuses a beam of helium atoms to a probe of about 1 nm in size. The Large Hadron Collider at CERN has a design energy of 7 TeV, and produces sub-nuclear particles, possibly including the Higgs boson. All of these instruments use electric and magnetic fields to accelerate and focus a beam of charged particles.

The optics of charged particle beams derives from classical mechanics (geometrical optics), and quantum mechanics (wave optics). The central dynamical problem can be stated as follows: given an initial state for a particle, calculate the state at all future times. Hamilton's principle of least action holds that the classical physical trajectory, chosen among an infinite number of hypothetical trajectories, has an extremum of the action integral between the initial and final points. This forms the starting point for the quantum mechanical description as well. A close analogy exists between charged particle optics and light optics. A survey of these ideas will be presented.

Bio

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