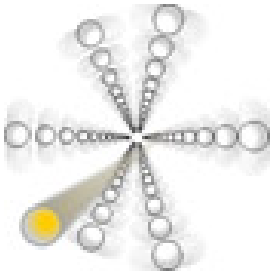

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The Effect of Electron Beam Reflection in Axial Channeling Mode

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The subject of this work is description and investigation of some of the recently demonstrated phenomena in the thin crystal channeling related to charged particle refraction effects via computer simulations based on methods developed in [1,2].
In the proposed model charged particle beam evolution is simulated using the trajectory- based approach. The latter can be viewed as the Monte-Carlo method applied to the kinetic energy equation for distribution in the 2D phase space of particle's position and velocity in the plane transversal to the crystallographic axis. Each trajectory is evaluated as a solution of the corresponding stochastic differential equation. The coherent scattering of particle by crystal atomic chain is taken into account as an interaction with averaged (along crystallographic axis) potential. Contribution of incoherent scattering to atoms thermal vibrations is introduced into the model via diffusion coefficient.
Computer simulation involving the 500'000 trajectories for each initial parameter set revealed the following picture. For the beams falling at small angles (10-50% of the Lindhard critical angle) the angular distributions of the reflected beams have strong preferable direction for small crystal thickness $l \sim c/(2\omega_0)$, where c –light velocity, ω_0 –frequency of electron oscilation in the transversal potential well.
Simulations with the proposed model show specific structure of angular beam distribution's evolution in thin crystals in axial channeling mode. The proposed model can be used for reliable beam control (focusing, splitting).

References

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[2] A.K. Maslov, I.V. Polimatidi Modeling of axial channeling of ultra-relativistic charged particles in a bent single crystal. Computational Mathematics and Mathematical Physics, 2002, 42:12, 1780–1791

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