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Deflection of High-Energy Negatively Charged Particles by Means of a Bent Crystal

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When a high-energy charged particle moves in a crystal having a small angle between its momentum and one of the main atomic axes or planes, correlations between successive collisions of the particle with neighboring atoms occur. These correlations give the possibility to deflect the direction of motion of the particle to the angles, which significantly exceed the critical angle of channeling. There are three mechanisms of high-energy charged particles deflection by a bent crystal: planar channeling, volume reflection and stochastic deflection. All these mechanisms are well studied in the case of positively charged particles. However, in the case of negatively charged particles, an important contribution to the dynamics of particles in the crystal is made by incoherent scattering. The effect of incoherent scattering complicates the consideration of the problem of particles deflection and leads to a decrease in the angles of deflection of negatively charged particles in comparison with positively charged particles. In recent years, a number of experiments have been carried out to study the motion of negatively charged particles in bent crystals. In this work we analyze the possibility of deflection of high-energy negatively charged particles by a bent crystal using theoretical calculations and numerical simulation. This study makes it possible to compare the efficiency of the three mechanisms of deflection of negatively charged particles with the help of bent crystals.

Primary author: Dr KYRYLLIN, Igor (Akhiezer Institute for Theoretical Physics of National Science Center Kharkov Institute of Physics and Technology)

Co-author: Prof. SHUL'GA, Nikolai (Akhiezer Institute for Theoretical Physics of NSC KIPT)

Presenter: Dr KYRYLLIN, Igor (Akhiezer Institute for Theoretical Physics of National Science Center Kharkov Institute of Physics and Technology)

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