HIGH ENERGY NUCLEI CHANNELING

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Channeling of charged particles in crystals received extensive attention in the interpretation of related nuclear processes, such as the suppression of nuclear reactions (Tulinov effect), resonant excitation of nuclear radiation (Okorokov effect), powerful electromagnetic radiation (Baryshevsky-Kumahov effect), etc. The beam divergence of high energy particles (either from ground based accelerators or galactic rays in space) considerably exceeds, as a rule, the critical angle of channeling when these particles interact with crystals. That requires a simultaneous consideration of a coherent scattering with zero momentum transfer to the lattice [1, 2] and incoherent scattering in vast transition area from the channeling to a random mode of motion with independent collisions with atoms of the crystal. The results of studies of the motion of charged particles with high energy E , taking into account the coherent scattering by atomic chain (using a modified Lindhard continuous potential and assumption of conservation of energy of the transverse motion, $\varepsilon_{\perp}$) and incoherent multiatomic scattering with non-conserved E, $\varepsilon_{\perp}$ (taking into account the correlated vibrations in the atomic chain in the crystal). The model crystal was composed of atomic chains in accordance with the symmetry of a real crystal. It is demonstrated the existence of an extensive angular range, exceeding the range of axial channeling up to two orders of magnitude, where the regime antichanneling (RA) realizes with the level of incoherent scattering exceeding the random scattering by two or more times. Distribution of the particles moments in RA regime is shifted to small values, which requires a consideration of all the above-mentioned nuclear processes. Basing on the results obtained, an interpretation is given for the experimental data of Ref. [3] what has not been done yet. A new scheme of the particle motion regimes, driven by the crystal lattice, is suggested.

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