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Quantitative theory of channeling particle diffusion in transverse energy and direct evaluation of dechanneling length

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A new diffusion equation is suggested to correctly describe the channeling particle diffusion in transverse energy, taking into consideration the contribution of both the fourth power of incoherent scattering angle to the transverse energy dispersion and the catastrophic dechanneling effect, caused by the large-angle single incoherent scattering. This equation is reduced to the Sturm-Liouville problem applied both to rigorously introduce and evaluate numerically with a one-percent precision the dechanneling length as well as the percentage of the channeling positively charged particles for the SPS, LHC and FCC energies.
On the opposite, an application of this newly formulated diffusion theory to the case of negatively charged particles confirms our previous conclusion, made on the basis of both the experimental studies and Monte Carlo simulations, that an application of the dechanneling length concept is possible for them only after the consideration of both intensive particle dechanneling and rechanneling processes.

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