Half-Wave-Crystal Channeling of Relativistic Heavy Ions at Super-FRS GSI/FAIR and Possible Applications

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A half-wavelength crystal (HWC) is a thin crystal where a channeling particle experiences only one collision with a crystallographic plane ("mirroring" or HWC channeling) during penetration through a crystal. The HWC channeling was observed for 400 GeV protons at CERN-SPS [1] and for 255-MeV electrons at the SAGA-LS Facility [2, 3]. The HWC channeling is explained by computer simulations as a sequence of specific particles trajectories governed by the one-dimensional periodic potential of crystallographic planes. The perspective atomic physics experiments (including crystal targets) with Relativistic Heavy Ion (RHI) beams are the part of the Super-FRS Experiment Collaboration program [4].

Here, we present the results of computer simulations of HWC channeling of high-Z (^{129}Xe, ^{208}Pb, ^{238}U) and low-Z (p,t, d, ^{6}Li, ^{9}Li, ^{11}Li) relativistic ions with kinetic energy $E_k = 300$ MeV/u passing through a (200) tungsten crystal, using the computer code BCM-2.0 [5]. Possible applications of HWC-channeling of RHI are discussed, e.g. as fragments deflectors and splitters and even as the charge Ze and mass number A (isotopes) filters.

References

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