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## Half-Wave-Crystal Channeling of Relativistic Heavy Ions and Possible Applications

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Half-wavelength crystal (HWC) is a thin crystal, when a channelled particle experiences only one collision with crystallographic plane during penetration through a HWC. Recent experiment [1] demonstrated 2 MeV protons mirroring by thin silicon HWC. More recently, the mirroring effect was observed for 400 GeV protons at CERN-SPS [2]. The existence of mirroring effect using HWC in the case of negative charged particles was recently demonstrated at the SAGA-LS Facility using 255-MeV electrons and thin (HWC) Si crystal [3]. The HWC effect is explained by computer simulations as a sequence of specific trajectories of planar channelled particles governed by 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 Super-FRS Experiment Collaboration program [4]. The critical channeling angle depends on three parameters of RHI beam: proton number  $Z$ , neutron number  $N$  and beam energy  $E$  (MeV/u), and one crystal parameter  $U_0$  –potential energy of a unit charge in the field of atomic plane (of order of 20 - 50 eV for planar channeling).

Here, we present the results of computer simulations of RHI penetration through a HWC using computer code BCM-2.0 [5]. According the simulations, the RHI beam deflection angle through the HWC mirroring effect is of order of critical channeling angle  $\theta_c$ . Moreover, simulations demonstrate the sensitivity of HWC-RHI channeling and mirroring effect to the isotope mass ( $N$  value). Based on simulations, we discuss possible applications of HWC-mirroring of RHI beams: as effective beam deflector similar to high-energy particle physics [2] and even more exotic ones, like  $Z$  filter, velocity ( $E$ ) filter, isotope mass ( $Z+N$ ) filter.

### References

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### Summary

Here, we present the results of computer simulations of RHI penetration through a HWC using computer code BCM-2.0. According the simulations, the RHI beam deflection angle through the HWC mirroring effect is of order of critical channeling angle  $\theta_c$ . Moreover, simulations demonstrate the sensitivity of HWC-RHI channeling and mirroring effect to the isotope mass ( $N$  value). Based on simulations, we discuss possible applications of HWC-mirroring of RHI beams: as effective beam deflector similar to high-energy particle physics and even more exotic ones, like  $Z$  filter, velocity ( $E$ ) filter, isotope mass ( $Z+N$ ) filter.

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