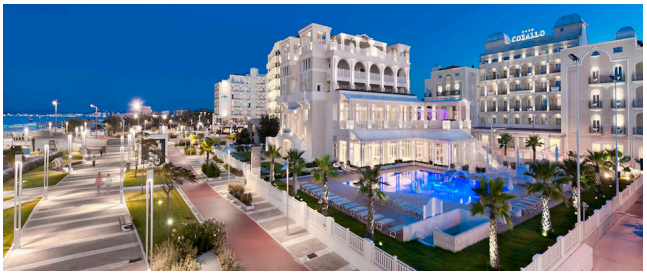

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# Half-Wavelength-Crystal Channeling of Relativistic Ions and its Possible Application for Beam Deflection and Focusing

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The phenomenon of Half-Wavelength Crystal (HWC) channeling, where a particle experiences “mirroring” due to a single collision with a crystallographic plane, has been observed for protons and electrons. While the HWC channeling phenomenon has been observed for 400 GeV protons at CERN-SPS [1] and for 255-MeV electrons at the SAGA-LS Facility [2, 3], there are additional parameters that arise in the case of Relativistic Heavy Ions (RHI), namely the ion charge Ze and mass number A. The critical channeling angle is influenced by (Z/A)1/2. The computer simulations of HWC channeling of low-Z isotopes [4] revealed the significant iso-topic effect. The results of computer simulations of HWC channeling of high-Z RHI (129Xe, 208Pb, 238U) with almost the same values of (Z/A)1/2 in Si, Ge and W crystals, using the computer code BCM-2.0 was obtained in [5]. The assembly of sequentially placed and rotated HWC crystals can increase the deflection angle. Re-cently, calculations were performed for two HWC crystals rotated to the critical channeling angle, and they showed that such a system could be used as secondary beam deflectors or splitters similar to the applications of bent crystals in high-energy particle physics.
In this work, we present results of computer simulation of HWC crystals channeling in an assembly of N sequentially placed and rotated HWCs. Our simulation demonstrated that such system could achieve a de-flection angle up to N times the critical channeling angle. A similar system of several bent and straight (but not HWC) crystals for deflection of a 1.3 GeV proton beam was recently studied in [6]. We also discuss the potential applications of HWC channeling for RHI beam deflection and focusing on the downstream target, in view of atomic physics experiments with RHI beams planned for the Super-FRS Experiment Collaboration [7].
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