PERSPECTIVE FOR DEVELOPMENT OF A UNIVERSAL SOURCE OF HIGHLY POLARIZED IONS

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High beam polarization degree is essential to the scientific productivity of colliders. If there is no depolarization during acceleration and storage, the final beam polarization is determined by the initial polarization at extraction from the ion source. Therefore, ion sources with performances exceeding those achieved today is a key requirement for the development of the next generation high-luminosity high-polarization colliders.

We present a single universal H-/D-/He++ ion source design combining the most advanced developments in the field of polarized ion sources and targets to provide high-current high-brightness ion beams with >90% polarization and improved lifetime, reliability, and low ownership cost. The new source is an advanced version of the atomic beam polarized ion source (ABPIS) with resonant charge-exchange ionization of polarized neutral atoms by negative (or positive) ions generated by surface-plasma interactions with cesiation. The main innovation of this approach is the strong suppression of parasitic generation of unpolarized H-/D- ions by using novel designs of the dissociator, plasma generator, and surface-plasma ionizer, which prevent adsorption and depolarization of particles from the polarized atomic beam. The same system with some modifications is capable of producing positive and negative ion beams of different species including polarized and unpolarized H^-, D^-, H^+, D^+, $3He^{++}$, and Li+, Li^{+++}. Computer simulations of the formation, extraction, and transport of the polarized atomic and ion beam in the new source are presented. Manufacturing techniques are discussed.