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Predominantly Electric Storage Ring with Nuclear Spin Control Capability

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A predominantly electric E&m storage ring, with weak superimposed magnetic bending, is shown to be capable of storing two different particle type bunches, such as helion (h) and deuteron (d), or h and electron (e^-), co-traveling with different velocities on the same central orbit. Rear-end collisions occurring periodically in a full acceptance particle detector/polarimeter, allow the (previously inaccessible) direct measurement of the spin dependence of nuclear transmutation for center of mass (CM) kinetic energies (KE) ranging from hundreds of keV up toward pion production thresholds. With the nuclear process occurring in a semi-relativistic moving frame, all initial and final state particles have convenient laboratory frame KEs in the tens to hundreds of MeV.
The rear-end collisions occur as faster stored bunches pass through slower bunches. An inexpensive facility capable of meeting these requirements is described, with several nuclear channels as examples. Especially noteworthy are the $e^{+/-}$-induced weak interaction triton (t) β-decay processes, t + $e^+ \rightarrow$ h + ν and h + $e^- \rightarrow$ t + ν. Experimental capability of measurement of the spin dependence of the induced triton case is emphasized. For cosmological nuclear physics, the experimental improvement will be produced by the storage ring's capability to investigate the spin dependence of nuclear transmutation processes at reduced kinetic energies compared to what can be obtained with fixed target geometry.

Keyword-1

Electric/magnetic storage ring

Keyword-2

nuclear spin capable

Keyword-3

control/measure nuclear spins

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