Non-Neutral Plasma Confinement in a Cusp -Trap and Possible Application to Anti-Hydrogen Beam Generation

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Combination of a magnetic quadrupole (cusp) with an electric octupole (MCEO, or cusp-trap) forms a trap for non-neutral plasmas. Perfect trapping of a single charged particle[1)] and the existence of the equilibrium of cold non-neural plasmas at the Brillouin limit in this cusp-trap[2)] have been proved theoretically. Also, experiments performed so far have shown that electron plasmas with finite temperatures can be confined in the cusp-trap for a long time[3)].

In order to synthesize anti-hydrogen from cold positrons and antiprotons, a positron plasma trapped in the cusp trap should possess an internal electric field to grasp antiprotons for mixing. If cold anti-hydrogen atoms are synthesized, they come out as a focused spin-polarized beam from the trap[4)]. This internal electric field would appear through confinement dynamics of the positron plasma. For studying such an essential problem, a new cusp-trap with a super-conducting quadrupole magnet, which generates the field strength of 3.5 T and the field gradient up to 35 T/m, has been completed at RIKEN. Experiments using this trap are now being performed on electron confinement in a warm bore.

At the workshop, brief explanation of how the cusp-trap confines non-neutral plasma will be given and experimental results obtained in the new device are to be reported.

References

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