

Electrons Confined with an Axially Symmetric Magnetic Mirror Field

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When a non-neutral electron plasma was confined with an axially symmetric magnetic mirror field, it was found that a confinement time was longer than 50 ms with the mirror ratio $R \sim 5$ [1]. This is two orders of magnitude longer than the confinement time of $\sim 100 \mu\text{s}$ reported in reference [2] where the magnetic mirror field was used to accumulate low energy positrons. Since the details of the accumulation method have not been reported so far, it is worth performing the systematic investigation of the low energy charged particle accumulation with a magnetic mirror field. It is true that the confinement time obtained with a simple magnetic mirror trap is not long enough for the effective accumulation of charged particles. The original idea in the present experiment is that electrostatic potentials are applied to the magnetic mirror field to obtain a longer confinement time.

Here, electron beams with a current of $10 \sim 200 \text{ pA}$ and energies less than 8 eV were injected into a magnetic mirror trap and accumulated inside it by applying the electron cyclotron resonance heating. By introducing electrostatic potentials, a longer accumulation was made possible.

References

- [1] H. Higaki, K. Ito, W. Saiki, Y. Omori, and H. Okamoto, Phys. Rev. E 75, 066401 (2007).
- [2] S. Chu and A. P. Mills, Jr., Phys Rev. Lett. 48, 1333 (1982).