



Estimation of RF heating and cooling rates of an electron-positron plasma confined in a Combined Trap

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Manu Bajpai

Institute for Plasma Research, Near Indira Bridge, Gandhinagar - 382 428, INDIA

Abstract

The cross-sections have been estimated for heating of confined electrons and positrons due to two type of RF driven collisions, (a) elastic collisions between electrons/positrons and the background gas molecules (σ_n) (b) Coulomb collisions between electrons and positrons (σ_{ep}), in an electron-positron plasma confined in a RF quadrupole combined trap. Confinement is expected to improve if rate of cooling by cyclotron cooling mechanism as well as by inelastic collisions with CO_2 matches with the rate of heating. For this purpose, buffer gas assisted cooling rate at appropriate pressure as well as the required axial magnetic field have also been estimated in an extension of the case study that had been initiated earlier [1].

References

1. R. G. Greaves and C. M. Surko, CP606, Non-Neutron Plasma Phys IV, Ed. F. Anderegg, 10 (2002)]
2. J. Zhao, J. I. Sakai, K. Nishikawa and T. Neubert, Phys. Plasmas 1, 4114 (1994)
3. G. P. Zank and R. G. Greaves Phys. Rev. E 51, 6079 (1995)
4. C. M. Surko, M. Leventhal and A. Passner Phys Rev Lett 62, 901 (1989)
5. R. G. Greaves and C. M. Surko, Phys. Rev. Lett. 75, 3846 (1995)
6. S. J. Gilbert, D. H. E. Dubin, R. G. Greaves and C. M. Surko, Phys. Plasmas 8, 4982 (2001)
7. Y. P. Raizer, "Gas Discharge Physics", Ch 3, Springer – Verlag 1991
8. J. A. Bittencourt, "Fundamentals of Plasma Physics" 3rd Edition, Springer – Verlag, 2004
9. C. M. Surko, "Enrico Fermi School of Physics – Physics with many positrons", Varenna, Italy 2009
10. F. G. Major, V. N. Gheorghe, G. Werth, "Charged Particle Traps", Springer International 2005
11. J. P. Sullivan, S. J. Gilbert, and C. M. Surko, Phys. Rev. Lett. 86, 1494 (2001)
12. K. Iwata, R.G. Greaves, T.J. Murphy, M.D. Tinkle and C.M. Surko, Phys. Rev. Lett. 51, 473 (1995)

Primary author: Mr BAJPAI, Manu (Institute for Plasma research, Gandhinagar, India)

Presenter: Mr BAJPAI, Manu (Institute for Plasma research, Gandhinagar, India)