Chaotic motion of positrons in a planned compact levitated dipole experiment

H. Saitoh[1] and I. Tanioka[1]

[1]*Graduate School of Frontier Sciences, The University of Tokyo, Kashiwa, Japan*

The dipole magnetic field can confine plasmas at any non-neutrality, and is planned to be used as one of trapping configurations for electron-positron plasmas [1]. The RT (Ring Trap) Group of the University of Tokyo is planning to develop a compact levitated dipole device toward the trapping of pulsed positron beam [2] and other plasma experiments. Although the dipole magnetic field is axisymmetric, the adiabaticity of trapped particle orbits in this geometry are not always conserved due to several reasons. Among these reasons, the coupling of gyro and bounce motions in the dipole field can break the first and second adiabatic invariants, resulting in chaotic orbits [3]. In the magnetic field configuration of RT-1, a relatively large and originally fusion-oriented experiment, it was shown that high-energy positrons (>10keV) supplied from the Na-22 source have chaotic orbits [4]. In a planned compact dipole for antiparticle trapping, on the other hand, particles with much lower energies on the order of 10 eV can be chaotic [5]. We report the effects of chaos in the planned levitated dipole together with the status of the dipole experiment construction.

[1] M.R. Stoneking *et al.*, J. Plasma Phys. **86**, 155860601 (2020).
[2] H. Higaki, K. Michishio *et al.*, Appl. Phys. Express **13**, 066003 (2020).
[3] S. Murakami, T. Sato and A. Hasegawa, Phys. Fluids B **2**, 715 (1990).
[4] H. Saitoh, Z. Yoshida *et al.*, Phys. Rev. E **94**, 043203 (2016).
[5] H. Saitoh and I. Tanioka, Plasma Fusion Res. **17**, 2401026 (2022).