7th Asia-Pacific Conference on Plasma Physics, 12-17 Nov, 2023 at Port Messe Nagoya

Relaxation process of fundamental magnetized plasma structures

Young Dae Yoon[1,2] and Gunsu Yun[2]
[1] Asia Pacific Center for Theoretical Physics, [2] Department of Physics, POSTECH
e-mail (speaker): youngdae.yoon@apctp.org

Magnetized plasmas are generally composed of local fundamental structures such as current sheets and flux ropes. Such structures have extensively been studied as equilibrium solutions, but how an initially disequilibrated system evolves to an equilibrium has been relatively less studied. It will be shown that a magnetized plasma system equilibrates in a collisionless manner through particle orbit class transitions. These particle orbits are classified by utilizing symmetries of the given system. Equilibration induces particle orbit class transitions that leave distinct features in phase-space distributions. Theses feature can be tracked in simulations to identify the types of particle orbit transitions that are taking place. The existence of a guide field induces asymmetries to the system that effectively acts as a dynamo that amplifies magnetic fields. Particle-in-cell simulations and spacecraft observations verify the equilibration process and demonstrate its ubiquity. [1, 2]

References
[1] Y. D. Yoon, G. S. Yun, D. E. Wendel, and J. L. Burch, “Collisionless relaxation of a disequilibrated current sheet and implications for bifurcated structures,” Nature Communications 12, 3774 (2021)
[2] Y. D. Yoon, D. E. Wendel, G. S. Yun, “Equilibrium selection via current sheet relaxation and guide field amplification,” Nature Communications 14, 139 (2023)