

# **Gyro-kinetic Study of Residual Zonal Flow for Slowing down Distribution Function**

**Kyeong Pyo Lee and T. S. Hahm**

Department of Nuclear Engineering, Seoul National University, 32-203, 599 Gwanak-ro, Gwanak-gu, Seoul  
Republic of Korea

kplee2001@snu.ac.kr

## ***Abstract***

In toroidal plasma, zonal flow in bi-normal direction doesn't fully decay by collisionless process but remains with specific ratio of an initial level. This flow is called "Residual zonal flow" [1]. Since the residual flow regulates particle & heat transport in tokamak, it is important to know the exact level depending on its wavelength. In a burning plasma, fusion reaction produces fast alpha particles with an energy about 3.5 MeV. In the previous works, residual zonal flow level (and also zonal flow itself) is calculated in the Maxwellian equilibrium [1,2,3]. However, for alpha particle, the equilibrium distribution function is different from the Maxwellian distribution. In this study, we calculate the residual zonal flow level for slowing down distribution function. We use modern gyro-kinetic pull-back transformation method for residual zonal flow calculation [3]. The results of alpha particle contribution are compared with those obtained with the equivalent Maxwellian distribution function.

[1] M. N. Rosenbluth and F. L. Hinton, Phys. Rev. Lett. Vol. 80, No. 4, 1998.

[2] Y. Xiao and P. J. Catto, Phys. Plasmas. 13, 102311, 2006.

[3] L. Wang and T. S. Hahm, Phys. Plasmas. 16, 062309, 2009