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Gyrokinetic simulation of zonal-flow response in LHD plasma with equilibrium-scale radial electric field TOMO-HIKO WATANABE, HIDEO SUGAMA, National Instituite for Fusion Science — For the anomalous transport reduction, it is important to seek a magnetic configuration with strong zonal-flow generation. The zonal-flow response is enhanced in a neoclassically-optimized helical configuration with slower radial drift of trapped particles, such as the inward-shifted LHD plasma. It is also pointed out that an equilibrium-scale radial electric field (E_r) leads to further increase of zonal flows in helical systems [1]. Our gyrokinetic simulations show increase of the residual zonal flows in case with the poloidal Mach number of 0.1-0.3, and support the theoretical prediction. The residual zonal-flow amplitudes are weakly dependent on the radial wavenumbers in the inward-shifted LHD plasma, while, in case without E_r, the lower residual level is found for the longer radial wavelength. In the standard LHD configuration, furthermore, the zonal-flow response shows an oscillatory behavior. It is also noteworthy that, under the identical conditions on the magnitude of E_r and the magnetic geometry, using ions with a heavier mass gives rise to a higher zonal-flow response. Therefore, the turbulent transport is expected to show a more favorable ion-mass dependence than the conventional gyro-Bohm scaling.

[1] H. Sugama and T.-H. Watanabe, Phys. Plasmas **16**, 056101 (2009).

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