3rd Asia-Pacific Conference on Plasma Physics, 4-8,11.2019, Hefei, China

Observation of Phase Pattern Accelerating Zonal Flow

Z. B. Guo

School of Physics, Peking University, Beijing, China

We report the first experimental observation of zonal ow(ZF) formation through phase patterning. Here the `phase' refers to the eikonal phase carried by streamer-like mode. It is observed that the phase-gradient profile tends to form `shock' layer structures in regions where there are strong streamer-ZF interactions. The emergence of phase-gradient shock layers invalidates the constant phase gradient hypothesis, which is frequently employed in the modulational instability models of ZF generation, and is consistent with a recent theoretical work [Z.B. Guo, et al, Phys. Rev. Lett. 117, 125002 (2016)], which predicts that the phase-curvature (gradient of the phase-gradient) can produce a new Reynolds force and accelerate the ZF. By decomposing the Reynolds' force of the tilted streamers into a phase curvature driven piece and an amplitude inhomogeneity driven one, it is found that inside the shock layers the phase curvature plays a prominent role in accelerating the ZF. We also explore the formation mechanism of the phase pattern and its consistent dynamics with phase-curvature-driven ZF. These findings potentially open a new way to understand the various illusive self-organization phenomena in plasma turbulence.