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**Collisionless Damping of Zonal Flows in Helical Systems** H.

SUGAMA, T.-H. WATANABE, National Institute for Fusion Science, Toki 509-5292, Japan — Zonal flows are observed in numerous natural systems such as atmospheric and oceanic currents while in fusion science they are intensively investigated as an attractive mechanism to regulate plasma turbulent transport. In the present work, collisionless time evolutions of zonal flows in helical systems are investigated by the gyrokinetic theory and simulation. The dependence of the frequency and damping rate of the geodesic acoustic mode (GAM) on the helical geometry is elucidated. Also, we analytically describe collisionless long-time behavior of zonal flows in helical systems after the damping of the rapid GAM oscillations [1]. It is shown that, under the influence of particles trapped in helical ripples, the response of zonal flows to a given source becomes weaker for lower radial wave numbers and deeper helical ripples while a high-level zonal-flow response, which is not affected by helical-ripple-trapped particles, can be maintained for a longer time by reducing their bounce-averaged radial drift velocity. This implies a possibility that helical configurations optimized for reducing neoclassical ripple transport can simultaneously enhance zonal flows which lower anomalous transport. A good agreement between the theoretical predictions and results from the gyrokinetic- Vlasov-simulation code [2] is verified. [1] H. Sugama and T.-H. Watanabe, Phys. Rev. Lett. 94, 115001 (2005). [2] T.-H. Watanabe and H. Sugama, in 20th IAEA Fusion Energy Conference, Vilamoura, Portugal, 2004, TH/8-3Rb.

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