Zonal flow driven nonlinear energy transfer in experiment and simulation

C. Holland,[a] G.R. Tynan,[a] R.J. Fonck,[b] G.R. McKee,[b] J. Candy,[c] and R.E. Waltz[c]

[a]University of California-San Diego, La Jolla, California.

[b]University of Wisconsin-Madison, Madison, Wisconsin.

[c]General Atomics, San Diego, California.

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Abstract. Using a newly developed algorithm, the *nonlinear* transfer of internal fluctuation energy $|\tilde{n}|^2$ due to convection of drift-wave turbulence by a geodesic acoustic mode (GAM, a finite-frequency zonal flow) has now been measured directly in a high-temperature plasma. By combining spatially resolved density fluctuation measurements obtained via an upgraded beam emission spectroscopy system in the edge region of the DIII-D tokamak [J.L. Luxon, Nucl. Fusion **42**, 614 (2002)] with a velocity inference algorithm, the convection of turbulent fluctuations by the GAM has been measured. Taken together, the results strongly suggest that GAM convection of turbulence leads to a transfer of internal fluctuation energy from low to high frequencies, in agreement with expectations from theory and simulation. In addition, the GAM is found to modulate the intensity of the density fluctuations. Calculations of the measured nonlinear interactions in the gyrokinetic code GYRO are found to be in good qualitative agreement with the experimental observations.

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