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Experimental Study of Nonlinear Energy Transfer in Frequency Domain Using a Two-field Model MIN XU, University of California, San Diego, GEORGE TYNAN, CHRISTOPHER HOLLAND, ZHENG YAN, STEFAN MUELLER, JONATHAN YU, University of California, San Diego — A two-field model for studying quadratic nonlinear energy transfer in frequency domain is proposed, and its theoretical standing, application in experiments and experimental results are presented. The magnitude of quadratically coupled energy among different frequencies is directly computed from nonlinear energy transfer terms in the derived energy balance equations. Experimentally, a 9-tip Langmuir probe array is used to measure all the quantities needed for the calculation. The experiments have been carried out on CSDX (Controlled Shear Decorrelation Experiment) plasma device. The cross-bispectral calculations for both the internal and kinetic energy show clearly that energy transfer from drift wave turbulence to the azimuthally rotating mean flow exists in the region where a shear layer is formed. The measured energy transfer terms (both the kinetic and internal) show a net energy transfer to low frequencies (corresponding to larger azimuthal scales) at the maximum shear location, and a net transfer to higher frequencies (corresponding to smaller azimuthal scales) on either side of the shear layer, indicating that the direction of non-linear energy transfer is closely related to the shear in plasma.

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