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Analysis of the influence of external biasing on Texas Helimak turbulence

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ABSTRACT

We analyze alterations on the electrostatic turbulence in experiments with imposed bias to control the plasma radial electric field in Texas Helimak (K. W. Gentle and H. He, Plasma Sci. Technol. **10**, 284 (2008)), a toroidal plasma device with a one-dimensional equilibrium, magnetic curvature, and shear. Comparing discharges from different biased potentials, we identify, in a roughly uniform gradient region, a continuous variation from low turbulence level and narrower frequency spectra, for negative bias, to high turbulence level and broadband spectra for positive bias. Overall, we distinguish two kinds of perturbed turbulence, classified according to their intensity, spectral, statistical, and recurrence properties. When the bias is positive, the turbulence shows enhanced and broadband spectra with non Gaussian probability distribution functions having noticeable long tails (extreme events) similar to the turbulence in tokamak scrape-off layer. On the other hand, negative bias reduces the turbulence level and decreases the spectrum widths. Also for negative bias, we found large frequency widths whenever the coupling between drift waves and the sheared plasma flow is fast enough to allow the enhancement of sidebands modes.

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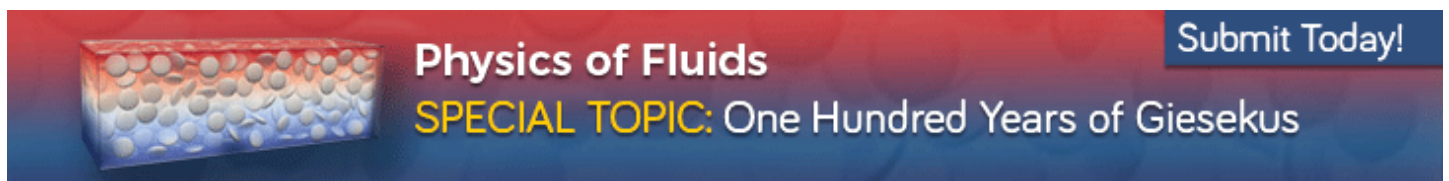
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