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Gradient-driven turbulence in Texas Helimak

Physics of Plasmas **29**, 042303 (2022); <https://doi.org/10.1063/5.0081036> D. L. Toufen^{1,a)},  F. A. C. Pereira^{2,3},  Z. O. Guimarães-Filho³,  I. L. Caldas³, and K. W. Gentle⁴[View Affiliations](#)[View Contributors](#)

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We investigate the turbulence level dependence on plasma profiles in experiments in Texas Helimak, a toroidal basic plasma device, with long stable electron cyclotron resonant heating (ECRH) discharges and great flexibility to alter the equilibrium magnetic field. A large set of Langmuir probes is used to obtain the turbulence level and also the plasma radial profiles for several magnetic field intensities with the same safety factor and field line pitch profiles. As a consequence of the ECRH heating, changing the toroidal magnetic field, the equilibrium density profiles are radially displaced. For all the analyzed discharges, with constant magnetic field curvature and shear profiles, we verify that the plasma turbulence has a critical dependence on the equilibrium density profile. Namely, radial regions with negative density radial gradient, i.e., in the opposite direction of the magnetic curvature, present high turbulence level. By properly comparing the turbulence radial profiles with the density peak position, we show that the negative density gradient is the main cause of high amplitude turbulence, in agreement with predictions for ideal interchange modes. Furthermore, intermittence analysis shows that the extreme events (bursts) contribution for the probability density functions (PDFs) is also related to the relative position with respect to the density peak, and that the turbulence level enhancement is likely due to the increase in burst occurrence.

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