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Study of the origin and nonlinear saturation mechanism of quasi-coherent modes in KSTAR ohmic plasmas

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We have found important phenomena associated with the origin and nonlinear saturation mechanism of quasi-coherent mode (QCM) by observing its evolution induced by the increased collisionality in ECH assisted low-density ohmic discharges. Here, QCM is a micro-turbulence with TEM-like characteristics [1-2]. A coherent mode is promptly excited by electron cyclotron resonant heating at low density and collisionality, and gradually or abruptly changed into QCM by slow or rapid increase of the collisionality through electron density control. Figure 1 shows an example of the gradual change from a coherent mode to QCM by slowly increased collisionality, measured by the microwave imaging reflectometer (MIR) [3]. The QCM is changed into broadband turbulence as the collisionality further increases above a critical level. These phenomena suggest that QCM originates from a coherent mode; it may be a primary mode (fastest growing mode) rather than a secondary mode (transport-dominant mode); the nonlinear saturation mechanism of the QCM is closely linked with the collisionality; and the QCM survives in a finite range of the collisionality.

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References

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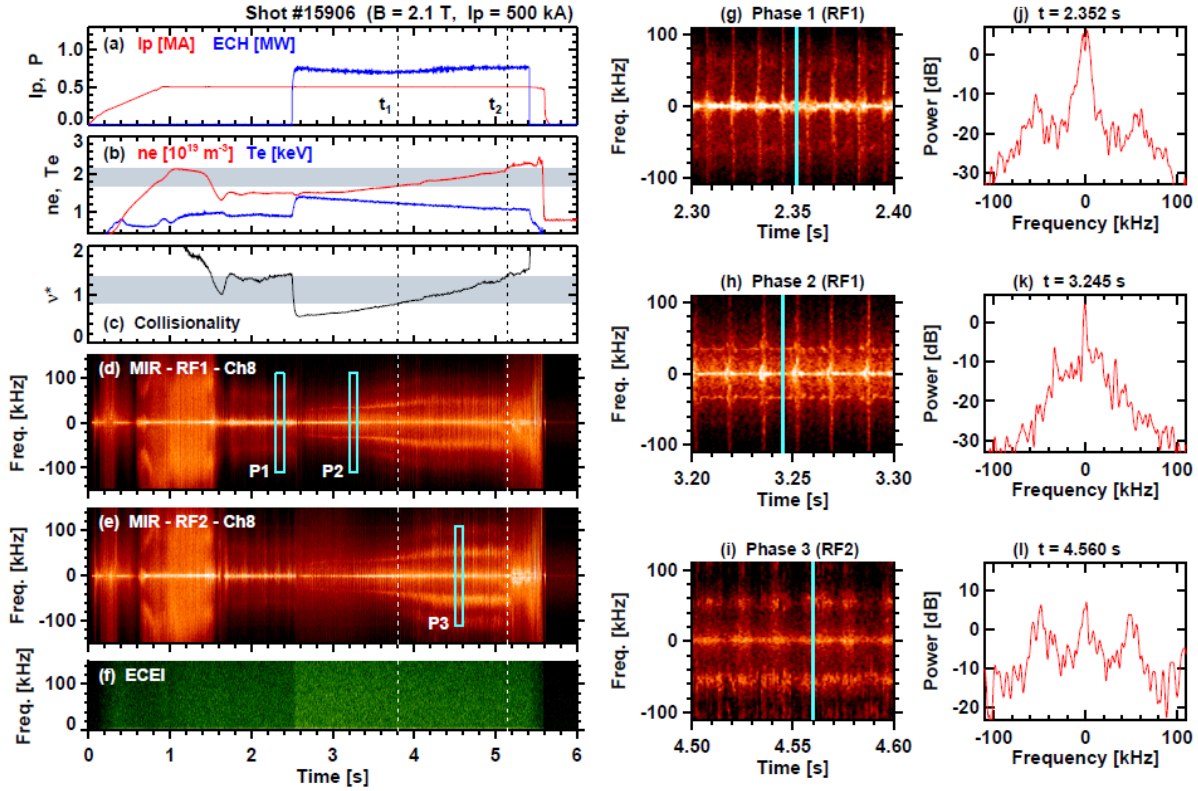

Figure 1. Time histories of the plasma parameters for an ohmic discharge #15906: (a) the plasma current and 140 GHz ECH power, (b) line-averaged electron density and electron temperature at R = 1.90 m (r/a ~ 0.24), and (c) normalized collisionality at R ~ 1.90 m. (d) – (e) Spectrograms of MIR signals from two radial channels. (f) Spectrogram of Te fluctuations at R = 1.90 m from ECEI. (g) – (i) show the zoom-in figures marked by cyan boxes in (d) and (e). (j) – (l) are the spectra at the times indicated by the cyan vertical line in (g) – (i).