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Study of interactions between GAMs and broadband turbulence in the T-10 tokamak

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The new finding in study of geodesic acoustic modes (GAMs) on the T-10 tokamak since the last IAEA FEC 2014 are described. The broadband oscillations of plasma electric potential and density in Ohmic and ECRH regimes are measured by Heavy Ion Beam Probe (HIBP) in the core plasma. At the periphery, at r/a > 0.8, the dominated GAM peak with frequency ˜ 14 kHz and noticeable peak of quasi-coherent oscillations with frequency 40-100 kHz and HFHM ˜30 kHz are observed. The noticeable GAM peak is also seen on the frequency resolved turbulent particle flux measured by HIBP and probes. It was found that in the high-density (ne˜4×1019m-3) discharges during ECRH pulse, causing the energy confinement degradation, the level of broadband fluctuations measured by correlation reflectometry and HIBP decreases. At the same time the amplitude of GAM oscillations of plasma potential increases. The bi-spectral analysis of potential oscillations shows the statistically significant auto-bicoherency at the GAM frequency at the periphery, r/a > 0.8, indicating existence of three-wave interaction between GAM and broadband turbulence up to the presently studied frequency band 250 kHz, that points to quadratic character of nonlinearity in GAM generation, e. g. owing to Reynolds stress. This also holds for the cross-bicoherency of potential with density and poloidal magnetic field. For the plasma periphery, the two-fluid model of nonlinear interplay between GAM and small-scale drift turbulence, excited by dissipative trapped electron mode is proposed. The model includes collisional damping of GAM due to parallel ion viscosity. The modelled GAM amplitude scales with density as 1/n that is consistent with the experimental observation.

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