ELM-like Mode Excited by the Off-axis-Fishbone-mode in the DIII-D Advanced Tokamak Regime*

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Recently, high β_N exploration in the DIII-D device revealed that the Off-axis-Fishbone Mode (OFM) triggers edge localized mode (ELM)-like events and causes massive carbon influx, preventing from achieving the long duration high β_N performance. The nonlinear, but, highly-reproducible "density-snake-like" mode distortion accompanies with the mode growth. The observed Energetic Particle (EP) losses increase with the amplitude of the snake. The snake is located toroidally in a synchronized manner with the OFM amplitude maximum at the outer midplane, but radially far from the magnetic axis and poloidally narrower than the OFM structure. This snake-like behavior increases toward the ELM-like events. The off-axis-neutral beam injection aimed at the $q \sim 2$ surface tends to more frequently excite these ELM-like events. Discharges were well above the no-wall β_N limit with the q-profile flat or slightly-inverted. The q_{min} was slightly below two. The excitation of ELM by the OFM was first reported by the JT60-U in the long duration high β_N exploration [1]. An interesting observation was the double-OFM events during the high β_N phase causing beta collapse. The double-OFM induces various combinations of OFM termination, ELM onset and resistive wall mode excitation. In spite of these differences from the traditional fishbone in the mode decay period, the mode during initial growing phase have typical fishbone characteristics, such as, the frequency chirping and neutron emission oscillation as previously reported [2]. The detailed analysis of the parametric dependences is in progress.

References

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