Effect of the temporal parameters of geodesic acoustic modes on the lh-transition initiation possibility in tuman-3m tokamak

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H-mode is a necessary operating regime for tokamak-reactor, thus study of possibility and methods of initiation of H-mode is of crucial importance for different fusion devices. Transition to H-mode (LH-transition) could be initiated under certain conditions by inducing the perturbation of radial electric field. Inhomogeneity of *E*r (or shear) leads to the suppression of turbulence.

Geodesic acoustic mode (GAM) is a specific kind of low-frequency Er oscillations in toroidal plasma. GAN oscillations do not affect particle and heat transport directly, though create strong inhomogeneity of radial electric field and poloidal rotation velocity, controlling anomalous transport. Er shear created by GAM is not constant in time, thus for LH-transition a specific combination of parameters of oscillating *E*r (primarily sup-threshold amplitude and burst duration) and plasma is required [1].

The effect of GAM temporal parameters on LH-transition initiation possibility is of special interest. GAM observations in TUMAN-3M tokamak [2, 3] show that in ohmic discharges with GAM activity LH-transition is observed in low density shots (1–1.4.1019 m–3) after a series of GAM bursts; in most cases GAM frequency decrease preceding LH-transition is also observed. Interchanging character of GAM is also clear, as GAM exists in a series of bursts with period close to 0.2 ms, and series of such bursts repeat with the period of around 2 ms.

To determine the role of GAM temporal features, the modeling of plasma density evolution with experimental discharge and GAM parameters was carried out for a single burst and for the series of bursts. Modeling results show that for fixed set of other GAM parameters frequency decrease lowers GAM amplitude and duration thresholds for LH-transition initiation. In case of short burst series similar to the observed one in TUMAN-3M, GAM frequency decrease could facilitate LH-transition, which is in agreement with experiment.

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References

1. L.G. Askinazi, A.A. Belokurov et al 2017 Plasma Phys. Control. Fusion 59 014037.
2. V.V. Bulanin et al 2016 Plasma Phys. Control. Fusion 58 045006.
3. L.G. Askinazi et al 2012 Tech. Phys. Lett. 38 6.