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GAM Evolution and LH-Transition in the TUMAN-3M Tokamak

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Geodesic acoustic mode (GAM) is a specific mode of low-frequency oscillations in toroidal plasma, which does not participate in radial transport directly, although affects anomalous transport through control of turbulence level [1]. GAM-induced shear of radial electric field is not constant in time, therefore possibility of LH-transition initiating in this case is to be studied.
GAM were experimentally studied in TUMAN-3M tokamak by means of heavy ion beam probe [2] and Doppler reflectometry. Oscillations were detected before ohmic LH-transition and disappeared in H-mode. There was also detected an interrelation between GAM and ambient turbulence.
To understand if GAM can hinder or facilitate the transition, there was designed a simple model of LH-transition under the effect of GAM-induced radial electric field, based on TUMAN-3M tokamak geometry and basic plasma parameters. Simulation of spatial and temporal evolution of plasma density profile was carried out. Radial electric field was disturbed by oscillations, which structure, frequency and localization area corresponded to GAM in TUMAN-3M tokamak. Diffusion coefficient was taken in a form D=k(omega(r,t))D_0(r), with radial electric field shear dependent factor k(omega), similar to one proposed in [3] and spatial dependent part D_0(r). Simulation results show possibility of LH-transition, initiated by a space- and time-localized GAM burst, if GAM parameters, such as amplitude, frequency, wavelength, burst duration, are within certain limits, which are related to each other and also depend on plasma parameters, primarily ion temperature. If GAM parameters are within those limits (e.g., amplitude is higher than a certain threshold), LH-transition occurs and system stays in H-mode after the GAM burst.
Comparison of modeling with experimental observation of GAM in TUMAN-3M tokamak shows that experimental GAM parameters are within the limits, which define possibility of GAM-induced LH-transition.

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[2] L.G. Askinazi et al, Evolution of GAM oscillations in a shot with ohmic H-mode in TUMAN-3M tokamak, JTP Letters 38, 6 (2012);
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