Limit cycle oscillation initiated l-h transition in globus-m tokamak [[1]](#footnote-1)\*)

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Studies of possibility of L-H transition, i.e. transition to improved confinement regime with suppressed turbulent transport (H-mode) is important for modern plasma physics and nuclear fusion. Turbulence is suppressed by highly inhomogeneous radial electric field [1].

Aside from L-H transition initiated by external Er perturbation, it is possible for internal processes in plasma which create such inhomogeneous Er self-consistently, e.g. zonal flows [2]. Zonal flows manifest itself as narrow radial layers of poloidal plasma rotation, which leads to generation of inhomogeneous Er on the border of adjacent layers; such Er could lead to turbulence suppresson. Effectiveness of suppression and possibility of L-H transition initiation depends on Er perturbation spatial and temporal parameters [3].

Intermediate state between L- and H-mode, or I-phase, characterized by presence of zonal flows in form of LCO (limit cycle oscillations) is observed on may tokamaks [2], including Globus-M tokamak [4]. Depending on observed LCO frequency, I-phase resulted in self-sustaining H-mode (with LCO frequency 6 kHz) or backwards transition to L-mode (with LCO frequency 8.5 kHz). This observation is in agreement with results of the studies of L-H transition initiation by varied Er of geodesic acoustic mode [3], which states that lesser frequency of varied Er is more effective for L-H transition initiation.

For experimental parameters of discharges with LCO in Globus-M tokamak there was created a numerical model which calculates density profile evolution with non-linear diffusion coefficient that considers turbulence suppression by inhomogeneous Er. Modeling results show that LCO with experimental Globus-M parameters could initiate L-H transition. Indeed lesser LCO frequency of 6 kHz leads to initiation of L-H transition, while higher LCO frequency of 8.5 kHz do not lead to L-H transition, which is in agreement with experiment.

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References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Mu/ru/BP-Belokurov.docx) [↑](#footnote-ref-1)