FAST ION LOSSES caused by toroidal alfven eigenmodes in spherical tokamak globus-m2 [[1]](#footnote-1)\*)

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Toroidal Alfvén modes (TAE) affect the fast ion confinement in tokamaks, since TAE excitation usually occurs due to the resonance with fast ions with velocities close to Alfven velocity, in spatial regions where toroidal coupling of neighboring poloidal harmonics of the Alfvén continuum occurs in a toroidal geometry [1]. The losses associated with TAE excitation turn out to be rather high: for example, in paper [2], provided in the DIII-D tokamak it is reported that losses are up to 70% of ions injected into the plasma. In spherical tokamaks, it is TAEs that are the most dangerous of the Alfvén instabilities, since the width of the frequency gap where TAEs are able to exist without damping is affected by the aspect ratio of the tokamak [3], therefore this instability was observed in almost all spherical tokamaks and also led to fast ion losses.

At the same time, the problem of predicting losses in certain operating regimes of a tokamak is rather important. For this purpose, the dependence of the fast ion losses on the perturbation amplitude, plasma current and toroidal magnetic field was investigated. The losses were estimated using data from various diagnostics: a charge-exchange neutral analyzer (NPA), a neutron spectrometer, a broadband SPD bolometer, as well as a high-speed SPD photodiode array.

Earlier, based on NPA diagnostics data, a regression fit of the value of neutral analyzer flux drops during single TAE bursts $dN/N$ in the Globus-M2 [4] tokamak was obtained [5]. A fairly strong dependence of the value of $dN/N$ on the plasma current in the extent close to $-1$, and rather weak dependence on the toroidal magnetic field was shown. The obtained dependence on the perturbation amplitude $δB$ in the extent close to $0.5$ does not explain the nature of the losses, mostly due to the fact that NPA flux drop does not indicate the final loss of the fast ions, but only their redistribution in the phase space. To study the degree of fast ion losses on TAE magnitude, the data of a broadband SPD bolometer, which registers individual particles as well as radiation, was used. The resulting dependence shows linear behavior, which indicates [6] predominantly coherent character of the losses. This is also confirmed by the presence of a pronounced harmonic at the frequency of the Alfvén mode in the spectra of high-speed SPD photodiodes array signals.

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