Runaway electron beam provides chirping instabilities at a spherical tokamak [[1]](#footnote-1)\*)

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Two different types of MHD instabilities with rapidly chirping frequency were found to arise in the Globus-M2 [1] spherical tokamak in substantially different frequency ranges. First type [2] arises at frequencies of an order of 1 MHz in OH plasmas at relatively low density $\left〈n\_{e}\right〉<2∙10^{19} m^{-3}$ in a wide range of toroidal magnetic fields and plasma currents. This type of instability was identified as compressional Alfven waves, driven by electrons, accelerated during a sawtooth crush. It was found that mode frequency is sweeping in time according to the Berk-Breizman hole-clump nonlinear chirping model [3]. The second type of waves arises in specific single-swing regime of central solenoid current, when the plasma tends to decay at extremely low density $\left〈n\_{e}\right〉≈2∙10^{18} m^{-3}$ and plasma current $I\_{p}<20kA$ and in fact is an instability of the RE beam. The exited modes cover whole observed frequency range and divided into several (two or three) frequency regions: approximately 0 – 30 MHz, 60 – 120 MHz and sometimes 30 – 60 MHz. Reconnection of the branches was also observed. Single chirps are more rapid than it is for 1 MHz Alfven instability and follow an exponential law. The reconstruction [4] of RE spectrum based on distant hard X-ray (HXR) spectrometer [5] data has shown that the observed instability may substantially modify RE distribution function. This paper, we suppose, is the first report of frequency chirping instabilities excited by accelerated electrons at a spherical tokamak.

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