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 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 and plasma current 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.

Measurements were carried out on the Unique scientific facility «Spherical tokamak Globus-M», which is incorporated in the Federal Joint Research Center Material science and characterization in advanced technology" in scope of state task 0040-2019-0023 in Ioffe institute.

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