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Parametric mechanism for formation of the fine structure of the dynamic spectra of Jovian S-bursts

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In present report a new mechanism for formation of the fine structure of decametric radio emission dynamic spectra is proposed. Our consideration is based on both the plasma model of Jovian decametric emission source and on parametric frequency modulation of the electromagnetic and plasma waves due to time variations of the planetary magnetic field, which is perturbed by intense magnetohydrodynamic oscillations. According to this model a plasma wave near the upper-hybrid frequency is generated, with a subsequent transformation into a fast extraordinary wave in the frequency interval where the refractive index of the electromagnetic waves is very small. In these frequency intervals the plasma waves as well as the extraordinary electromagnetic waves undergo the strong group velocity dispersion. It is well known that the amplitude-frequency characteristics of the waves, traveling in a medium with time-varying parameters, can be affected substantially. The laboratory model experiments and numerical calculations performed by us have shown that time variations of the magnetic field can lead to the amplitude-frequency modulation of the waves and, consequently, to the formation of quasiperiodic sequences of bursts or of solitary bursts in the dynamic spectra. The characteristic time scales of the quasiperiodic S-bursts sequences and the forms of the solitary S-bursts are determined by the characteristics of the low-frequency magnetic field variations, initiated, for example, by Io motion through the planetary magnetic field or by large-amplitude Alfven waves excited in Jovian ionosperic resonator.