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Fine spectral structures in Jovian decametric radio emission observed by ground-based radio telescope.

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Abstract

Jupiter with the largest planetary magnetosphere in the solar system emits intense coherent non-thermal radio emission in a wide frequency range. This emission is a result of a complicated interaction between the dynamic Jovian magnetosphere and energetic particles supplying the free energy from planetary rotation and the interaction between Jupiter and the Galilean moons. Decametric radio emission (DAM) is the strongest component of Jovian radiation observed in a frequency range from few MHz up to 40 MHz. This emission is generated via cyclotron maser mechanism in sources located along Jovian magnetic field lines. Depending on the time scales the Jovian DAM exhibits different complex spectral structures. We present the observations of the Jovian decametric radio emission using the large ground-based radio telescope URAN-2 (Poltava, Ukraine) operated in the decametric frequency range. This telescope is one of the largest low frequency telescopes in Europe equipped with high performance digital radio spectrometers. The antenna array of URAN-2 consists of 512 crossed dipoles with an effective area of 28 000 m^2 and beam pattern size of 3.5 x 7 deg. (at 25 MHz). The instrument enables continuous observations of the Jovian radio during long period of times. Jovian DAM was observed continuously since Sep. 2012 (depending on Jupiter visibility) with relatively high time-frequency resolution (4 kHz - 100ms) in the broad frequency range (8-32 MHz). We have detected a big amount of the fine spectral structures in the dynamic spectra of DAM such as trains of S-bursts, quasi-continuous narrowband emission, narrow-band splitting events and zebra stripe-like patterns. We analyzed mainly the fine structures associated with non-Io controlled DAM. We discuss how the observed narrowband structures which most probably are related to the propagation of the decametric radiation in the Jupiter's ionosphere can be used to study the plasma parameters in the inner Jovian magnetosphere.

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