Waveform analysis of Jovian decametric radiation; especially comparison of S-burst with narrow-band emission (N-burst)

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Since Burke and Franklin (1955) made the first report on the existence of the Jovian nonthermal radio emissions in the decameter wave length range, a lot of studies have been done to find out the nature of this strong radio burst (Call, et al., (1961), Ellis (1962), Warwick (1963), etc). Analyses of the microstructures of DAM (S-burst, L-burst, narrow-band emission(N-burst) and so on) have been carried out mainly by using the dynamic spectrum analysis; however, recent developments in the data handling techniques on the basis of the high speed A/D conversion have enabled us to study the microstructures in the waveforms. The first attempt of the waveform analysis of S-bursts was carried out by Carr et al, (1999) and they reported that a single S-burst consists of several subpulses which form wave packets and typically has the duration-time less than 1 msec. The time scale of subpulse is found to be time scale of wave coherence of S-burst signal that reflects the nature of the microscopic instabilities where efficient wave-particle interaction takes place in the source region. In the present study, the waveform analysis has been made by using the data of Tohoku University, especially focusing on the relation between the subpulse or wave packet structure and the phase coherence for both S-burst and N-burst. The present analysis has shown that in the case of S-bursts, each wave packet corresponds to the unit of phase coherent, however, for N-burst; each wave packet does not necessarily correspond to the unit of phase coherence. It has been suggested that S-bursts are highly-monochromatic coherent waves generated by a single instantaneous source with a spatial extent of a few kilometers along the IFT; however, N-bursts are not emitted by a single coherent source but a superposition of coherent radiation sources.