Instantaneous frequency analysis on nonlinear EMIC emissions: Arase observation

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In the inner magnetosphere, the Arase spacecraft has observed nonlinear electromagnetic ion cyclotron (EMIC) emissions with both rising and falling frequencies. The instantaneous frequency analyses on the electromagnetic fields of the EMIC rising tone emission have been performed by the Hilbert-Huang transform. The time variation of the instantaneous frequency shows a good agreement with the nonlinear theory for the frequency evolutions. Rapid instantaneous frequency modulation is also found during the rising tone emission. We estimate the peak-to-peak time of the fluctuation in the frequency, and find that the fluctuation is caused around a half of the particle trapping time. Considering the motion of the phase-bunched particle around the resonant velocity, it is expected that the nonlinear resonant current which induces the falling frequency is formed in the half of the trapping time.