Quasi-periodic Modulations of A Zebra Pattern in A Solar Radio Burst and Their Origin

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Various magnetohydrodynamic (MHD) waves have recently been detected in the corona and investigated intensively in the context of the coronal heating and coronal seismology. In the radio wave band, signatures of these waves can be recognized as quasi-periodic modulation in intensity and other quantities. Searching for signatures of such kind of waves, we investigated a zebra pattern (ZP) in a solar radio burst on 2011 June 21. For this, high-resolution radio spectral data observed with the Assembly of Metric-band Aperture Telescope and Real-time Analysis System (AMATERAS) were analyzed in detail. Consequently, we found two different quasi-periodic modulations in frequency separation between the stripes (Δf) and radio intensity with the typical periods of 1–2 s and 1–3 s, respectively. The modulation in Δf showed a characteristic negative frequency drift of 3–8 MHz/s. Based on the Double Plasma Resonance (DPR) model, the Δf modulation can be interpreted as small scale (about 8,000 km) disturbances propagating along the coronal loop with phase speeds of the 3,000–8,000 km/s. Most probably, the Δf modulation can be interpreted as impulsively generated propagating fast sausage mode waves. On the other hand, the intensity modulation can be explained by the quenching of the loss-cone instability, known as negative bursts. In this presentation we suggest that magnetic reconnection in the low corona could be the source of the both of modulations in Δf and in intensity.

Keywords: Sun, radio burst, zebra pattern, quasi-periodic variation, magneto-hydro dynamic wave

