Quasi-periodic acceleration of electrons in the flare on 2012 July 19

Quasi-periodic pulsations (QPPs) of nonthermal emission in an M7.7 class flare on 2012 July 19 are investigated with spatially resolved observations at microwave and HXR bands and with spectral observations at decimetric, metric waves. Microwave emission at 17GHz of two footpoints, HXR emission at 20–50keV of the north footpoint and loop top, and type III bursts at 0.7–3 GHz show prominent in-phase oscillations at 270 s. The microwave emission of the loop leg has less pulsation but stronger emission. Through the estimation of plasma density around the loop top from EUV observations, we find that the local plasma frequency would be 1.5 GHz or even higher. Thus, type III bursts at 700 MHz originate above the loop top. Quasi-periodic acceleration or injection of energetic electrons is proposed to dominate these in-phase QPPs of nonthermal emission from footpoints, loop top, and above. In the overlying region, drifting pulsations (DPS) at 200–600 MHz oscillate at a distinct period (200 s). Its global structure drifts toward lower frequency, which is closely related to upward plasmoids observed simultaneously from EUV emission. Hence, nonthermal emission from overlying plasmoids and underlying flaring loops show different oscillating periods. Two individual systems of quasi-periodic acceleration of electrons are proposed to coincide in the bi-direction outflows from the reconnection region.

Figure 4. Selected regions of the microwave loop at 17 GHz at 05:35 UT.

Figure 7. Contours of HXR sources at 10–20 (red), 20–30 (green), 30–40 (blue), and 40–50 (purple) keV, overlapping above the microwave loop at 17 GHz.

Figure 9. Decimetric and metric spectra observed by SBRs and YNRS.