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Radio and X-Ray Quasi-Periodic Pulsations during the Impulsive Phase of a Confined Solar Flare

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Quasi-periodic pulsations (QPPs) have been observed in nearly all wavelength regimes with different periods ranging from sub-seconds to several minutes during solar flares. It has been argued that flare-associated QPPs can be attributed to the quasi-periodic modulations of the flare energy release, loop oscillations, or emission processes. However, their exact physical nature and relation to the flare energy release are not well understood. Here, we report QPPs observed in radio and X-rays during the impulsive phase of a C1.8-class confined flare. Utilizing the radio spectroscopic imaging technique provided by Karl G. Jansky Very Large Array (VLA), we found that the radio QPPs, observed in the 1–2 GHz L band, consist of four spatially distinct radio sources with different periodicities. The brightest QPP, whose brightness temperature reaches 20 MK, is located close to the main sunspot. The emission is right-hand-circular-polarized and covers nearly the entire 1.0–2.0 GHz band with a period of ~6 s. The other three relatively weak radio QPP sources are located near the brightened flare arcade. One weakly polarized radio QPP source coincides spatially with a looptop X-ray source with a period of ~43 s. The other two radio QPP sources are located at the conjugate footpoints with the opposite sense of circular polarization. Their periods range from 25 to 47 seconds. We discuss the emission mechanism and the possible source of the energetic electrons responsible for the QPPs.

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