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Investigating the band-splitting of a type II solar radio burst using LOFAR imaging and spectroscopy

Type II solar radio bursts are regarded as signatures of shock-accelerated electrons in the solar corona. They show emission lanes drifting slowly from higher to lower frequencies at the fundamental and/or harmonic of the local plasma frequency. Occasionally, these lanes can be further split into two components. This phenomenon is known as band-splitting, and its origin is still under debate. In this study, we investigate the band-splitting of a type II radio burst with the Low Frequency Array (LOFAR). The type II burst exhibits a fundamental and a harmonic emission lane. Both lanes are further split into a higher-frequency and a lower-frequency band. The type II burst is associated with a faint CME, and the occurrence of a type II burst and herringbone bursts superimposed on the type II indicate the presence of a coronal shock wave accelerating electrons. Using LOFAR's spectro-polarimetric and imaging observations, we track the locations of the type II radio sources across multiple frequencies. We find two distinct sources: one corresponding to the higher-frequency component and the other corresponding to the lower-frequency component of the split harmonic band. We also find no significant change in the degree of circular polarisation between the two bands. Our results suggest that the components of the split emission lane originate in two close but distinct regions upstream of the shock.

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