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Observations of type II radio burst band-split and fine-scale motion using the Murchison Widefield Array

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Type II solar radio bursts are believed to be caused by MHD shock-accelerated electrons in the solar corona. Often both fundamental and harmonic bands of type II bursts are split into sub-bands, generally believed to be coming from upstream and downstream regions of the shock; however this explanation remains unconfirmed. Here we present results from imaging analysis of type II radio burst band-splitting and fine structures observed by the Murchison Widefield Array (MWA) on 2014-Sep-28. The MWA provides high-sensitivity imaging spectroscopy in the range of 80-300 MHz with a time resolution of 0.5 s and frequency resolution of 40 kHz. Our analysis shows that the burst was caused by a piston-driven shock, and we provide rare evidence that band-splitting is caused by emission from multiple parts of the shock (opposed to the upstream/downstream hypothesis). We also examine the small-scale motion of type II fine structure radio sources in MWA images. We suggest that this small-scale motion may arise due to propagation effects, a combination of scattering and refraction from coronal turbulence, and not because of the physical motion of the shock location. The study of the systematic and small-scale motion of fine structures may therefore provide a measure of turbulence in different regions of the shock and corona. We discuss how imaging the fine structure in type IIs can be used as a probe of propagation effects and turbulence during shock propagation through the corona.