Observation of quasi-periodic solar radio bursts associated with EUV intensity enhancements

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Radio emission observations from the Learmonth and Bruny Island radio spectrographs are analysed and a train of discrete, periodic radio 'sparks'(finite-bandwidth, short-duration isolated radio features) which precede a type II burst are detected. EUV imaging from SDO/AIA is analysed at multiple wavelengths and reveals a series of quasi-periodic rapidly propagating enhancements in conjunction with a CME and its associated EUV wave, and we link these to the radio features. The period of the radio sparks matches the period of the fast wave train observed at 171 Å. The inferred speed of the emission location of the radio sparks is comparable to the measured speed of the EUV wave which precedes the CME. The calculated height of the radio emission (obtained from an empirical density model) matches the observed location of the EUV wave ahead of the CME. Using the time delay between the wave train fronts and radio sparks, and the height at which the radio emission occurs, propagation velocities between the two locations in the range of fast MHD waves are obtained. From the above evidence we propose the following interpretation: a series of fast waves are produced by the active region during the flare and interact with the leading CME shell or the associated wave and shock, resulting in the acceleration of electrons, the bump-on-tail instability, and emission of radio waves with the frequency corresponding to the local electron plasma frequency, appearing as quasi-periodic sparks in the radio spectrograph.