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Modelling and detecting oscillations generated by magnetic reconnection in solar flares

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Quasi-periodic pulsations in flare emission may provide important information about the underlying energy release process. Here we investigate how reconnection, in the absence of external oscillating driving, may naturally generate oscillations, and we forward model the observable emission. Firstly, we consider 3D MHD simulations of a flaring twisted coronal loop with multiple reconnection sites, allowing for inclusion of a population of non-thermal particles produced at current sheets. We predict oscillations in the intensity of microwave emission in the range 1-15 GHz Two types of oscillations are identified: (a) slowly decaying oscillations with period about 70-75s and relative amplitude 5-10%, seen both in loops with and without energetic particles, and (b) a more transient burst of shorter period and larger amplitude oscillations, only in the loop with energetic particles. We interpret the longer period oscillations as the result of a global sausage mode modulating the average magnetic field strength in the loop, while fast intermittent oscillations associated with energetic particles are likely to be produced by fast variations of the electric field, responsible for energy release particle acceleration in this scenario. Secondly, a more generic MHD model is explored, with reconnection at a single current sheet formed as two twisted flux ropes merge, in order better to understand how reconnection can drive waves. We find the reconnection is oscillatory, and we investigate how this generates MHD waves propagating away from the reconnection site.

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