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Type III burst fine structure from Langmuir wave motion in turbulent plasma

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The Sun frequently accelerates near-relativistic electron beams that travel out through the solar corona and interplanetary space, producing type III radio bursts. The formation and motion of type III fine frequency structures is a puzzle but is commonly believed to be related to plasma turbulence in the solar corona and solar wind. Combining a theoretical framework with kinetic simulations and high-resolution radio type III observations using the Low Frequency Array, we quantitatively show that the fine structures are caused by the moving intense clumps of Langmuir waves in a turbulent medium. Our results highlight how type III fine structure can be used to remotely analyse the intensity and spectrum of compressive density fluctuations, and can infer ambient temperatures in astrophysical plasma, both significantly expanding the current diagnostic potential of solar radio emission.

Primary author: REID, Hamish (University College London)

Co-author: KONTAR, Eduard (University of Glasgow)

Presenter: REID, Hamish (University College London)

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