
Fluctuations in Solar Type III Radio Burst Spectra Observed by Parker Solar Probe and Solar Orbiter

Panisara Thepthong^{*1}, Matthieu Kretzschmar¹, Milan Maksimovic², and Aikaterini Pesini^{2,3}

¹Laboratoire de Physique et Chimie de l'Environnement et de l'Espace – Institut National des Sciences de l'Univers, Université d'Orléans, Centre National de la Recherche Scientifique, Centre National d'Études Spatiales [Paris] – France

²Laboratoire d'Instrumentation et de Recherche en Astrophysique – Institut National des Sciences de l'Univers, Observatoire de Paris, Centre National de la Recherche Scientifique, Sorbonne Université, Université Paris Cité, CY Cergy Paris Université – France

³Radboud Radio Lab, Department of Astrophysics, Radboud University Nijmegen, Nijmegen – Pays-Bas

Résumé

Solar Type III radio bursts are generated by electron beams accelerated during solar flares and propagating through the heliosphere. The most widely accepted mechanism involves the excitation of Langmuir waves by the electron beam through the bump on tail instability, followed by their conversion into electromagnetic (EM) wave emission near the local plasma frequency. This can occur through nonlinear processes or by linear mode conversion from Langmuir waves to EM waves in the presence of density fluctuations. Observational and theoretical studies have suggested that density fluctuations contribute to structured patterns frequently observed in the radio emission of Type III bursts. In this work, we analyze data from Solar Orbiter (SoIO) and Parker Solar Probe (PSP) across a wide range of heliocentric distances and observational angles to investigate the spectral structures of these bursts through the fluctuations in Type III spectra. For 595 Type III burst events, we analyze the fluctuations of the maximum spectrum of each burst, obtained from the peak value of the temporal profile at each frequency. We observed strong agreement between the fluctuations measured by both spacecraft, with no clear dependence on their radial distance from the Sun or longitude separation, suggesting that local effects are responsible for these fluctuations. We also find that the fluctuation bandwidth increases with frequency, while relative bandwidth and amplitude decrease, consistent with previous studies. These trends are similarly observed for both large and small fluctuations, suggesting that well-defined structured Type III bursts and those with smaller fluctuations may share the same generation mechanism.

^{*}Intervenant