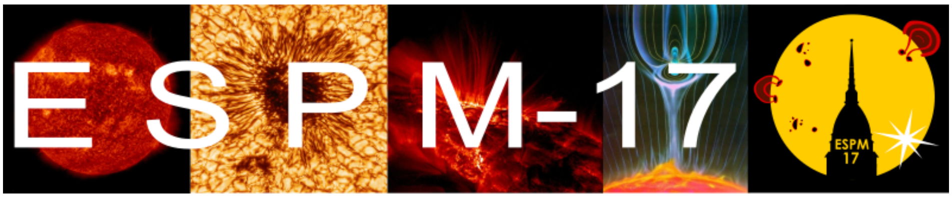

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The angular dependence of rise and decay times of solar radio bursts using multi-spacecraft observations

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Radio photons interact with anisotropic density fluctuations in the heliosphere which can alter their trajectory and distort the properties that are deduced from observations. This is particularly evident in solar radio observations, where anisotropic scattering leads to highly-directional radio emissions, meaning that observers at varying locations will measure different radio-source properties. However, it is not known whether the measurements of the decay time of solar radio bursts also depend on the observer's position. Decay times are dominated by scattering effects, and so are frequently used as proxies of the level of density fluctuations in the heliosphere, making the identification of any location-related dependence crucial. We combine multi-vantage observations of interplanetary Type III bursts from four non-collinear, angularly-separated spacecraft with simulations to investigate the dependence of the decay- and rise-time measurements on the separation of the observer from the source. We propose a function to characterise the entire time profile of radio signals, allowing for improved spectroscopic estimations, while demonstrating that the rise phase of radio bursts is non-exponential, having a non-constant growth rate. We determine that the decay and rise times are independent of the observer's position, identifying them as the only properties that do not require corrections for the observer's location. Moreover, we examine the rise-to-decay time ratio and find that it does not depend on the frequency. Therefore, we provide the first evidence that the rise phase is also significantly impacted by scattering effects, adding to our understanding of the plasma emission process.

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