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Sub-band Extensions to Measure Scattering with the Arrival-Times Pipeline for Repeating Fast Radio Bursts

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Fast radio bursts (FRBs) are millisecond-duration extragalactic radio transients, a subset of which repeat. Multipath propagation through ionized media convolves each burst with a one-sided exponential, producing a scattering tail whose timescale scales steeply with frequency, $\tau \propto \nu^\alpha$ with $\alpha \approx -4$. An observed burst width, however, also carries contributions from intrinsic emission, instrumental sampling, residual dispersion, drift smearing, and unresolved sub-bursts, several of which produce asymmetric profiles.

Sub-band methods have been widely used to estimate FRB scattering. Here we present a sub-band extension to the per-channel arrival-times pipeline of Chamma et al. (2025), designed to estimate scattering only where the data support it. Each profile is fit with an exponentially modified Gaussian (EMG), with an FRBs spectral bandwidth further divided into dedrifted sub-bands. The recovered tail timescales are fit with a power law, where only an index within the empirical range $-4.4 \leq \alpha \leq -3.6$ licenses a scattering interpretation.

As a preliminary single-burst demonstration, we apply the pipeline to FRB 20210415C from the second CHIME/FRB repeater catalogue. Seven sub-bands across 420–760 MHz yield $\alpha = -3.94 \pm 0.12$, consistent with thin-screen scattering. Initial tests on simulated bursts suggest the index is robust. While these results are preliminary, we estimate that the scattering tail exceeds Galactic model predictions along this sightline by $\sim 400\times$, pointing to non-Galactic scattering. This work highlights the importance of further efforts to separate scattering from other broadening processes.

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Yes

What is your career level?

PhD

Which keyword describes the area of focus of this talk?

Transients

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