中華民國天文學會
The Astronomical Society of the Republic of China (Taiwan)

Contribution ID: **82** Type: **Oral**

Time-Frequency Correlation of Repeating Fast Radio Bursts

Friday, May 16, 2025 3:15 PM (15 minutes)

The production mechanism of fast radio bursts (FRBs) remains elusive, and potential correlations between burst occurrence times and various burst properties may offer important clues. Among them, the spectral peak frequency is particularly important because it may encode direct information about the physical conditions and environment at the emission site. Analyzing over 4,000 bursts from the three most active sources – FRB 20121102A, FRB 20201124A, and FRB 20220912A – we measure the two-point correlation function $\xi(\Delta t,\Delta\nu_{peak})$ in the two-dimensional space of time separation Δt and peak frequency shift $\Delta\nu_{peak}$ between burst pairs. We find a universal trend of asymmetry about $\Delta\nu_{peak}$ at high statistical significance; $\xi(\Delta\nu_{peak})$ decreases as $\Delta\nu_{peak}$ increases from negative to positive values in the region of short time separation ($\Delta t<0.3$ s), where physically correlated aftershock events produce a strong time correlation signal. This indicates that aftershocks tend to exhibit systematically lower peak frequencies than mainshocks, with this tendency becoming stronger at shorter Δt. We argue that the "sad trombone effect" – the downward frequency drift observed among sub-pulses within a single event – is not confined within a single event but manifests as a statistical nature that extends continuously to independent yet physically correlated aftershocks with time separations up to $\Delta t\sim0.3$ s. This discovery provides new insights into underlying physical processes of repeater FRBs.

Section

High Energy

Primary author: YAMASAKI, Shotaro (National Chung Hsing University)

Co-author: TOTANI, Tomonori (University of Tokyo)

Presenter: YAMASAKI, Shotaro (National Chung Hsing University)

Session Classification: Plenary session