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The Role of High-Frequency Transverse Oscillations in Coronal Heating

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The coronal heating problem is one of the long-standing astrophysical puzzles. The wave-based coronal heating mechanism has become in the spotlight since it was observationally revealed that the solar corona is filled with transverse MHD waves[1]. The transverse waves that appear as repetitive transverse displacements of the coronal loop axis have been amply observed with EUV imaging instruments. One of the interesting regimes in the transverse waves called decayless waves does not show significant damping in solar coronal loops for several oscillation cycles and is found to be ubiquitous. Due to these characteristics, the energy content that decayless waves could carry and dissipate in the solar corona becomes of interest. In this talk, I will overview decayless transverse waves detected with recent missions, minding their energy contents. In addition, I will present a wave heating theory based on wave energy statistics[2,3] as shown in Figure 1, which could be considered a counterpart of similar statistical arguments in the nanoflare heating theory. The spectral slopes in quiet Sun regions and active regions are less than the critical slope of 1, implying that the higher frequency transverse waves can give a dominant contribution to coronal heating.

References

[1] V. Nakariakov *et al*, Space Science Reviews, 217, 73 (2021)

[2] D. Lim *et al*, The Astrophysical Journal Letters, 952, L15 (2023)

[3] D. Lim *et al*, Astronomy & Astrophysics, in press (2024)

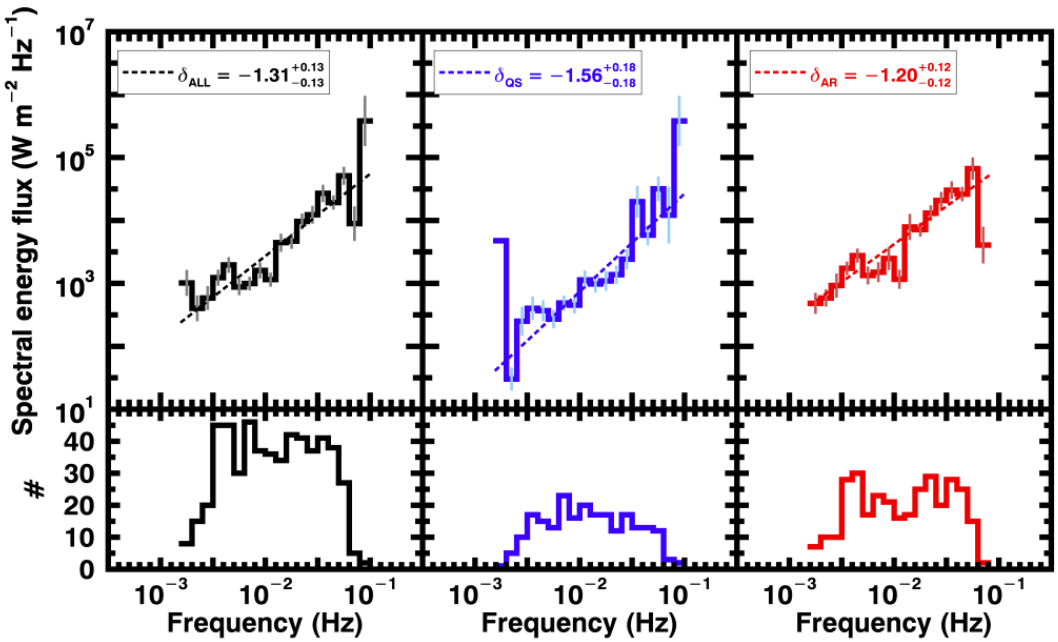

Figure 1. Distribution of spectral energy fluxes of decayless transverse waves as a function of wave frequency (top panels) and the number of waves for each frequency bin (bottom panels).