The Final Frontier of Kinetic Turbulence: Distribution Function Dynamics

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Servidio et al. 2014 JPP  
He et al. 2015 ApJ
Nature of Turbulent Dissipation is an Open Question

- Understanding how solar wind turbulence governs energy transport and plasma heating is a grand challenge for the SHINE community.

- To understand turbulent dissipation, particle velocity distributions not in local thermodynamic equilibrium need to be considered.

- Improved measurements of velocity distribution functions, combined with kinetic plasma theory and numerical simulations, represent an untapped resource for determining the nature of turbulent dissipation.

Valentini et al. 2014 PoP
We Seek to Address the Following Questions:

- What features in the velocity distribution functions are associated with the turbulent dynamics?
- What are the predicted signatures in the velocity space distribution of plasma particles associated with different collisionless damping mechanisms?
- How can these predicted signatures be identified in high resolution measurements of particle velocity distributions from future missions?
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Jason TenBarge: Plasma Turbulence in the Era of Non-Trivial Velocity Space Structure

- Transition from local thermodynamic equilibrium/fluid model to kinetic plasma description
- Overview of theory and numerical kinetic simulations
- Focus of particle distribution function signatures of damping mechanisms, as well as how PDF structure may feedback on solar wind turbulence

Numata & Loureiro 2015 JPP
Jiansen He: Parallel & perpendicular heating of S.W. protons by kinetic waves as observed from WIND

- Focus on current observational efforts using PDF measurements
- Landau and cyclotron resonances
- Dynamic features of proton PDFs

He et al, SW15
We hope to establish a community effort now to develop the tools necessary to exploit fully the scientific potential of upcoming in situ observations of solar wind velocity distribution functions.

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