Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Magneto-kinetic turbulence and particle heating in collisionless, high-beta plasmas[1] MATTHEW KUNZ, LEV ARZAMASSKIY, Princeton University, ELIOT QUATAERT, University of California, Berkeley, JONATHAN SQUIRE, University of Otago, ALEXANDER SCHEKOCHIHIN, University of Oxford — The transport of energy and momentum and the heating of plasma particles by waves and turbulence are key ingredients in many problems at the frontiers of heliospheric and astrophysics research. This includes the heating and acceleration of the solar wind; the observational appearance of black-hole accretion flows on event-horizon scales; and the properties of the hot, diffuse plasmas that fill dark-matter halos. All of these plasmas are magnetized and weakly collisional, with plasma beta parameters of order unity or even much larger. In this regime, magnetic-field-biased deviations from local thermodynamic equilibrium (i.e., pressure anisotropies) and the kinetic instabilities they excite can dramatically change the propagation and damping of Alfvénic and compressive waves from predictions based on fluid (MHD) and linear kinetic theory. In this talk, results from hybrid-kinetic simulations are used to demonstrate this physics in the context of driven, steady-state turbulence, with a focus on energy spectra and nonlocal energy transfer, particle energization and velocity-space structure, and effective collisionality due to particle scattering off ion-Larmor-scale instabilities. Testable predictions are made for pressure-anisotropic parts of the solar wind and magnetosheath.

[1]Support from NASA grant NNX17AK63G, US DOE contract DE-SC0019047, an Alfred P. Sloan Research Fellowship to M.W.K., and a Princeton University Honorific Fellowship to L.A. is acknowledged.

Matthew Kunz
Princeton University

Date submitted: 03 Jul 2019 Electronic form version 1.4