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Kinetic Alfvn Wave Turbulence: New Insight from Gyrokinetics and beyond[1]

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One of the most eminent unsolved problems in space physics is the nature of the turbulent energy dissipation at the smallest spatial scales, which is thought to explain the localized plasma heating observed in the solar wind [1]. This work focuses on new results obtained from gyrokinetic simulations of Kinetic Alfvn Wave turbulence, a major ingredient of solar wind turbulence [2]. For conditions similar to the solar wind at 1 AU, previous work [3,4] showed that electron Landau damping can become important even on ion spatial scales and is responsible for about 70In addition, studies of linear wave physics in various kinetic models [5,6] indicate that this dominance of electron damping may be enhanced even more in conditions of plasma beta ¡ 1, which is characteristic of the solar wind closer to the sun. Making use of multi-scale nonlinear simulations, we shed light on how such findings carry over to nonlinear simulations for different plasma beta values. We focus in particular on characterizing the kinetic mechanisms that catalyze heating, their dependence on plasma parameters, and their relative importance to each particle species. [1] R. Bruno, V. Carbone, Living Rev. Sol. Phys. 10: 2 (2013) [2] C. H. K. Chen, S. Boldyrev, Q. Xia et al., Phys. Rev. Lett. 110, 225002 (2013) [3] D. Told, F. Jenko, J. M. TenBarge et al., Phys. Rev. Lett. 115, 025003 (2015) [4] A. Ban Navarro, B. Teaca, D. Told et al., Phys. Rev. Lett. 117, 245101 (2016) [5] G. G. Howes, Mon. Not. R. Astron. Soc. Lett. 409 (1): L104-L108 (2010) [6] D. Told, J. Cookmeyer, F. Muller, et al., New J. Phys. 18, 065011, 2016

[1]These computations were carried out on Titan at OLCF within a 2016 INCITE Award.