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Recent progress in plasma turbulence, heating, and related processes, from solar wind observations

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Plasmas in the solar system represent an unprecedented opportunity to learn about how basic processes such as turbulence and dissipation work in astrophysical environments, as well as their impacts on the large-scale dynamics. This is because they are the only astrophysical plasmas that can be directly probed in situ by spacecraft, which provide a wealth of data to characterise these processes in great detail. The solar wind, in particular, is well-suited to this, since the system-size and plasma microscales are well-separated, allowing potentially universal physics to be probed, and the plasma is fast flowing, allowing spatial structure to be measured with a single spacecraft. In this talk, I will describe some of the recent progress we have made in understanding solar wind processes such as turbulence (at both MHD scales and in the small-scale kinetic range), pressure-anisotropy instabilities (such as firehose and mirror), dissipation mechanisms (such as Landau damping), and some recent measurements of the effective collisionality. I will also talk about the impacts of these processes, e.g., for how the solar wind is generated and how its large-scale structure originates. I hope this will be of interest to those studying similar processes in the ICM, and that interesting discussions on the comparisons will be stimulated.

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