Turbulent regimes in 3D Alfvén-wave-packet collisions

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A wide range of space and astrophysical systems host turbulent, magnetised plasmas. The turbulent cascade transfers energy from the injection to dissipation scales: understanding the mechanisms underlying the transfer through scales and dissipation of turbulent fluctuations is crucial to understand how turbulence feeds back on the macro-scale evolution and energetics of such systems. In this context, space plasmas are probably the best laboratory for the study of plasma turbulence due to the availability of *in-situ* measurements from space missions. At large ("fluid") scales, the cascade is described by magnetohydrodynamic (MHD) turbulence, and the building blocks of its Alfvénic component are considered to be the interactions of counter-propagating Alfvén waves. Another fundamental aspect of plasma turbulence is the formation of current sheets that typically undergo disruption through magnetic reconnection, which is a process that has been suggested to potentially mediate the non-linear energy transfer.

In the present talk, we report results from large-size, three-dimensional (3D) gyro-fluid simulations in which we revisit the problem of Alfvén-wave (AW) collisions as building blocks of the Alfvénic cascade at MHD scales. The interplay between AW interaction and magnetic reconnection is investigated depending on the turbulent regime that is present at the injection scales. We discuss three type of turbulent regimes that can arise from different large-scale conditions and their relevance in the context of solar-wind turbulence.