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Propagation and reflection of MHD waves in the solar wind

Spacecrafts such as Parker Solar Probe (PSP) and Solar Orbiter (SolO) study the solar atmosphere by making in-situ and remote observations at an unprecedented spatial and temporal resolution, shedding light on coronal heating and solar wind acceleration mechanisms. Alfvenic fluctuations such as switchbacks and pure Alfven waves are some of major carriers of magnetic energy, but the energy dissipation mechanisms remain unclear. Phase mixing can be an effective mechanism, that has mostly been studied in the context of closed magnetic field structures such as coronal loops. Along open field lines, trapping and/or dissipating wave energy becomes more difficult. Non-uniformities in the medium can, in general, reflect a fraction of the input wave energy. Not only does this increase the opportunities for energy dissipation, but also has seismological applications in the sense that the transmitted wave spectrum contains information about the non-uniformities in the underlying medium. Using magnetohydrodynamic modelling, we aim to understand these phenomena in the context of a spherically expanding background solar wind. Therefore, our simulations encompass a numerical domain from the chromosphere where waves are generated to the PSP and SolO perihelia and whose propagation and dissipation are studied in an extended solar atmosphere with a supersonic and superalfvenic background solar wind. Our model, in conjunction with space-based solar wind observations, provides an estimate of the conditions and constraints for maximal amount of wave energy trapping available for coronal heating and solar wind acceleration in terms of inherent spatial and temporal scales.

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