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HPC MHD modelling of unstable reconnecting plasma in the solar corona and EUV diagnostics with the MUSE mission

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The solar corona consists of plasma confined by, and interacting with, the coronal magnetic field. The magnetic processes are highly dynamic and non linear, and their description requires time-dependent magnetohydrodynamic modelling on high performance computing systems.
Large-scale energy release in the corona may involve MHD instabilities such as the kink instability in a single twisted magnetic flux tube. The turbulent dissipation of the magnetic structure into small-scale current sheets converts into a sequence of a-periodic, impulsive, heating events. Since single twisted magnetic filaments are generally embedded in a multi-threaded structure, an unstable strand could trigger a global MHD instability, and a nanoflare cascade.
Using full 3D MHD simulations with the PLUTO code we show that avalanches are a viable mechanism for the storing and release of magnetic energy in the solar corona, as a result of photospheric motions. We provide a synthetic perspective for the NASA MUSE forthcoming mission. Many fine scale features as well as rapid changes in emissivity and Doppler shifts might be accessible to the MUSE spectrometer and shed new light on coronal heating mechanisms.

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