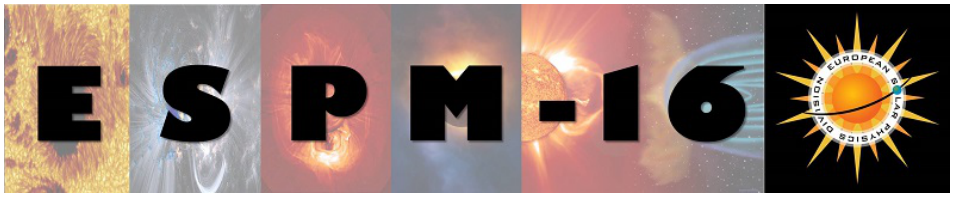

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Will it rain today? The role of asymmetries in coronal rain formation during thermal non-equilibrium cycles

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Thermal non-equilibrium (TNE) produces several observables that can be used to constrain the spatial and temporal distribution of coronal heating. Its manifestations include prominence formation, coronal rain, and long-period intensity pulsations in coronal loops. The recent observation of abundant periodic coronal rain associated with intensity pulsations by Auchère et al. allows to unify these two phenomena as the result of TNE condensation and evaporation cycles. On the other hand, many intensity pulsation events observed by Froment et al. show little to no coronal rain formation. Our goal is to understand why some TNE cycles produce abundant coronal rain, while others produce little to no rain.

We reconstruct the geometry of the event reported by Auchère et al., using images from STEREO/SECCHI/EUVI and magnetograms from SDO/HMI. We then perform 1D hydrodynamic simulations of this event, for different different heating parameters and variations of the loop geometry (9000 simulations in total). We compare the resulting behaviour to simulations of TNE cycles by Froment et al. that do not produce coronal rain. Our simulations show that both prominences and TNE cycles (with and without coronal rain) can form within the same magnetic structure. We show that the formation of coronal rain during TNE cycles depends on the asymmetry of the loop and of the heating. Asymmetric loops are overall less likely to produce coronal rain, regardless of the heating. In symmetric loops, coronal rain forms when the heating is also symmetric. In asymmetric loops, rain forms only when the heating compensates the asymmetry.

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