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Dynamic formation of multi-threaded prominences with fine structure

Prominences are large-scale structures found in the solar corona, characterized by two orders of magnitude larger densities and lower temperatures than their surroundings. On a large scale they are relatively stable structures, closer-up they exhibit intricate and complex dynamics with small-scale structures [1]. Prominences form via thermal instability, an in-situ condensation process that is triggered by plasma evaporation from the chromosphere. Prominence plasma offers us information on the processes within coronal heating, in addition to thermal-nonequilibrium cycles and instabilities within the corona (from thermal to Kelvin-Helmholtz and Rayleigh-Taylor) all of it relating to mass and energy circulation throughout the Sun's atmosphere. In this work, we use an open-source MHD code, MPI-AMRVAC [2] (http://amrvac.org/) to simulate the localized stochastic heating. The parameter space related to the stochastic heating needed to trigger thermal instability is broad [3] and still largely unexplored, particularly in multidimensional setups. We describe how varying the amplitude and height of such heating heavily influences the topology of the resulting prominences, most crucially their average density and temperature properties [4]. This has a critical influence on the appearance of these simulated structures in observations; we will explore corresponding Hydrogen spectrum variations according to the non-LTE problem. Finally, we demonstrate how the shear flows present throughout this inhomogeneous domain generate signatures of the Kelvin-Helmholtz instability within realistic and dynamically formed prominence threads [4]. Our efforts, including the ongoing migration to additional dimensions and higher resolution, are continuing to bring each aforementioned aspect yet closer to direct confrontations with observations.

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