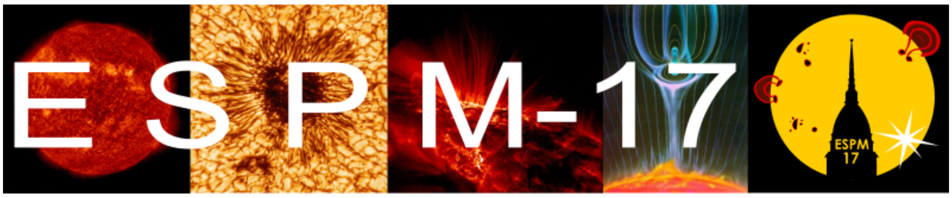

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Observationally driven 3D MHD simulation of a coronal loop above a sunspot group

The solar corona is extremely hot with temperatures above 1 MK. In the decades after this discovery, many different heating methods have been developed to explain the high temperatures. A prominent category of these heating models is direct current (DC) heating, where the dissipation of strong currents, created by the tangling and braiding of magnetic field due to the convective motions in the photosphere. To test this hypothesis, we perform 3D magnetohydrodynamic simulations of the corona, where we want to heat a coronal loop with Ohmic heating. The simulation is driven by high resolution magnetograms and a photospheric velocity field consisting of large scale flows obtained by local correlation tracking and an artificial granulation driver. After around 40 minutes we see that our model produces a heating strong enough to counteract the energy losses. After around 60 minutes, the heating and losses roughly balance each other out and create a loop with a mean temperature of around 1.4 MK. As we drive our simulation with observations, we can compare directly to observations. We find that the synthetic Fe XII emission and Doppler shifts generated with the CHIANTI database match observed emission and Doppler shifts, showing that our heating mechanism is a viable method to heat a coronal loop. We also analyze the helicity density in the simulation box to study the energy buildup due to the photospheric footpoint motion. We find opposite signs of the helicity density at different heights above two sunspots.

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