Observations and modeling of transition region and coronal heating associated with spicules

De Pontieu, Bart - Lockheed Martin Solar & Astrophysics Laboratory

Spicules have been proposed as significant contributors to the coronal energy and mass balance. While previous observations have provided a glimpse of short-lived transient brightenings in the corona that are associated with spicules, these observations have been contested and are the subject of a vigorous debate both on the modeling and the observational side so that it remains unclear whether plasma is heated to coronal temperatures in association with spicules.

We use high-resolution observations of the chromosphere and transition region with the Interface Region Imaging Spectrograph (IRIS) and of the corona with the Atmospheric Imaging Assembly (AIA) onboard the Solar Dynamics Observatory (SDO) to show evidence of the formation of coronal structures as a result of spicular mass ejections and heating of plasma to transition region and coronal temperatures. Our observations suggest that a significant fraction of the highly dynamic loop fan environment associated with plage regions may be the result of the formation of such new coronal strands, a process that previously had been interpreted as the propagation of transient propagating coronal disturbances (PCD)s. Our observations are supported by 2.5D radiative MHD simulations that show heating to coronal temperatures in association with spicules. Our results suggest that heating and strong flows play an important role in maintaining the substructure of loop fans, in addition to the waves that permeate this low coronal environment. Our models also matches observations of TR counterparts of spicules and provides an elegant explanation for the high apparent speeds of these "network jets".