Diagnosing the Prominence-Cavity Connection

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Abstract

The leading paradigm to describe the formation of cavities suggests that cavities are rarified because they supply mass to the prominence through a condensing process. In this study, we use time-dependent EUV emission and a hydrodynamic model for catastrophic cooling to test this hypothesis. Observationally, the cavity and the prominence exhibit strongly correlated dynamic emission structures that we refer to as horns. We conduct a statistical study of the spatial, temporal, and spectral characteristics of horns in the SDO/AIA dataset. We find there is a strong correlation between the 304A and 171A data but a very weak correlation between the 171A and 193A data. This suggests that horns may be a signature of the cooling process. We extend this analysis by comparing the light curves observed in horns to synthetic light curves based on 1D simulations of the thermal non-equilibrium (TNE) model, which produces a prominence through heating. While the TNE model shows a correlation between 171A emission and the formation of a condensation, the model predicts that the coronal segment of a post-condensation loop will be density-enhanced relative to an identical non-condensed loop. Based on the TNE model, we suggest that the cavity cannot be the mass source of the prominence, as the cooling process would produce density-enhanced cavities as opposed to the rarified cavities we observe in the corona.

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