Theoretical Models of the Origin of Prominence Mass

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Abstract

Prominences are spectacular manifestations of both quiescent and eruptive solar activity. The largest examples can be seen with the naked eye during eclipses, making prominences among the first solar features to be described and catalogued. Steady improvements in temporal and spatial resolution from both ground- and space-based instruments have led us to recognize how complex and dynamic these majestic structures really are. Their distinguishing characteristics – cool knots and threads suspended in the hot corona, alignment along inversion lines in the photospheric magnetic field within highly sheared filament channels, and a tendency to disappear through eruption – offer vital clues as to their origin and dynamic evolution. Interpreting these clues has proven to be contentious, however, leading to fundamentally different models that address the basic questions: *What is the magnetic structure supporting prominences, and how does so much cool, dense plasma appear in the corona?* In this talk I will address the second question, although significant insight into the magnetic structure can also be gained from the plasma distribution and dynamics. Despite centuries of increasingly detailed observations, the process responsible for prominence mass has been difficult to establish, although we have long known that the chromosphere is the only plausible source. A combination of observations, theory, and numerical modeling must be used to determine whether any of the competing theories accurately represents the physics of prominence mass formation and evolution. I will discuss the criteria for a successful prominence model, compare the leading models, and present in detail one promising, comprehensive scenario for prominence mass formation and evolution: the thermal nonequilibrium model.

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