Structure and topology of magnetic fields in solar prominences and their local environments

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Abstract

Magnetic fields are believed to play an important role in the support of filament/prominence plasmas against gravity. I review recent observations of prominence fine structure and dynamics, as well as measurements of prominence magnetic fields using the Hanle effect. Observations indicate that on large scales (_˜ 100 Mm) prominences are located in coronal magnetic flux ropes or sheared arcades that lie horizontally above polarity inversion lines in the photosphere. For active region filaments the field is highy sheared but weakly twisted; for quiescent filaments the degree of twist in the flux ropes is still unknown. The plasma may be supported by dips in the field lines. The long lifetime of prominences implies that the flux ropes or sheared arcades are in magnetostatic balance with their surroundings, i.e., they are held down by less-sheared overlying arcades. Models for the 3D magnetic fields in and around prominences, based on photospheric magnetograms, have been developed using various techniques. These models allow detailed investigation of the magnetic topology and the role of the magnetic field in solar eruptions. On smaller spatial scales ($<$ 10 Mm) prominences exhibit a wide variety of fine structures: some are nearly horizontal and appear to be field-aligned, but others are more vertically oriented and their magnetic structure is still being debated.
A related question is how mass is injected into the these vertical threads. Different models for prominence formation and support are discussed.

Keywords: prominence fine structure, filament environment, magnetic fields, flux ropes, Hanle effect

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