The Role of Magnetic Helicity in the Structure and Heating of the Solar Corona

The Sun's outer atmosphere, the solar corona, is the major driver of space weather, with solar eruptions sending energetic charged particles streaming towards the Earth, where they can interact with and damage infrastructure both in space and on the ground. These eruptions emanate from structures in the solar corona known as filaments, concentrations of cool, dense plasma suspended in the otherwise hot, low-density solar corona by a magnetic field. The magnetic field that supports this plasma is highly stressed, and as such contains the tremendous free energy that is released during solar eruptions. As a result, understanding how the magnetic field in filaments obtains so much stress is an important problem in solar physics. This stress represents not only magnetic energy, but also magnetic helicity, a topological quantity that is conserved in the solar corona. In this talk, I describe magnetic helicity, its importance for the solar corona, and how its conservation can be used to understand the formation of the magnetic field in filaments. I present numerical simulations that test a model for its formation based on the conservation of magnetic helicity, and show how the results are fully consistent with observations. Finally, I describe how this model self-consistently explains the presence of the multi-million degree solar corona.

Wednesday, February 15, 2017
4:00pm
108 Hannan Hall
Refreshments will be served at 3:45

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