

A New Understanding of Coronal Heating

The X-ray and UV radiation from the Sun---the solar spectral irradiance---controls the dynamics, chemistry, and ionization state of the Earth's upper atmosphere. Variations in the radiation affect radio signal propagation and satellite drag and thereby impact communication, navigation, surveillance, and space debris collision avoidance. Predicting the spectral irradiance is therefore a major goal of the national space weather program. Having this capability requires an understanding of the mysterious mechanism that heats the outer part of the solar atmosphere, the corona, to multi-million degree temperatures. Traditional models of the corona that assume steady and uniform heating have been shown to be inconsistent with observations. However, scientists are now pursuing two recent breakthroughs with great excitement. A comparison of numerical simulations with imaging and spectral data from NASA missions reveals that the coronal heating mechanism is likely to be highly impulsive (Warren & Winebarger 2007; Klimchuk et al. 2008) or concentrated close to the solar surface (Mok et al. 2008) or both. Efforts are now underway to probe these possibilities in more detail and to use the new knowledge to build realistic models of solar active regions---models that may one day be used for space weather forecasting of the spectral irradiance.

Klimchuk, J. A., Patsourakos, S., & Cargill, P. J. 2008, "Highly Efficient Modeling of Dynamic Coronal Loops," *ApJ*, in press.

Mok, Y., Mikic, Z., Lionello, R., & Linker, J. A. 2008, "The Formation of Coronal Loops by Thermal Instability in Three Dimensions," *ApJ Letters*, in press.

Warren, H. P., and Winebarger, A. R. 2007, "Static and Dynamic Modeling of a Solar Active Region," *ApJ*, 666, 1245.



Simulated 171 Å image, corresponding to a TRACE or SOHO/EIT observation, from an active region model by Mok et al. (2008).