The self-organization of the Sun's corona

Spiro Antiochos
NASA Goddard Space Flight Center, Greenbelt, United States

The solar corona is an amazing example of the self-organization of a complex system. The magnetic field in the corona is due to the flux at the photosphere, which has enormous structure, consisting of many bipole sources that are constantly emerging and cancelling. In addition, this magnetic field is continuously driven by the photospheric convective motions that are fully turbulent and have structure at many scales. In spite of this complexity, the coronal field is always observed to be close a minimum-energy potential (current-free) state, except for certain very specific locations. We show how chaotic reconnection in the corona, coupled with magnetic helicity conservation accounts for the observed coronal structure. Furthermore, we argue that these processes are the underlying causes of both the explosive activity and quasi-steady activity observed in the corona.

This work was supported by the NASA LWS and the NASA/GSFC ISFM programs.