Ron Moore's Canfield Meeting abstract

The Driving Magnetic Field and Reconnection in CME/Flare Eruptions and Coronal Jets

Signatures of reconnection in major CME (coronal mass ejection)/flare eruptions and in coronal X-ray jets are illustrated and interpreted. The signatures are magnetic field lines and their feet that brighten in flare emission. CME/flare eruptions are magnetic explosions in which:

1. The field that erupts is initially a closed arcade.
2. At eruption onset, most of the free magnetic energy to be released is not stored in field bracketing a current sheet, but in sheared field in the core of the arcade.
3. The sheared core field erupts by a process that from its start or soon after involves fast "tether-cutting" reconnection at an initially small current sheet low in the sheared core field. If the arcade has oppositely-directed field over it, the eruption process from its start or soon after also involves fast "breakout" reconnection at an initially small current sheet between the arcade and the overarching field. These aspects are shown by the small area of the bright field lines and foot-point flare ribbons in the onset of the eruption.
4. At either small current sheet, the fast reconnection progressively unleashes the erupting core field to erupt with progressively greater force. In turn, the erupting core field drives the current sheet to become progressively larger and to undergo progressively greater fast reconnection in the explosive phase of the eruption, and the flare arcade and ribbons grow to become comparable to the pre-eruption arcade in lateral extent.

In coronal X-ray jets:

1. The magnetic energy released in the jet is built up by the emergence of a magnetic arcade into surrounding unipolar "open" field.
2. A simple jet is produced when a burst of reconnection occurs at the current sheet between the arcade and the open field. This produces a bright reconnection jet and a bright reconnection arcade that are both much smaller in diameter that the driving arcade.
3. A more complex jet is produced when the arcade has a sheared core field and undergoes an ejective eruption in the manner of a miniature CME/flare eruption. The jet is then a combination of a miniature CME and the products of more widely distributed reconnection of the erupting arcade with the open field than in simple jets.

Cartoons illustrating the above characteristics are presented along with representative examples of observed CME/flare eruptions and jets. The main point to be drawn from the observations is that, for either a pre-eruption current sheet or a pre-simple-jet current sheet to remain quasi-static and stable against fast reconnection, it must remain much smaller in span than the driving arcade. Conversely, a current sheet comparable in span to the driving arcade can be made only dynamically, by eruption of the driving arcade, and continually undergoes massive fast reconnection.