Friday November 1st, 2013
4:10 – 5:00 pm, EPS108

"Determining the current in a current sheet above emerging flux on the Sun"

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Abstract:

When magnetic flux emerges from beneath the photosphere it displaces the preexisting field in the corona, and a current sheet generally forms at the boundary between the old and new magnetic domains. Reconnection in the current sheet relaxes this highly stressed configuration to a lower energy state. This scenario is most familiar, and most often studied, in flares, where the flux transfer is rapid. We present here a study of steady, quiescent flux transfer occurring at a rate three orders of magnitude below that in a large flare. In particular we quantify the reconnection rate, and related energy release, occurring as new polarity emerges to form Active Region 11112 (SOL16 October 2010T00:00:00L205C117) within a region of preexisting flux. A bright, low lying kernel of coronal loops above the emerging polarity, observed with the Atmospheric Imaging Assembly onboard the Solar Dynamics Observatory and the X-ray Telescope onboard Hinode, originally shows magnetic connectivity only between regions of newly emerged flux when overlaid on magnetograms from the Helioseisimic and Magnetic Imager. Over the course of several days, this bright kernel advances into the preexisting flux. The advancement of an easily visible boundary into the old flux regions allows measurement of the rate of reconnection between old and new magnetic domains. We compare the reconnection rate to the inferred heating of the coronal plasma. To our knowledge, this is the first measurement of steady, quiescent heating related to reconnection. We determine that the newly emerged flux reconnects at a fairly steady rate of 0.38 \times 10^16 Mx/s over two days, while the radiated power varies between 2~8x10^25 erg/s over the same time. We find that as much as 40% of the total emerged flux at any given time may have reconnected. The total amount of transferred flux (~10^21 Mx) and radiated energy (~7.2x10^30 ergs) are comparable to that of a large M-or small X-class flare, but are stretched out over 45 hours.

Host:

Jiong Qiu

******Refreshments served in the EPS second floor lobby at 3:45******