Twisted Magnetic Field Emergence, Interchange Reconnection, Flux Cancellation, and Blow-out Eruptions in a Small Coronal Hole

Mitzi Adams¹, Navdeep K. Panesar¹, Ronald Moore²

1. NASA/MSFC, Huntsville, AL; 2. Center for Space Plasma and Aeronomic Research, UAH, Huntsville, USA

In this work, we report on the structure, evolution, and explosive behavior of an emerging flux region of March 3-4, 2016. Flux emergence in a small coronal hole resulted in G-band brightening, subsequent eruptions, and the late development of a small active region, observed with SOHO's Atcor Bipicolimaging (ABI) to multiple wavelengths (e.g., 171 Å, 193 Å, 396 Å, and 131 Å). We find that interchange reconnection of initially closed emerging filed with ambient open field affected the contourline, diluting the open field from one side of the emerging magnetic field to the other. A blow-out eruption in this region is made by a minifilament that forms over and erupts from a polarity inversion line between emerging and cancelling opposite-polarity magnetic flux on the outside of the emerging bipole. There are three other blow-out eruptions from inside the emerging bipole, the latter of which makes a closed coronal hole. Blow-out eruptions from inside-emerging bipole are rare. This emerging bipole had repeated blow-out eruptions from inside, probably because the emerging magnetic field was extremely twisted, which is evident from the sigmoidal coronal field of the magnetic field.

Using http://solarmonitor.org, on March 4 at 20:58, AR 12512 was seen on the central meridian in HMI-6173 form of the magnetic field.

In this work, we report on the structure, evolution, and explosive behavior of an emerging-flux region of March 3-4, 2016, observed with SOHO's Atcor Bipicolimaging (ABI) to multiple wavelengths (e.g., 171 Å, 193 Å, 396 Å, and 131 Å). We find that interchange reconnection of initially closed emerging field with ambient open field affected the contourline, diluting the open field from one side of the emerging field to the other. A blow-out eruption in this region is made by a minifilament that forms over and erupts from a polarity inversion line between emerging and cancelling opposite-polarity magnetic flux on the outside of the emerging bipole. There are three other blow-out eruptions from inside the emerging bipole, the latter of which makes a closed coronal hole. Blow-out eruptions from inside-emerging bipole are rare. This emerging bipole had repeated blow-out eruptions from inside, probably because the emerging magnetic field was extremely twisted, which is evident from the sigmoidal coronal field of the magnetic field.

**Overview**

**Eruption 1**

**Eruption 2**

**Eruption 3**

**Eruption 4**

**Field of View for Flux Emergence Rate Over 10 minutes**

**Evolution of the Magnetic Field**

**Time-Distance Plot**

**Summary/Results:**

1. The flux-emergence rate over ten minutes was 7.86 x 10^15 Mx/s. In contrast, From Vemareddy et al. (2015) the rate of positive flux emergence over four days from NOAA 11584, a region that produced a X2.2 flare, was 4.4 x 10^15 Mx/s, suggesting that for larger regions, the flux rate will be higher.

2. The magnetic "bubble" increased in size from approximately 20 x 20' to 40' x 40' from 2016/03/03 18:44 UT to 2016/03/04 02:55, 8 hours 11 minutes.

3. Flux emergence begins between 17:30 UT and 18:44 UT, followed by brightening in AIA 211 (~19:05 UT), 304 (~19:12 UT), 193 (~19:30 UT), and 94 (~20:00 UT) Angstroms.

4. All four eruptions occurred with minifilament eruptions.

5. In contrast to the work of Panoce, Steeleing, and Moore (2018), only the first eruption resulted from obvious flux cancellation; apparently each of the other three eruptions was the result of twisted-field emergence and interaction with the open-field of the coronal hole.

**References:**


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