EVALUATION OF THE MINIFILAMENT-ERUPTION SCENARIO FOR SOLAR CORONAL JETS IN POLAR CORONAL HOLES

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ABSTRACT

Solar coronal jets are suspected to result from magnetic reconnection low in the Sun’s atmosphere. Sterling et al. (2015) looked at 28 jets in polar coronal holes, using X-ray images from the Hinode/X-Ray Telescope (XRT) and EUV images from the Solar Dynamics Observatory (SDO) Atmospheric Imaging Assembly (AIA). They suggested that each jet was driven by the eruption of twisted closed magnetic field carrying a small-scale filament, which they called a “minifilament”, and that the jet was produced by reconnection of the erupting field with field surrounding open field. In this study, we carry out a more extensive examination of polar coronal jets. From 180 hours of XRT polar coronal hole observation spread over two years (2014-2016), we identified 130 clearly identifiable X-ray jet events and thus determined an event rate of over 17 jets per day in the Hinode/XRT field of view. From the broader set, we selected 25 of the largest and brightest events for further study in AIA 171, 193, 211, and 304 Ångstrom images.

INTRODUCTION

Our X-ray jets are explosive and short lived phenomena originating in the low atmosphere of the Sun (e.g., Shibata et al. 1996; Shinagawa et al. 1996; Cirtain et al. 2007; Sheevers et al. 2007). These jets are easily identifiable near the solar limb and frequently observed in coronal regions by satellite telescopes in the 0.2-20 km Hz range. These jets are thought to be best explained by merging of emerging flux on the coronal surface and subsequent reconnection with the ambient field. More recently it has been suggested that Solar X-ray Jets are formed by a minifilament eruption which induces magnetic reconnection, in a manner comparable to solar flare eruptions.

We present observations of coronal jets observed in the coronal regions of the Sun from 180 hours of observation spread over two years collected from the Hinode Space Satellite, aggregating to 130 distinct jet events. Of these 25 events 25 jets were selected for coronal jets and further study by utilization of the Solar Dynamics Observatory / Atmospheric Imaging Assembly.

METHODOLOGY

By using Solar Monitor we visually inspected the astrophotographic conditions at the polar region of the Sun. Dates which exhibited clear conditions on these images were recorded.

The vertical scale is in km s⁻¹. The bottom line is the distance of the jet from the solar limb in au. The jet type is labeled to the right of the jet. The jet type is labeled not known if the jet type could not be determined.

MINIFILAMENT VISIBILITY

The horizontal scale is the distance of the jet from the solar limb in au. The jet type is labeled not known if the jet type could not be determined.

CONCLUSION

• Jet Bright Point (JBP) formation difficult to determine due to time resolution in X-ray wavelengths.
• No jet had a visible spine before the jet bright point.
• Potential further investigation is in AIA wavelengths would be required for concrete statement.

REFERENCES

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