Solar coronal jets are narrow, short-lived eruptions that occur frequently throughout the entire solar disk (Raouafi et al. 2016); quiet regions, coronal holes, and on the edge of active regions. These eruptions are often observed in extreme ultraviolet (EUV) and X-ray emissions (Raouafi et al. 2016). Previous EUV observations by Panesar et al. (2016) have observed an average base width of 17,000 ± 650 km and an average jet duration of 12 minutes. Recent studies indicate that coronal jets in quiet regions (Raouafi et al. 2016) and coronal holes are driven by the eruption of a minifilament (Sterling et al. 2015). Because Sterling et al. (2015) only looked at jets near the limb, they had no conclusive results regarding the magnetic origin of these minifilaments. This study by Panesar et al. (2016) followed this by investigating the magnetic origin of 10 coronal jets and observed a pattern of flux cancellation at the magnetic neutral line prior to the formation of a minifilament. Here we seek to confirm this observation of jet triggering by flux cancellation with a larger sample of 60 jets.

Results

We have examined the evolution of 60 on-disk quiet-region and coronal hole jets using EUV images from SDO/AIA to track the structure of the jets as well as using line-of-sight magnetograms from SDO/HMI to analyze the magnetic field evolution of the jet base region. In this paper we show two detailed examples of coronal jets in figure 1: quiet-region jet and figure 4: coronal hole jet. Both jets exhibit a clear minifilament at the neutral line (figure 1a) and figure 4a) prior to onset. The white boxes in figure 1c-h and figure 4c-h show the area in which we quantitatively measured the magnetic flux flowing through the jet. We were careful to be as accurate as possible in removing the background horizontal field that may be present across the boundary of the box. As seen in figure 1c and 1d, and 4c and 4d, which display this flux through time, we find a clear pattern of flux cancellation before and during the eruption of both the quiet region and coronal hole jets. We confirmed this observation with the rest of the 60 jet sample. As the opposite polarity magnetic flux patches are cancelling at the neutral line (see figures 1e-h and 4e-h), the field enveloping the minifilament (minifilament) destabilizes and begins to erupt (see figure 3(b-d)). This minifilament eruption takes place on the neutral line and results in internal reconnection within the minifilament field (represented by the lower star in figure 3a). This reconnection then produces the jet bright point (white arrow in figure 1b and figure 4b) at the neutral line. As the eruption continues, the minifilament field goes through external reconnection with the surrounding magnetic field (represented by the upper star in figure 3c and 3d), allowing the minifilament plasma to flow along that field line and become a part of the resulting jet spire (figure 3f).

We find that the triggering mechanism for all 60 jets is flux cancellation, shown here by the two example figures in 1 and 3. This observation is consistent with the findings of Panesar et al. (2016), who observed flux cancellation in a sample of 10 quiet-region coronal jets. Additionally, we present measurements of base width and duration for all 60 jets. Jet base width was measured by taking the average of three distinct measurements across the jet base in 1A: a 1% minute prior to jet spike. By doing so, we found the average jet base to be 7600 ± 2700 km. Jet duration was measured in 1A from the initial brightening of the jet base spike to the spire at a maximum height. The jets in this sample had an average duration of 9.0 ± 3.6 minutes.

Conclusion

We report the trigger mechanism of 60 randomly selected, on-disk solar coronal jets in quiet regions and coronal holes, as well as the duration and base width of each jet. From our observations of the magnetic flux behavior of coronal jets in quiet regions and coronal holes, we find that prior to each jet eruption, a magnetic structure is present at the neutral line. This minifilament erupts due to continuous flux cancellation at the neutral line. Additionally, we find an average base width of 7600 ± 2700 km for our jets. We also find the 60 jets to have an average duration of 9.0 ± 3.6 minutes.

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