Double Arc Instability in the solar corona

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The stability of flux rope in the solar corona must be related to the occurrence of solar flares and coronal mass ejections (CMEs), which are primary cause of solar weather disturbance. Torus Instability (TI) was recently proposed by Kliem & Toeroek (2006) as the cause of solar eruptions. However, how the instability can be initiated is not yet well understood. On the other hand, one of the most likely scenario for the process causing unstable flux rope is the tether-cutting reconnection suggested by Moore et al. (2001). This scenario suggests that magnetic reconnection between sheared magnetic fields forms a double-arc loop which can erupts. However, the stability of double-arc loop was not analyzed yet.
The objective of this study is to analyze the stability of double-arc loop theoretically. We model double-arc electric current loop using two circular tori connected each other, and numerically calculate the stability of it. As the result, we found that the double-arc current loop can be destabilized even if the external field is uniform in contrast to the TI. The results indicate that the Double-Arc Instability (DAI) is different from the TI. The decay index which is used as a criteria for TI is not applicable to DAI. Furthermore, we found that in order to make the DAI the twist of magnetic field line must be larger than one-half. We also show that the growth of DAI is similar to the observation of flux eruption. These results indicate that the DAI caused by the tether cutting reconnection is a possible scenario, which can well explain how solar eruption can be triggered.

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