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Assessing the eruption scenario triggered by flux emergence in a non-zero beta environment

Along with the increase in high-performance computing resources, the ability to conduct 3D simulations has made a difference to unveiling the topology of the magnetic structures during the eruption. Flux emergence has been proposed as a main trigger mechanism of CMEs Feynman & Martin(1995). The emergence of magnetic flux can reconnect with an existing, current-carrying flux rope and lead to an unbalanced configuration which can trigger CMEs.

Török(2023) have studied this scenario on a pre-existing stable twisted flux rope coming from a model called TDm . Several trigger mechanisms have been identified, such as the interaction between emerging magnetic flux and the overarching confining magnetic field or the flux-rope itself causing a magnetic reconnection restructuring the magnetic topology. These results have been obtained in a zero-beta environment that did not take into account thermal and kinetic effects. We will show simulations following the same approach but with a stratified atmosphere and a non-zero plasma beta. Some parameters influencing the eruption or non-eruption of the pre-existing TDm are explored, such as duration of the emergence, strength of magnetic dipole, orientation and distance to TDm. For each of them, we characterise their ability to trigger the eruption, and, how they affect the speed of the ejection.

We will add synthetic emission thanks to the non zero beta environment and test particles to characterise non-thermal emission due to accelerated particles. These observations will be compared to solar flares signature of the EUV spectrum and X-ray Spectrum using the data provided by Solar Orbiter.

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