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3D Modelling and observations of solar flares

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The Sun is a fascinating physics laboratory where periodically phases of strong activity and of quietness alternate during a eleven years cycle. The phase of strong activity is linked to the appearance of sunspots. These sunspots are cooled down regions of the sun and are the place of energetic events called solar eruptions.

Solar eruptions are major events corresponding either to solar flares which are transient, energetic brightenings occurring in strong and complex magnetic structures. It happens due to the reconfiguration of the magnetic structures releasing energy up to 10^{32} erg in diverse forms (radiative, thermal and particle accelerations). The solar flares are sometimes associated to ejection of solar materials following magnetic structures expelled from the solar atmosphere. They are called, coronal mass ejections (CMEs), and are one of the main perturbation in the heliosphere, which can cause geomagnetic storms when Earth is on the trajectory of these CMEs. These geomagnetic storms can have a huge impact on our economy.

In order to decipher these complex events, we need to use MHD simulations and observations conjointly. The use of different methods and tools is essential to dive into the convoluted processes occuring in the solar atmosphere. Our ultimate goal is to replicate the behaviour of the Sun and to predict the next solar eruptions that could impact us on a global scale.

Astrophysics Field

Solar Physics, MHD, Simulation

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