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Modelling and observations: what is (still) needed to understand the role of magnetic fields in flares and eruptions?

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Solar flares are amongst the most energetic events in our solar system. Accompanied by intense UV and X-ray emissions, energetic particles and coronal mass ejections can be injected into the interplanetary medium during flares. As these various aspects can have a large impact on solar system bodies and a detrimental effect on human activities, there is a strong interest to gain a deeper knowledge of these events.

Over the past decades, ground and space solar observatories and the variety of observations available (from imaging to plasma and particle diagnostics and magnetic field measurements), aided by numerical modelling and theory, have helped us refine a standard model for eruptive flares. At the core of such a model lies the dynamical evolution of magnetic fields that shape and power them. In particular, understanding how flux ropes become unstable, where and how reconnection takes place (especially in complex 3D structures), has shed some light in the understanding of flare processes at large.

Because of the intrinsically transient nature of solar flares and the energy range covered by such events, some questions are still pending: where and how is the energy deposited, how the non local magnetic field topology actual shapes eruptions, how to join the various aspects of flares, from particles to CMEs? This talk will aim at looking at how previous works on flare models are still challenged by new observations, and what are the steps that are needed to continue working towards a (more) complete understanding of solar flares.

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