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Solar Eruptions Triggered by Flux Emergence

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Observations have shown a clear association of prominence eruptions and CMEs with the emergence of magnetic flux close to or within filament channels. It has been suggested that reconnection triggered by the emergence destroys the force balance between the magnetic field in the filament channel and its ambient field, causing the former to erupt. Magnetohydrodynamic (MHD) numerical simulations support this scenario for two-dimensional (2D) coronal flux-rope configurations. However, they do not take into account 3D effects such as the anchoring of the flux rope in the dense photosphere or the occurrence of 3D MHD instabilities. Here we present the first fully 3D MHD simulations of flux emergence in the vicinity of a coronal flux rope. We vary the position and orientation of the emerging flux and investigate under which conditions eruptions occur. We compare our results with corresponding 2D simulations and demonstrate how they can be used to explain a complex, two-phase prominence eruption observed on 18 July 2014.