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Quantitative study of initiation and evolution of CMEs

S. Poedts, B. Van der Holst, C. Jacobs, E. Chane, G. Dubey, D. Kimpe
Centre for Plasma Astophysics, K.U.Leuven, Celestijnenlaan 200 B, 3001 Leuven, Belgium

The shocks and magnetic clouds related to Coronal Mass Ejections (CMEs) in the solar corona and interplanetary space play an important role in the study of space weather. The geomagnetic storms they cause can damage satellites, disturb radio communication, power supplies etc. Better predictions or forecasts of space weather and magnetic storms require a deeper insight in the physics behind it. Therefore, numerical simulations of some simplified CME models were performed by means of a finite volume, explicit solver to advance the equations of ideal magnetohydrodynamics.

The studied CMEs are generated with different kinds of initiation models, e.g. foot point shearing and magnetic flux emergence. The effect of the initiation parameters, like the shear velocity, the extend of the shear region, the emergence rate of the magnetic flux etc., on the evolution of the CMEs is studied. Another important aspect of our study is the fact that we do the same CME simulations superposed on different models for the background solar wind. This enables us to quantify the effects of both the CME parameters (e.g. the initiation mechanism, the presence and polarity of magnetic flux rope, etc.) and the the background solar wind on the CME evolution parameters, such as the velocity, acceleration, propagation direction, shock formation and topology, etc. ...