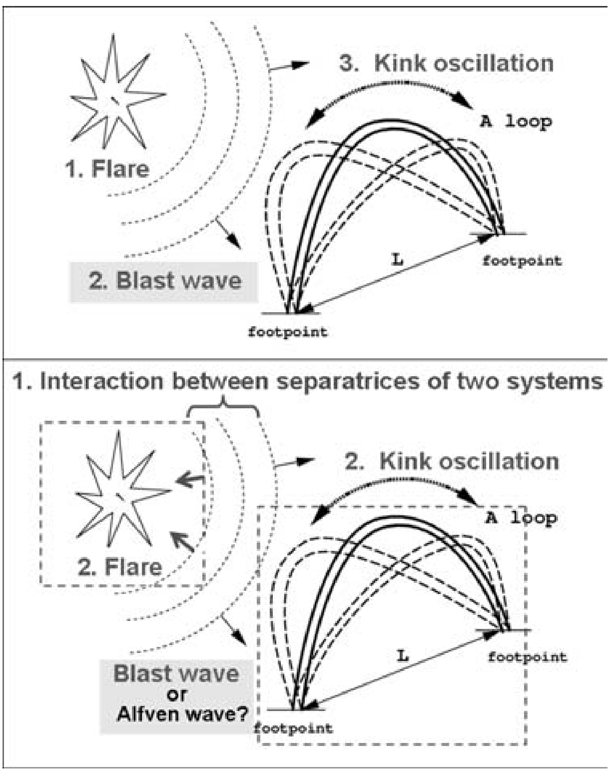
Session 5
Comparisons of CME models and observations



https://doi.org/10.1017/S1743921305000748 Published online by Cambridge University Press

Coronal and Stellar Mass Ejections
Proceedings IAU Symposium No. 226, 2005
K. P. Dere, J. Wang & Y. Yan, eds.

doi:10.1017/S1743921305000748

The Connections Between CME Models and Observations

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Keywords. Sun: coronal mass ejections (CMEs)

Discussion

SCHWENN: About the spiral pattern in the U.Michigan animation: We saw such unwinding spirals. Question: what are they?

FORBES: They are difficult to interpret because what is plotted in the animation are really flux surfaces rather than field lines. In the regions where there is a strong component of the field out of the plane of the figure, the flux surfaces do not correspond well to the true field line structure. Thus, one needs to be cautious in interpreting the unwinding motion. The expansion of the flux surface corresponds to the decrease of current in the flux rope, but the rotation could be an illusion.

KOUTCHMY: You correctly pointed out that theoretical models are dealing with the behavior of the magnetic field which is not observed on the corona. However observations of CME show very important feature like (1) filament eruption and (2) the heating as well as the (3) mass loading process and finally during the evolution of the CME we see also downflowing gas which mean that (4) gravity could be important for models. Why modelers are not trying to deal with some of these parameters?

FORBES: The reason I emphasize observations which give information about the magnetic field is because the magnetic energy is the dominate factor controlling the dynamics of a CME. In CME models, it is the magnetic field and the current density which control the evolution of the plasma and which distinguish one model from another. Other factors, such as gravity, can play a significant role, but for the modelers, they do not have the same importance as the magnetic field.

JIE ZHANG: My question is about the escape of slow, gradually accelerated CMEs. For fast/impulsive CME, one may introduce magnetic reconnection to allow fast energy release and remove overlying field. But for slow CMEs without strong energy release, how do they remove the overlying field and escape? By the tendency of flux rope system expansion, as you mentioned for basic principles? Or by slow wind dragging?

FORBES: I don't know the answer. It may be that slow CMEs are directly driven by a combination of emerging flux and the force exerted by the solar wind. Reconnection and the decrease of the flux rope current may not be so important for the slowly accelerating CMEs.

Zhukov: Do you agree that it should be a concern for models to include more realistic photospheric motions involved in trigging the eruptions?

Forbes: Yes. The motion of the photospheric plasma, whether it is due to flux emergence or simple surface flows, is closely associated with the build up of currents in the corona. From the modelers point of view, these currents are the key factor in determining the equilibrium and stability properties of the coronal magnetic field.

Sterling: 1) Comment: can you publish your quantitative criticisms of the flux injection model, in order to assist in a productive dialog? I understand that you would want to do this tactfully.
2) Soft X-rays often precede HXRs in eruptions: which model best matches this observation?
3) Regarding to Serge Koutchmy's question: some CMEs do not involve filament eruptions; doesn't this rule out mass loading as a mechanism?

Forbes: 1) I've been asked this before, but I am reluctant to just publish a negative criticism of someone else's work.
2)I think this fact best matches the tether cutting model, where the soft X-rays and also the filament activation period, corresponds to the reconnection process which destabilizes the magnetic field.
3) For the eruptions without filaments, Low and [?] suggest that mass in the corona can account for the mass loading. This could explain some slow CMEs. However, even some fast CMEs do not involve filament eruptions.

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