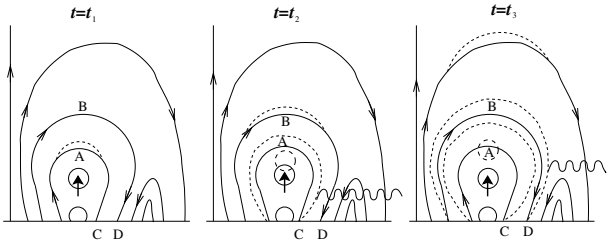
Session 2
Observations of coronal MASS ejections



Coronal and Stellar Mass Ejections
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What have we learned with SOHO?

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Abstract. The Solar and Heliospheric Observatory (SOHO), a space mission of international collaboration between ESA and NASA, has been operating almost continuosly since early 1996. The Sun and the heliosphere went through both: the minimum and maxumum of solar activity in 1996 and 2000, respectively. The perfectly working set of modern solar telescopes and in-situ instrumentation has been producing an unprecedented set of most valuable observational data that are almost immediately available to the public via the Internet. A wealth of new results has been published in innumerable papers. For CME research in particular, SOHO has started a new era. CME evolution can now be studied from their initiation up to the arrival of the ejecta clouds at 1 AU. For the first time, helioseismological observations reveal flow vortices underneath sunspots, i.e., activity centers that are involved in subsequebt eruptions. Combined EUV disk observations and coronagraph images allow to differentiate between CMEs pointed towards to or away from the Earth. Thus, space weather predictions have achieved a new quality. The occurrence of "EIT waves" at CME onset was discovered, the internal structure of CMEs (including "disconnection", magnetic topology and helicity, etc.) was made visible, statitics about CME properties and their change with solar activity were refined. Spectacular CME images and animations have been attracting the public to an unexpected extent, to the benefit of solar research in general.

Keywords. Sun: coronal mass ejections (CMEs)

Discussion

KOUTCHMY: From your talk we get the impression that there is a one to one correspondence between flares and CMEs. Is it always the case? What about the latest event producing a very large storm: why it should be related namely to the small flare you pointed out ?

SCHWENN: It is not always the case: there are many CMEs without associated flares and the other way round. For the big events, you usually have both flare and CME, but not in a unique cause-effect relation. My last example was just to illustrate that even minor flares may be associated with geo-effective CMEs. Be prepared for surprises.

RILEY: I like your idea about global CMEs being a coincidence. But I am a little bit surprised that you think that all "Sympathetic CMEs" are a coincidence. I would have thought that a large-scale eruption could provide a sufficient perturbation to initiate another eruption. Could you comment on that?

SCHWENN: I see no evidence for sympathetic events at large separations, except by mere coincidence. All events formally considered "global" could be traced back to single events samewhere close to Sun center.

ZHUKOV: You mentioned the result by C. St.-Cyr that the number of slow CMEs did not increase with the increased sensitivity of LASCO; you mentioned this in connection with the idea that slow wind might be composed of many small slow CMEs. Are the "blobs"

described by Sheeley et al. included in St.-Cyr's statistics? Do you think these "blobs" are relevant to CMEs?

Schwenn: Sheeley's "leaves in the wind" are not included in St.Cyr's study, to my knowledge. I do not consider them CMEs, although they seem to meet the definition. The leaves are definitely not sufficient to become the slow solar wind, nor are the other slow CMEs.

Sterling: a) you said that 85% of halo CMEs are geoeffective. Does that included only earth-directed events?
b) Can you see back side halos as efficiently as earth-side halos?

Schwenn: a) Yes, we did not include back side events.
b) I do not know of any such study [somebody else responds: says that Andrews has studied this and found that you can see backside events as well as front side events]. Right.

Tylka: I was somewhat surprised by your statement that "modern instrumentation has not increased the number of small faint CMEs". But one of the new insight on impulsive SEP events (i.e., ^{3}He/^{4}He>10%) is that at least half are accompanied by CMEs, that are small, faint, narrow, etc. Can you comment?

Schwenn: It may deal with the definition of what we call a CME. In fact, there is no size specification in the classical CME definition. There is very much activity on the active Sun which does not produce CMEs and yet might energize particles.