

Participants:

T. Amari, S. Antiochos, G. Aulanier, V. Bommier, P. Demoulin,
B. Filippov, L. Klein, S. Koutchmy, C. Marque, Z. Mouradian,
S. Patsourakos, N. Vilmer

WG Report:

-> Redacteur: G. Aulanier

WG3 : Magnetic Fields

- Quiescent prominences :
 - Formation & structure of \vec{B} in 3D
- Eruptive prominences :
 - Triggering mechanisms

Physical mechanisms
 ↓
 MHD models
 ↓
 predictions + observations

QUIESCENT PROMINENCES

(joint with WG 2: class)

• 3 main models:

- (i) undipped & untwisted arcades (Engvold)
- (ii) dipped & $\lesssim 0.5$ twist "sheared arcades" (Antiochos)
- (iii) coherent twisted flux rope (Amari)

• Comparison with observations:

- TRACE movies "may" show weak ($\lesssim 1$ turn) twist (Title)
- prediction for B_z (phot) (Amari)
 - ↳ crucial issue of 180° ambiguity
- 3D distribution of dips in filament body (Aulanier)
 - ↳ with model (ii): mainly IP, but a few NP
 - ↳ with model (iii): all IP
 - ↳ (ii) & (iii):
 - weakly twisted
 - flows are possible
 - all IP dips in feet (burbs)

• Origin of the axial fields:

- phot. shearing motions?
 - ↳ typically no, but yes for rot. sunspots (Koutchmy)
- converging + upward flows at I.L.? (Amari)
- coherent emergence of a flux rope twisted in the convection zone? (Démoulin)
- diff. rot + axial field emerg. around I.L.? (MueKay)
 - ↳ yes, but emerg. flux too high
 - + disconnected sheared emerging AR?
 - ↳ yes, but only in rising phase
- Is there a confusion with fibrils? (Title)
 - ↳ AR & large quiescent fil are different? (Démoulin)
 - ↳ possible "leaky bucket" model

• The cavity: (Koutchmy)

- better explained by a large flux rope (Démoulin)

ERUPTIVE PROMINENCES

- Storage of magnetic energy :
regardless of the (prom) magnetic configuration,
the important parameter is $\alpha = \mu_0 B'$ (Amari)
- Physical mechanisms rather than models : (Amari)
 - (i) current in a TFR (Filippov)
↳ unstable if $|\partial B/\partial h| > h^{-1}$
 - (ii) varying $B(\text{pot})$ by flows or E (Amari)
 - (iii) singular non equilibrium (reconn. below) (Démoulin)
 - (iv) reconn. at overlaying Null Point ("breakout")
↳ sufficient for opening sheared fields (Antiochos)
↳ can help, but not necessary (Amari)
- Identification in Observations :
 - (i) sample of proms + potential extrapol (Filippov)
↳ $h(\text{obs}) + \partial B/\partial h(\text{potential})$
 - (ii) effect of typical diffusion of ARs? (Démoulin)
 - (iii) history of Sigmoid flare (reconn.) loop (Démoulin)
 - (iv) radio precursor of eruption (1-3 min before flare)
 - along large TIL (Vilmer)
 - in a neighboring AR (Marqué)
- Related issues :
 - activated (twisting) filaments which are "disrupted", not "erupted" (Title)
↳ loss of equil (kink)? (Amari)
 - During filament eruption, $\mathcal{H}(\text{plasma}) = F(h)$ (Koutchmy)
 - Passive role of prom. plasma
↳ obs : ~75% CMEs have no prom (Antiochos)
↳ theory : high shear α , low plasma β ? (Démoulin)
 - Signatures of precursors (reconn., \mathcal{H} , ...) observable with plasma diagnostics ??? (Antiochos)

The truth is out there...

- Future observations

- *typical morphologies & flows in twisted flux ropes*

- 3D visualization of corona (STEREO/SECCHI)
 - high spatial/temporal resolution (TRACE)
 - plasma in filaments (THEMIS/MSDP, SOHO/SUMER & CDS)

- *where/when does reconnection occur ?*

- spectroscopic signatures (SOHO/SUMER, Solar Orbiter)
 - high temporal resolution in radio (NRH, Nobeyama)

- *magnetic field measurements*

- Hanle effect in prominences (THEMIS/MTR)
 - vector magnetograms (THEMIS/MTR & MSDP, SOLAR-B)

- Extension of MHD models & application to observations

- *propagation of interplanetary flux ropes*

- different structures with/without initial twisted flux rope
 - distortions by the solar wind

- *fully 3D models of CME initiation*

- without initial flux ropes (tether cutting, breakout)
 - with initial flux ropes (loss of equilibrium)
 - predicted height-time profiles in each case

- *magnetic extrapolations compared with observations*

- (non) linear force-free and magneto-hydrostatic fields
 - incorporating the thermodynamics in each field line
 - magnetic dips ($H\alpha$, UV) & sigmoidal loops (EUV, X-rays)