Dusan Odstrcil: Heliospheric Simulations of SHINE Events Using CME Cone Models

CMEs and Cone Models

Cone Model - CME as a shell-like region of enhanced density

Heliospheric Model Input Parameters
Ambient solar wind
Transient disturbances
Ejecta (cloud with momentum and overpressure) → shock is generated

Application to May 12, 1997 (SHINE#1) Event

Application to May 2, 1998 (SHINE#2) Event

Cone Model Limitations and Possible Improvements

Application of Cone Model to Heliospheric Simulations

	Feature
Plus	▪ observationally based (main causal geo-effectivity link) ▪ simple specification (with direct control of consequences) ▪ numerically robust (beyond supercritical point) ▪ slightly more accurate than empirical formulae (realistic solar wind) ▪ global context (transient and background structures) ▪ interplanetary shocks and IMF line connectivity (shock-observer)
Minus	▪ absence of internal magnetic structure ▪ initial effect on surrounding solar wind ▪ reverse shock ▪ shock stand-off distance ▪ internal profile of parameters

R. Frazin: Driving models with 3D tomographic reconstructions from white-light and EUV data

White light rotational tomography

Input: time series of WL coronagraph (LASCO, Mk IV) images

Output: 3D electron density

EUV Rotational Tomography (DEMT)

Input: time series of full-disk EUVimages (EIT, EUVI, AIA, XRT) in multiple bands

Output: 3D emissivity, local (not LOS integrated) DEM $N^2(r,T)$,

irregularity factor $\langle N^2(r)\rangle/\langle N(r)\rangle^2$

Tomography in the future

    Time-dependent tomography (movie)

    Multiple spacecraft views (will be especially important for time dependent modeling)

    Determining Magnetic fields from 2D EUV images or 3D EUV tomographic reconstuctions.

Importance of Spectral diagnostics (e.g., UVCS, SUMER)

Empirical lower boundary condition on density (& Temp).