STEREO/WAVES

Interplanetary Radio Burst Tracker

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Science Working Group Teleconf

29 March 2012

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Status

- Both A & B receivers continue to function nominally
  - No unexpected resets or anomalies
  - No trend changes in HK health and safety parameters

- Operations continue to go well
  - Commands go up
  - Telemetry comes down
  - Associated data products are produced and made available
  - APL operations team continues to get us our bits - thanks

- We recently found a problem in flight software
  - A counter overflowed because we've had too much uptime
    - After 390 continuous days of uptime, a counter rolls over – becoming negative
    - After another 390 days, the problem corrects itself
  - Problem causes each of 8 channels to shift one
    - Partially correctable on the ground
  - A software patch is in hand – need to upload one day

Science/Engineering

- APL recently convened another *annual* mission status meeting
  - 11 January 2012
  - Very interesting – could be interesting for science teams
  - There are some engineering mysteries
  - Thermal changes as a long term function of time

- S/WAVES continues to have *dust* issues - mysteries
  - We have seen changes in the behavior as a long term function of time

- We propose getting some science and engineering interests together at some point in the near term to work out some of the mysteries

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LFR/HFR Calibration Status and Direction Finding

- Meetings
  - Three « calibration weeks » held in 2008 (Feb., May & Oct)
  - Direction Finding workshop @ GSFC (Nov. 2011)
- Status of the LFR & HFR calibrations
  - For both receivers the calibrated data are fine for normal & high level intensities (for signals ≥ 5 10-16 V2/Hz). This allow performing the following science
  - For LFR : Dust, Langmuir waves, Shot Noise (density determination)
  - For HFR : Type III's and intense Type II's, Auroral Kilometric radiations
  - For weaker signal (galaxy, weak Type II's) corrections need to be applied in order to take into account the internal receiver noise. This is a bit tricky because this noise seems to be a function of the intern S/C temperature (on-going work, need discussions with APL engineers)
- Direction Finding status
  - Inter-comparisons between Several techniques & methods (Krupar/Cecconi & Lecacheux @ Obspm, Reiner @ GSFC, Martinez-Oliveros @ UCB)
  - General good agreement

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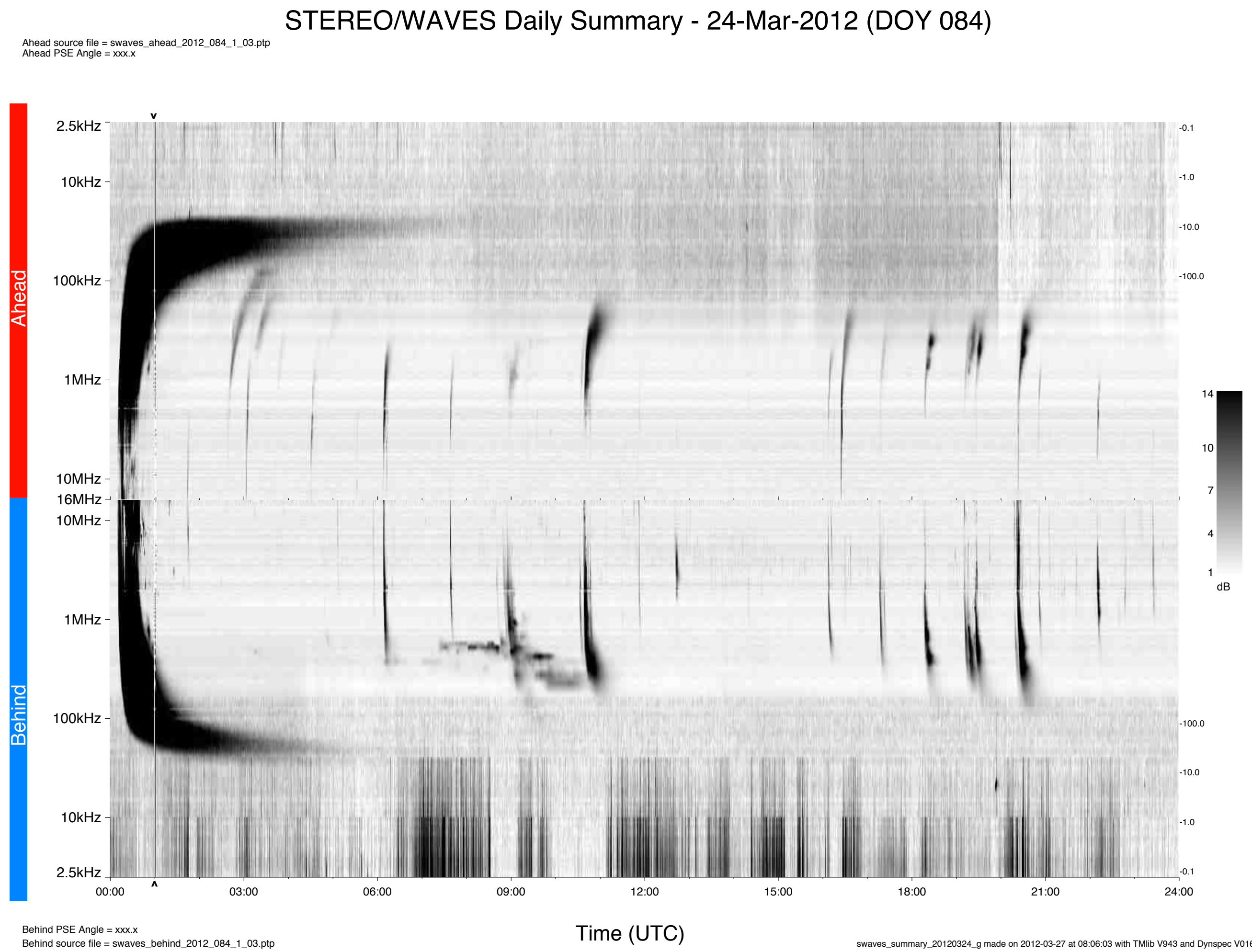
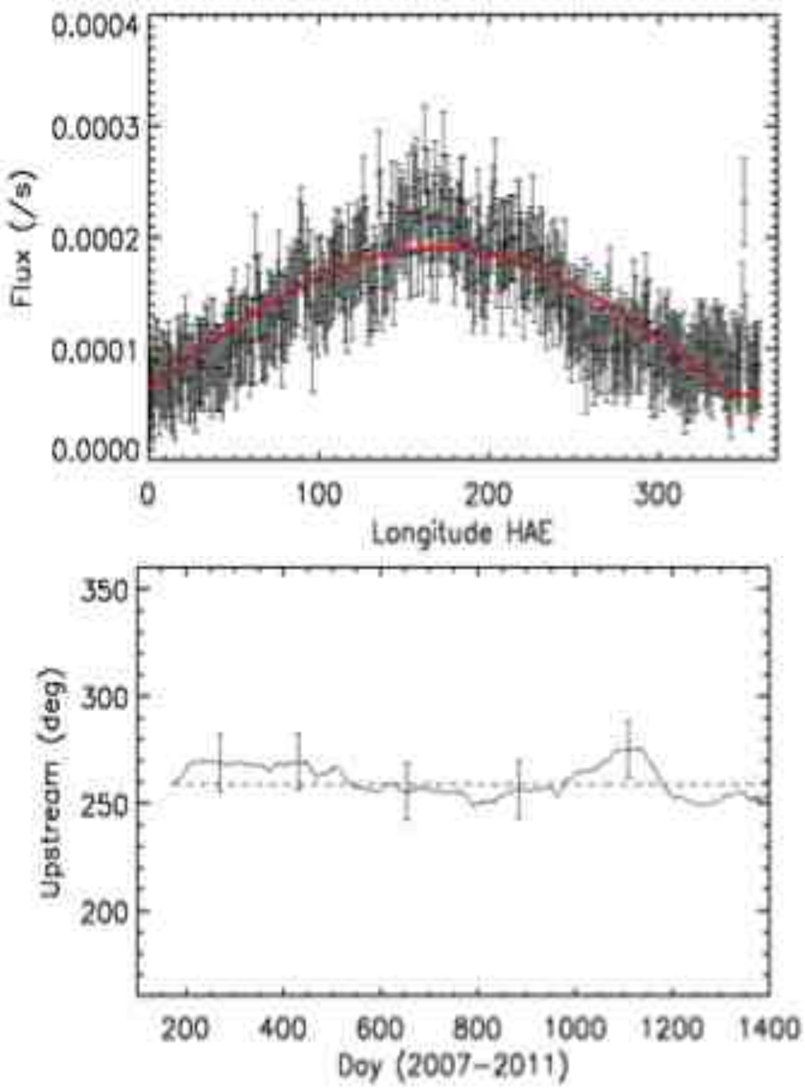
Daily summary plots available (http://swaves.gsfc.nasa.gov)



Interstellar dust grains in the interplanetary medium



Observation of a modulated flux of dust in the range 0.1-0.3 microns.

Longitudinal modulation interpreted as due to interstellar dust

Modelisation and data enable to determine the upstream direction of the interstellar dust flux, and its variation with time.

(Figs. from S. Belheouane, A. Zaslavsky, N. Meyer-Vernet, K. Issautier, I. Mann, M. Maksimovic, *Solar Phys*., accepted, 2012)

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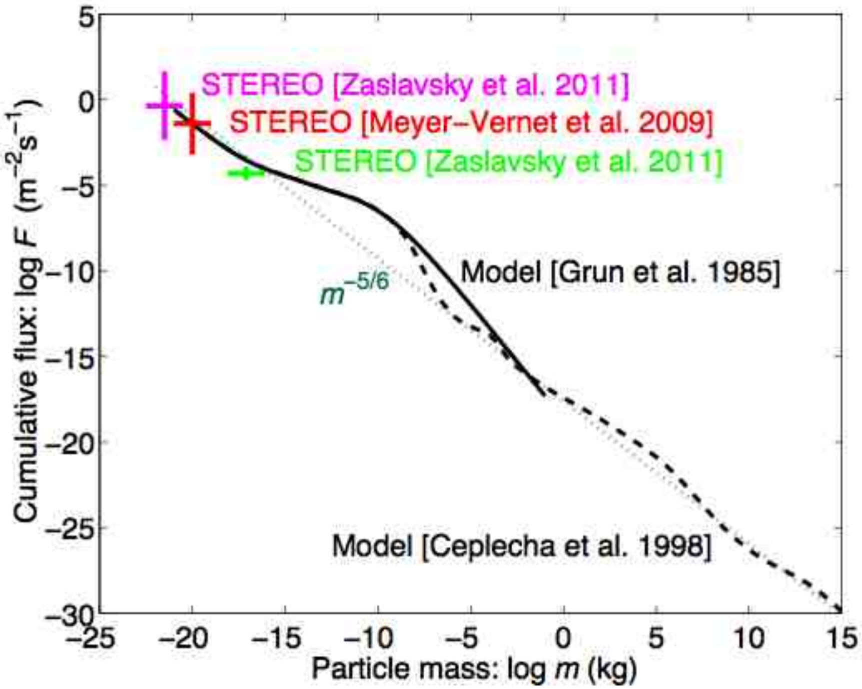
S/WAVES dust fluxes: 3 measurement points



Measurements in the 0.1 micron size range : <u>Interplanetary and interstellar dust</u> (results in agreement with previous measurements onboard other spacecraft)

Measurements in the nano-meter size range : first ever observations of nano dust of inner-heliospheric origin (0.3 AU?)

<u>6 publications submitted / accepted / published:</u>

Meyer-Vernet et al., ***Sol. Phys., 256,*** **2009**
Zaslavsky et al., ***JGR, under review, 2012***
Belheouane et al., ***Sol. Phys., accepted, 2012***
Meyer-Vernet and Zaslavsky***, in Nanodust in the solar system:Discoveries and Interpretations,2012***
Pantellini et al., ***Plasma. Phys. Control. Fusion, 54*****, 2012**
Pantellini et al., ***Astrophys. And Space Sci.,submitted*****, 2012s**

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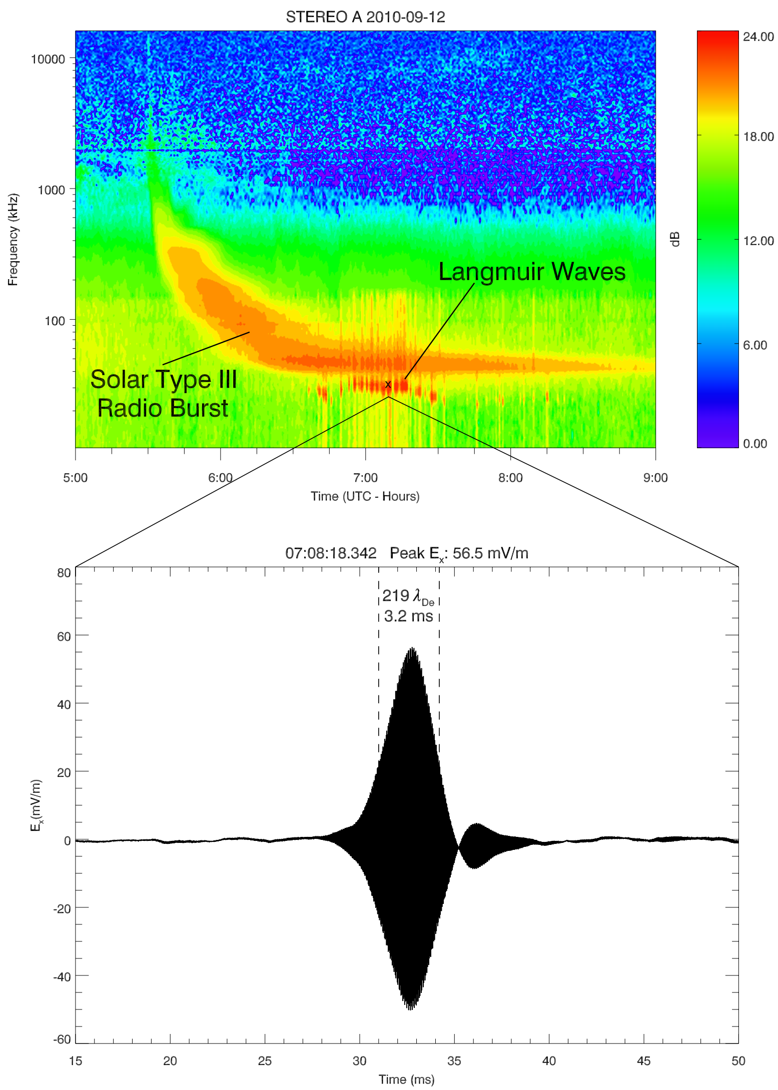

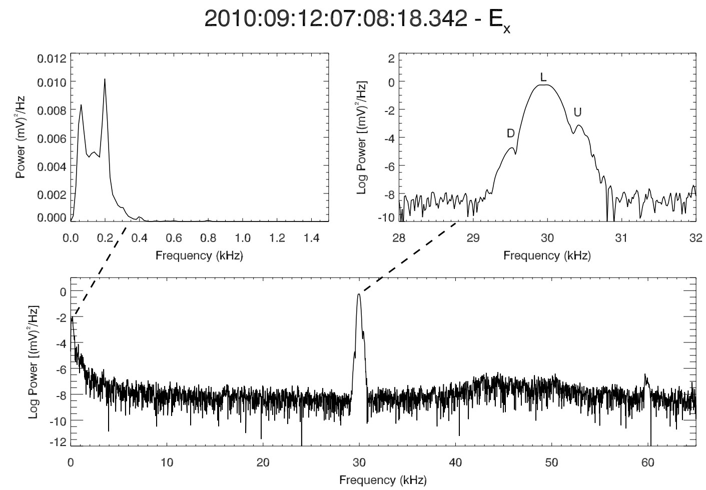

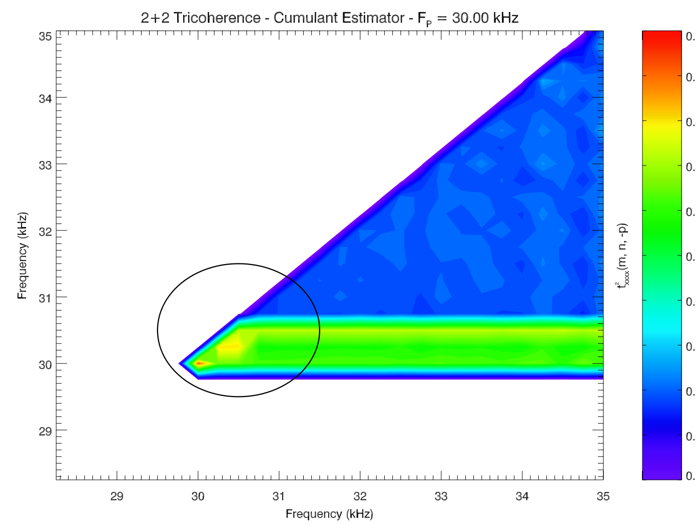

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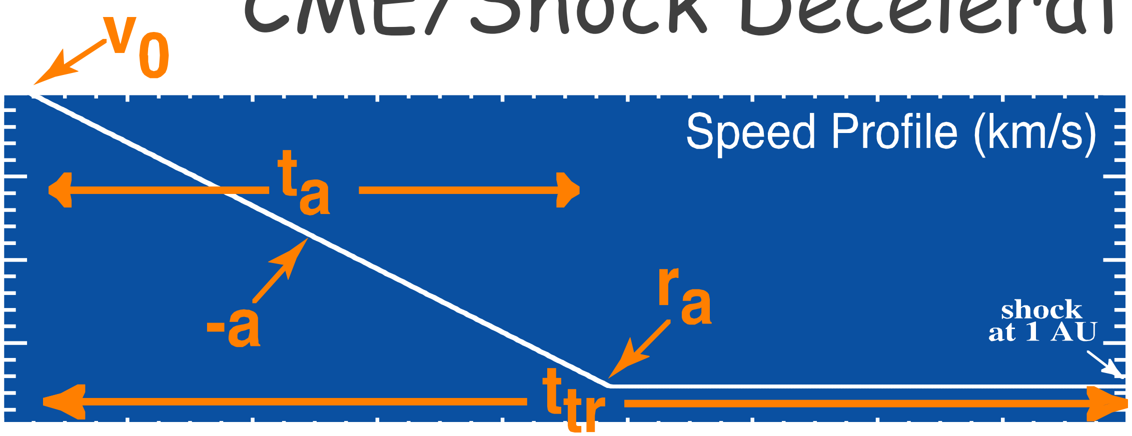
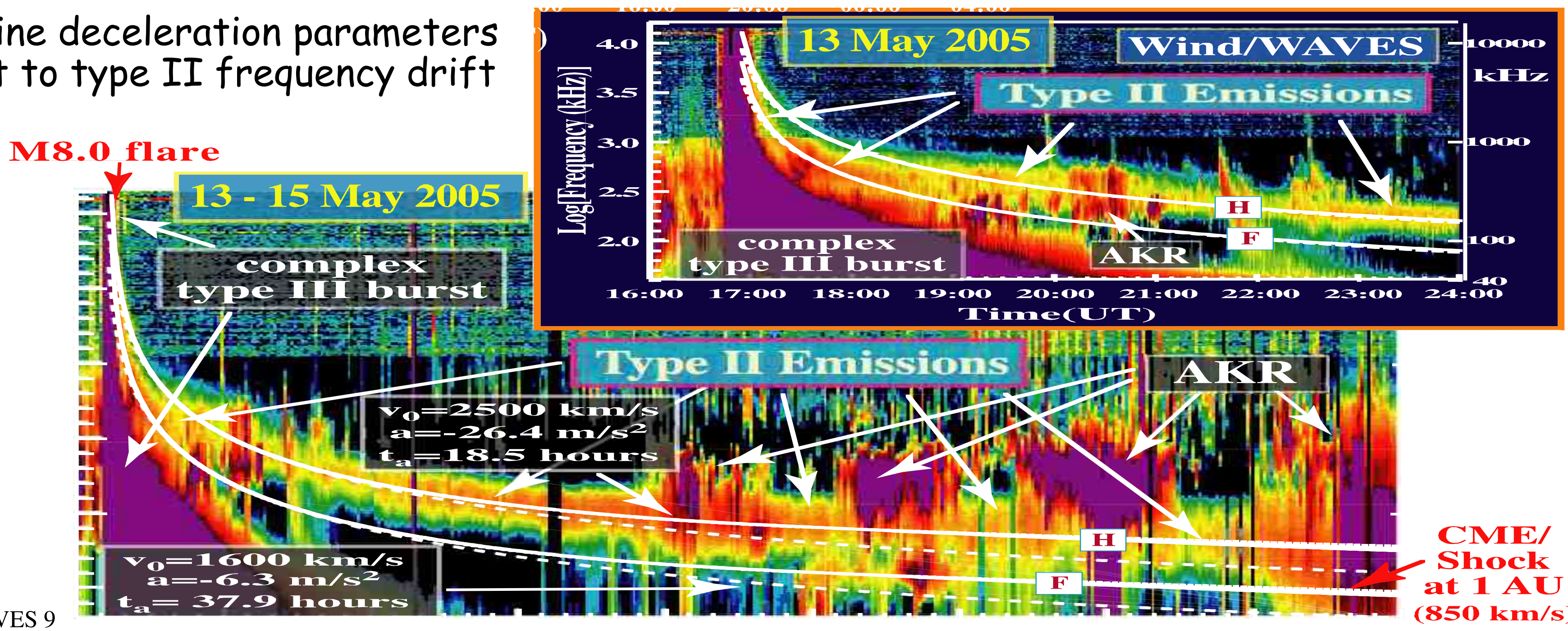
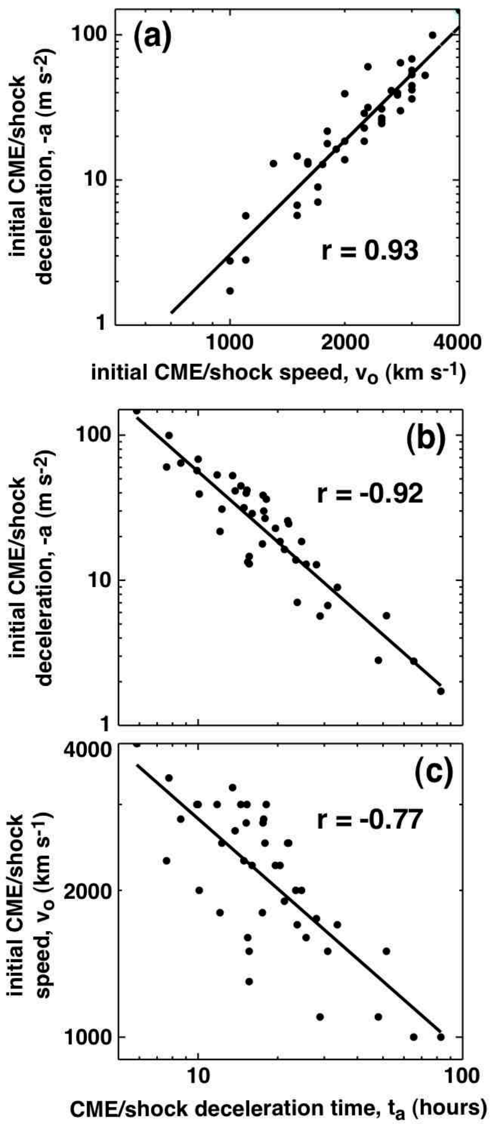
CME/Shock Deceleration Parameters



Assume that CME/shock decelerates at a constant rate,
followed by propagation at a constant speed

Determine deceleration parameters from fit to type II frequency drift





From a statistical sample of CMEs find correlations between deceleration parameters

This procedure yields a **Space Weather** predictive algorithm that includes the effects of CME deceleration

$$-a(m/s^2) = 4.55\times10^{-8}\ v_o(km/s)^{2.61}$$

$$-a(m/s^2) = 2.68\times10^{3}\ t_a(hr)^{-1.61}$$

$$v_o(km/s) = 8417\ t_a(hr)^{-0.477}$$

Given an initial speed v_o, the Space Weather algorithm predicts a and t_a and transit time to 1AU

Expected to work best for fast CMEs that produce significant type II radiation

Want to validate and improve this algorithm using STEREO/Wind observations

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Recent fast CMEs observed by Wind & STEREO

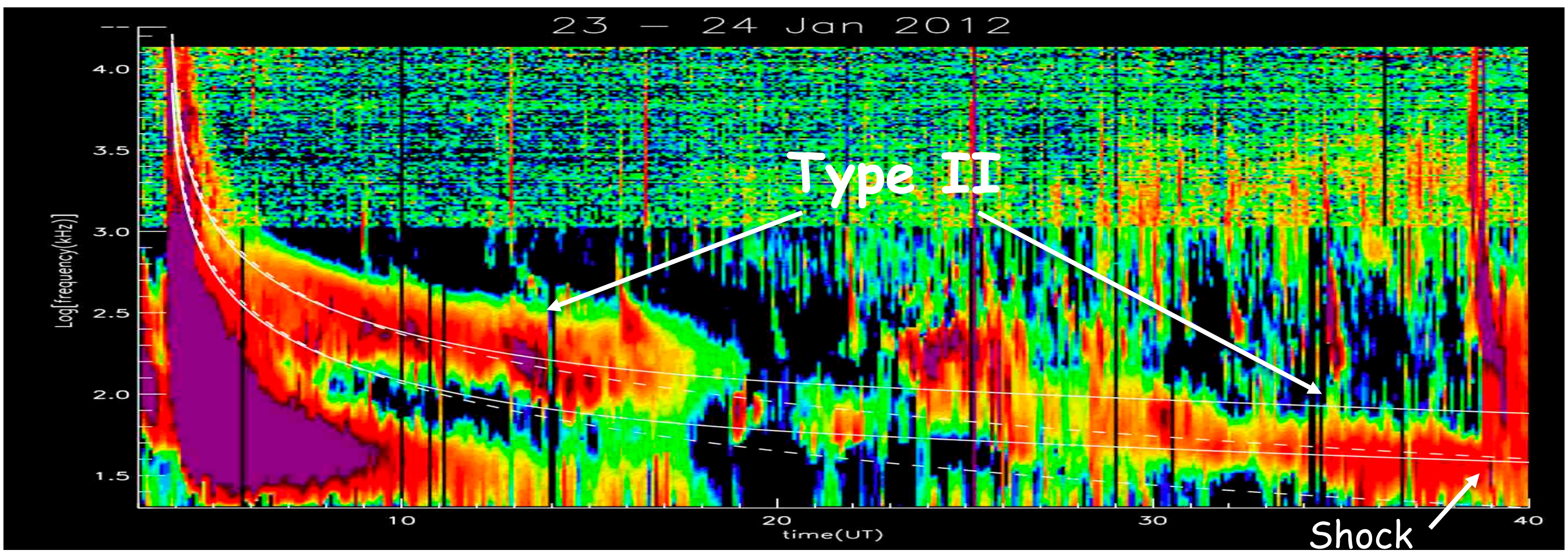
January 23 - 24, 2012 — Estimated initial speed v_0 ~ 2200 km/s

SW algorithm prediction → $a = -24 m/s^2$ for $t_a \sim 17^h$

Observation — Transit time to 1 AU ~ 39^h

Shock at Wind at 14.6 UT on Jan. 24 → Observed transit time to 1 AU ~ 34.9^h

If CME speed were constant at 2200 km/s → Observed transit time to 1 AU would be 19^h



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