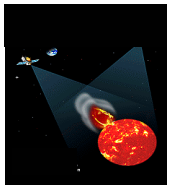
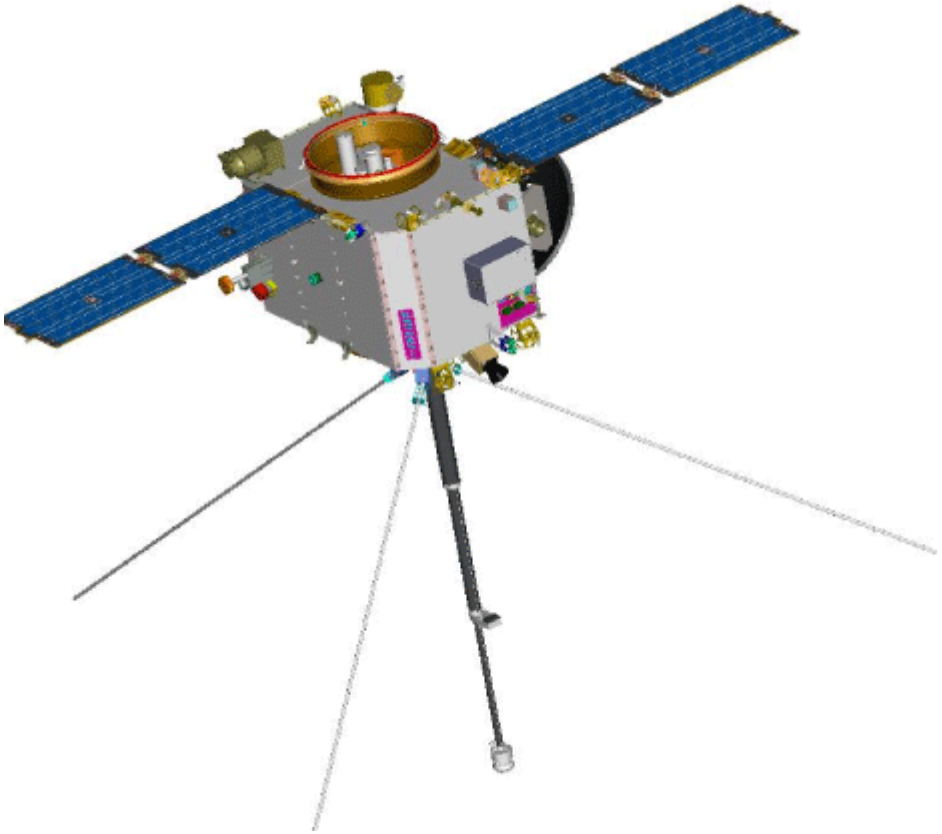
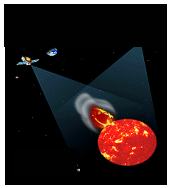
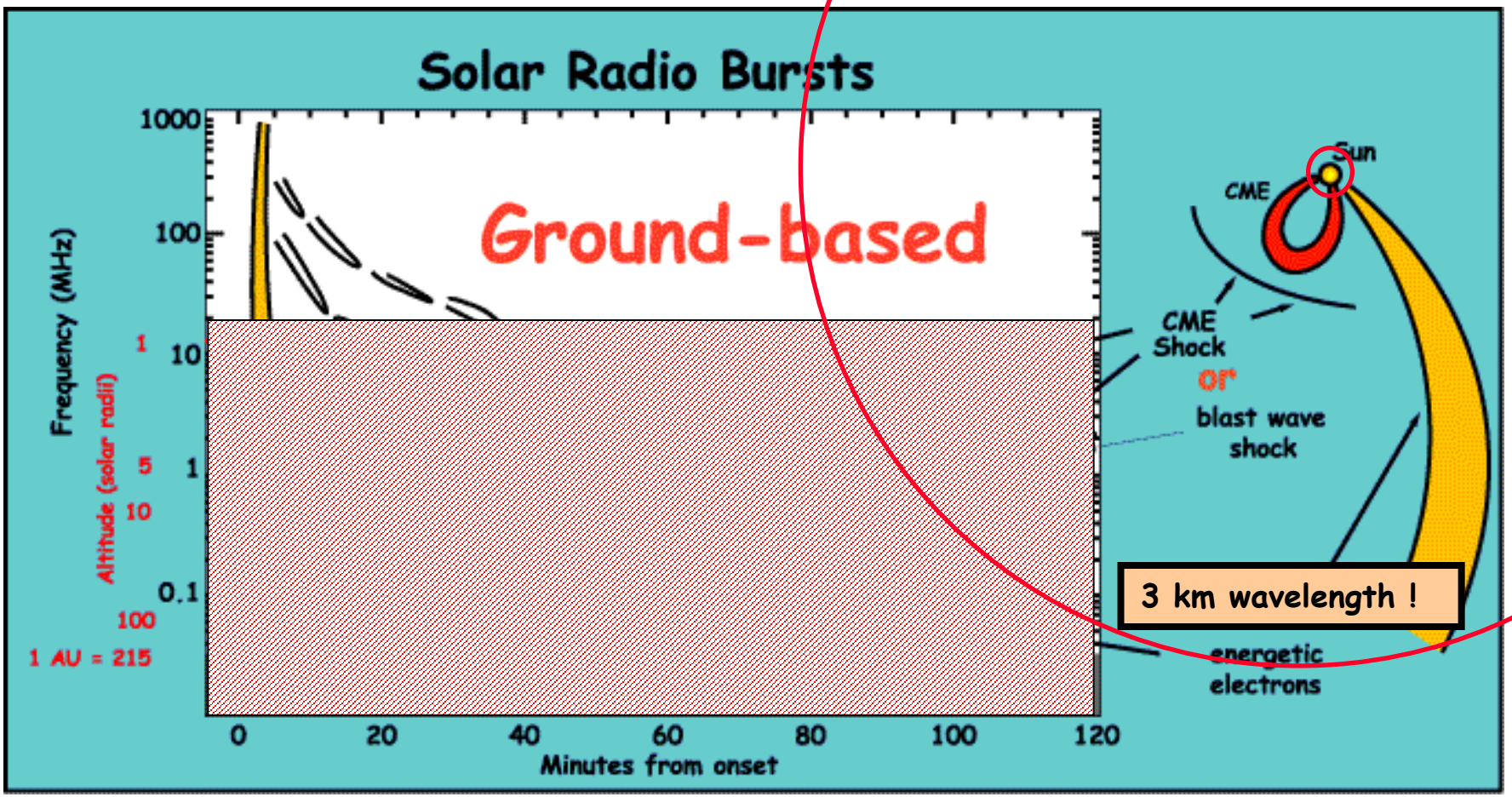


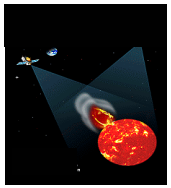
SWAVES Data Processing Plans
(such as they are)





1 Minute tutorial

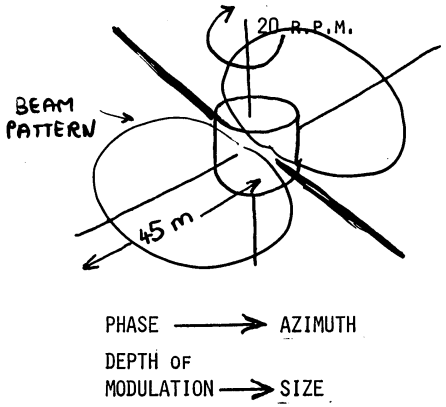


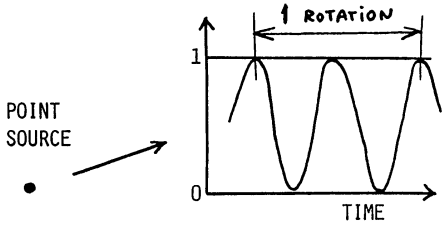


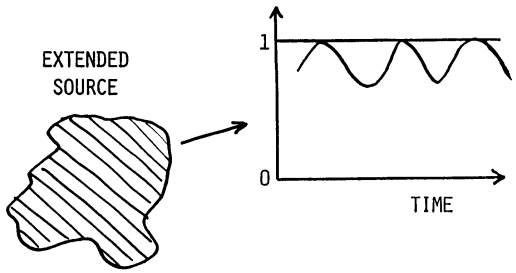
Radio tracking in the past

THE SPINNING DIPOLE TECHNIQUE
(SIMPLIFIED SKETCH)

E.G. ISEE-3



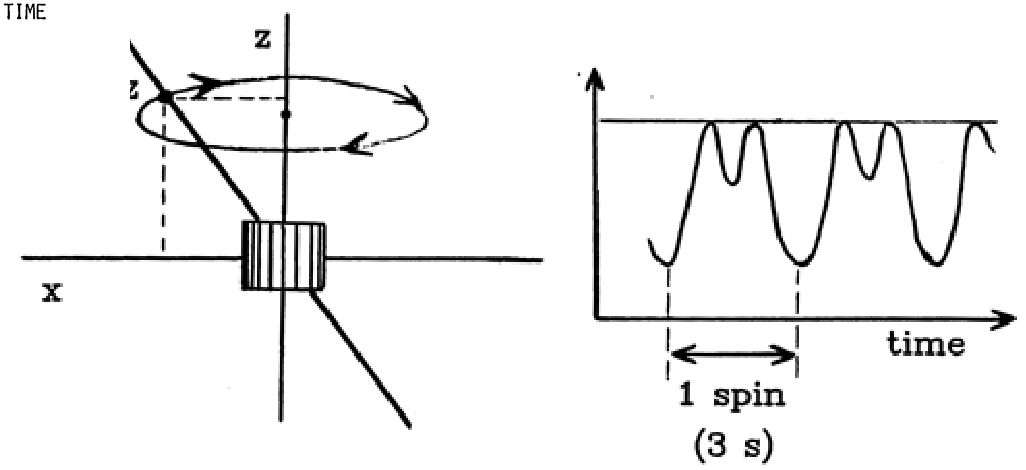




e.g. IMP-6, ISEE-3

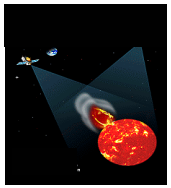
e.g. Ulysses, Wind

THE SYNTHESIZED DIPOLE TECHNIQUE

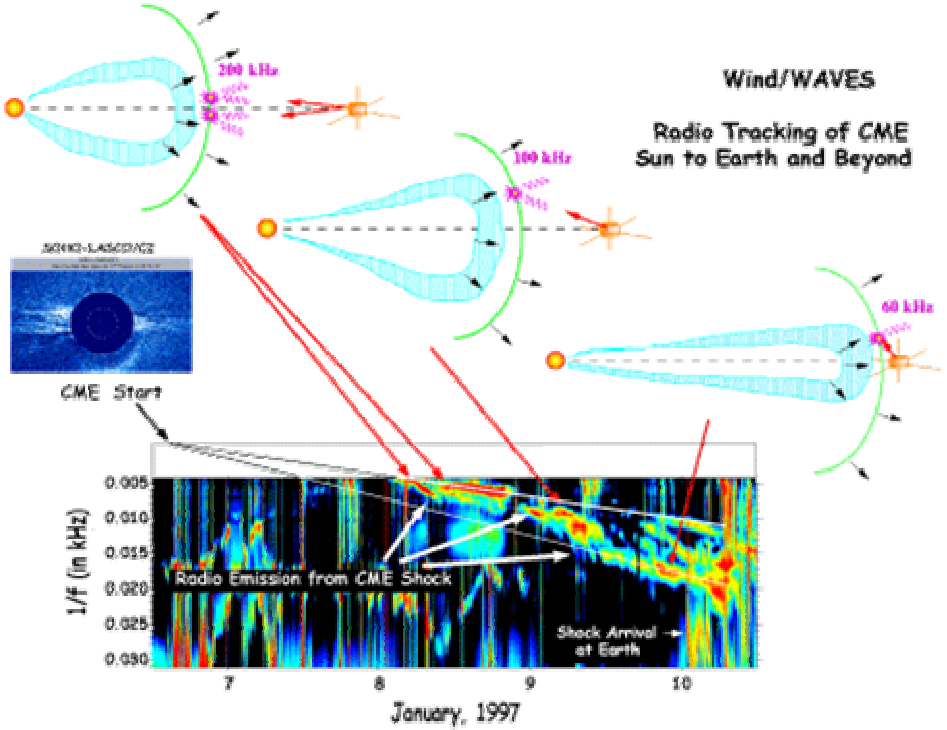


equivalent to cross-correlation:

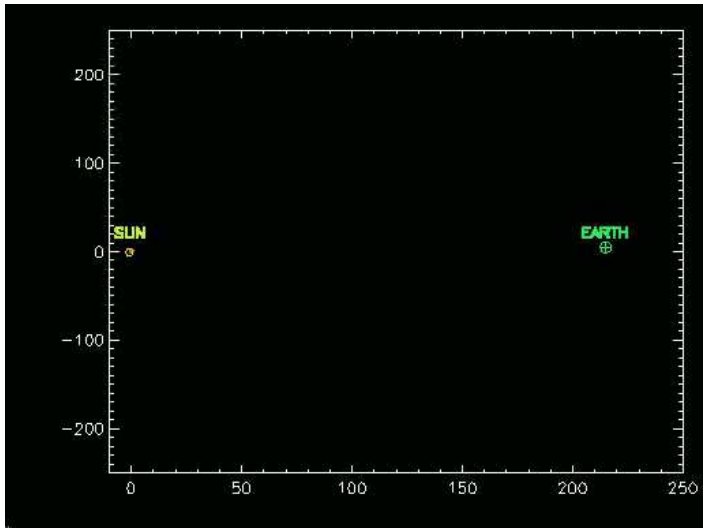
- Real part — direction
  linear polarization
- Imaginary part — circular polarization

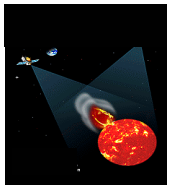


An old favorite

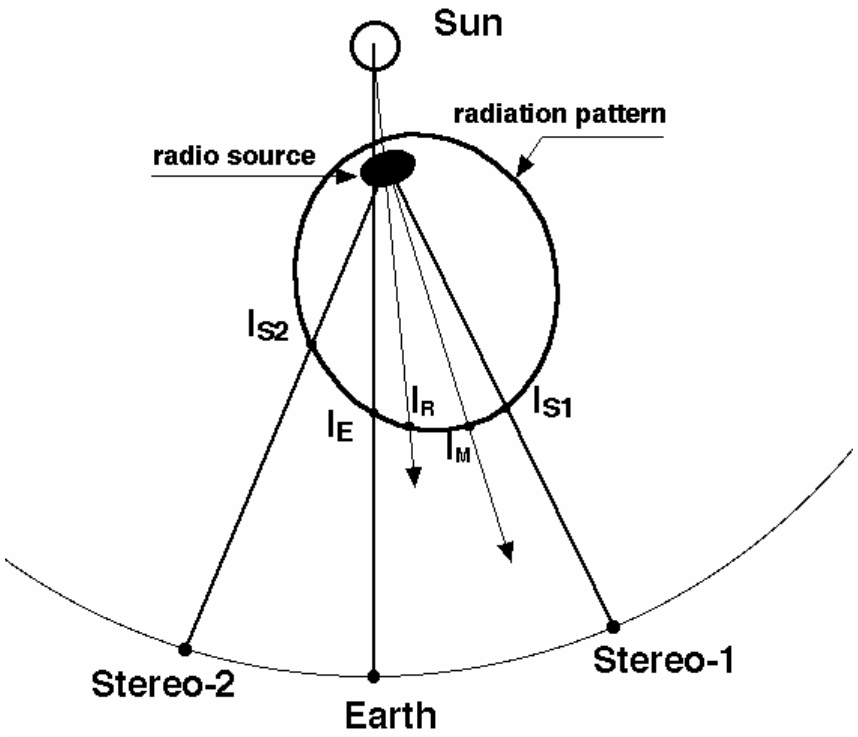


Must have density model to get distance

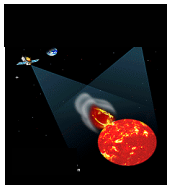




Radio stereoscopy

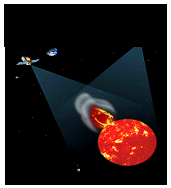


- **measured parameters:**
  - radio intensity ----> directivity
  - polarization ----> directivity of modes, propagation
  - time-of-flight ----> localization, anomolous propagation
  - dynamic spectrum ----> overview
  - source direction ---- localization
  - source diameter ----> source structure, scattering

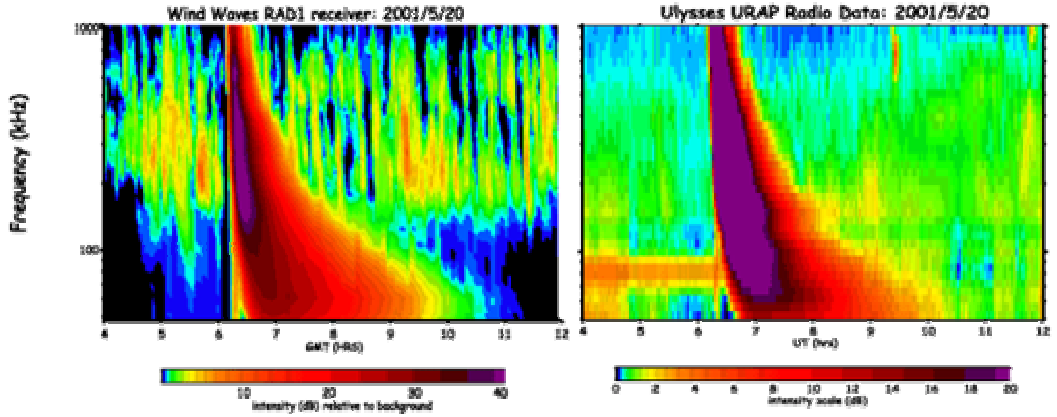


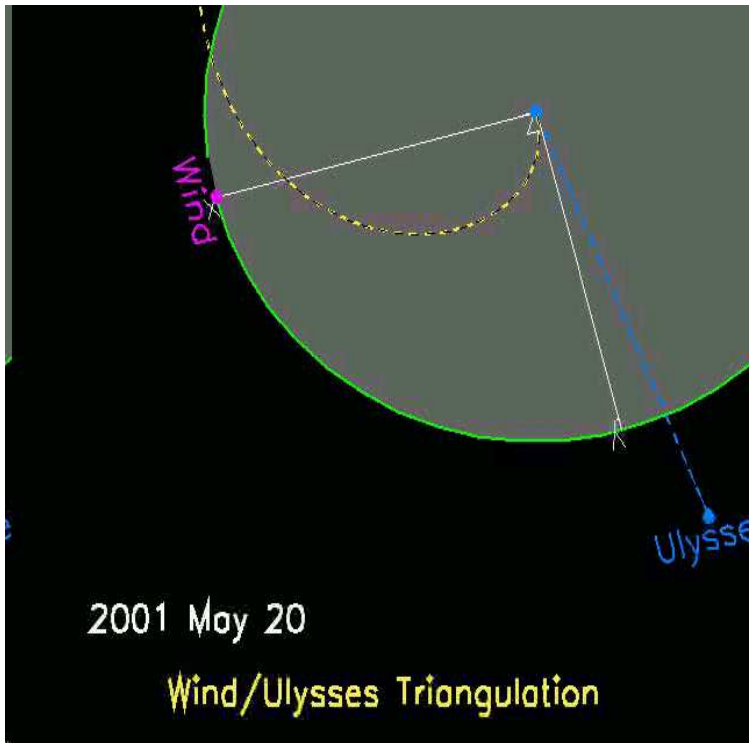
What can we learn from radio stereoscopy?

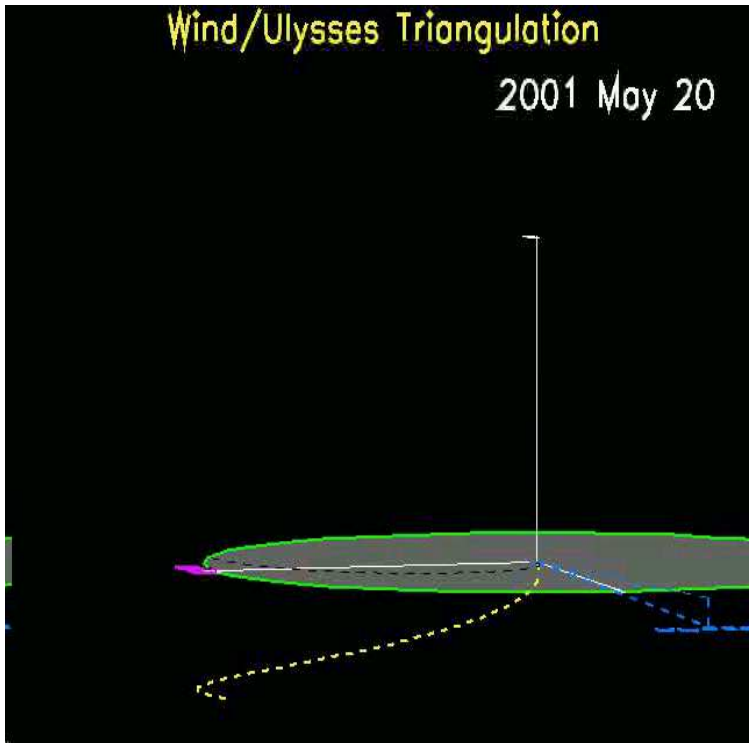
- **type III bursts (energetic electrons)**
  - Radiation mechanism, association with electron events
  - structure and topology of large scale magnetic fields (mapping)
  - understanding propagation phenomena (weak/strong scattering)
- **type II bursts (shock waves)**
  - association with Coronal Mass Ejections (3-D localization of the source)
  - formation and evolution of the shock (study of multiple sources)
  - acceleration of energetic particles from the shock and interacting shocks (cannibalism)
- **radio radiation mechanisms**
  - radiation modes (fundamental and/or harmonic)
  - Wave-particle correlations (micro-physics)
    - contraints on theories
    - local structure and topology of the source

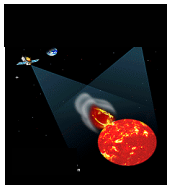


Wind-Ulysses stereography

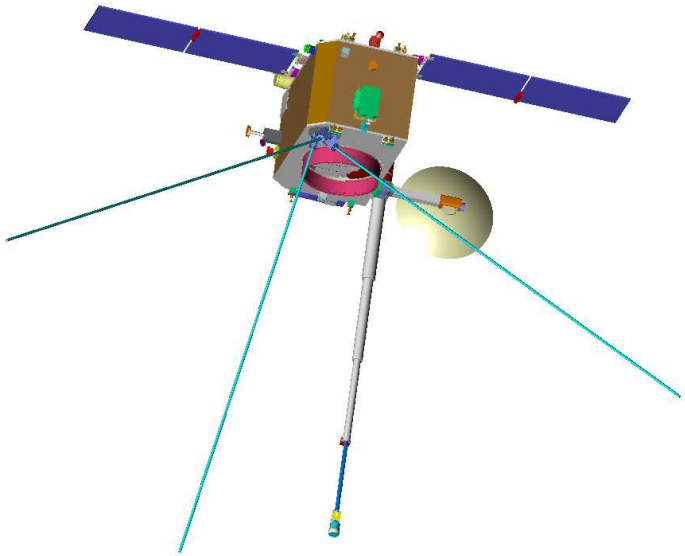




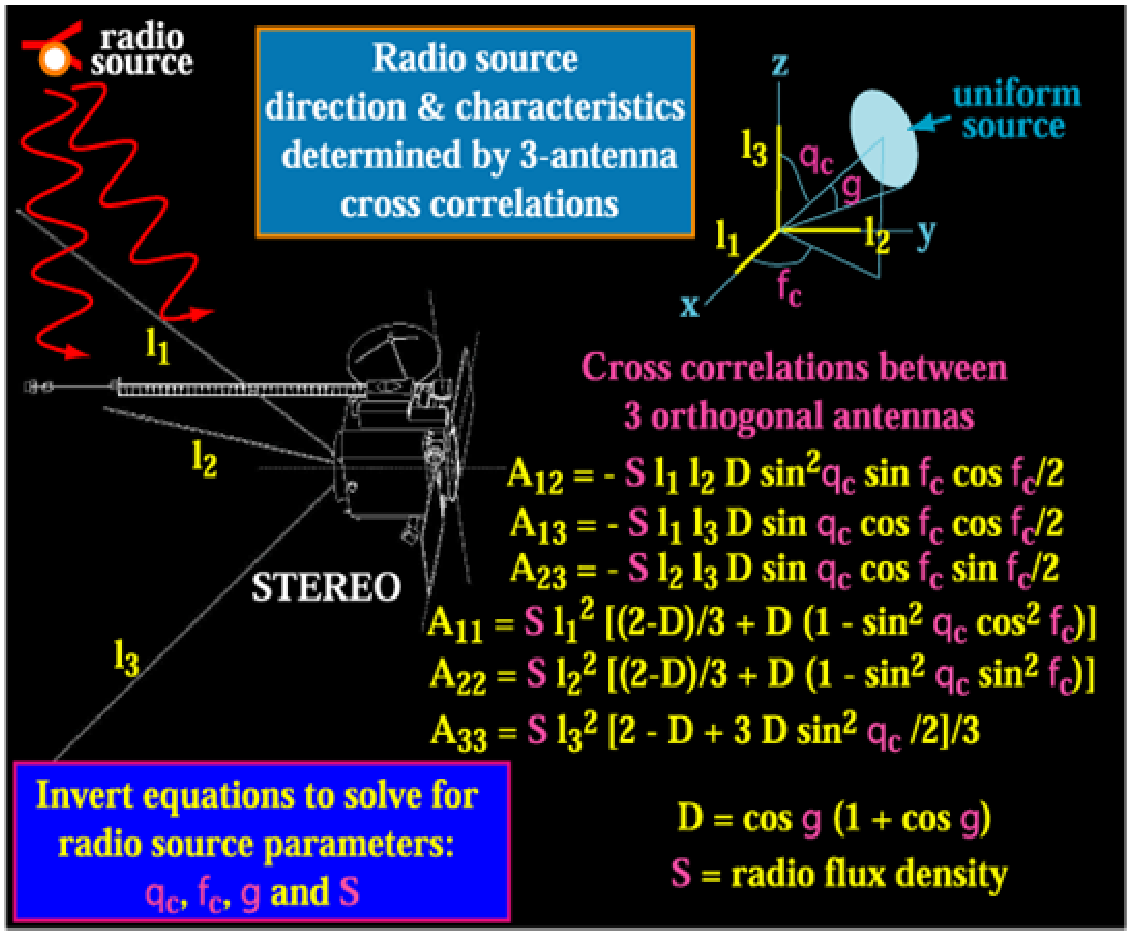


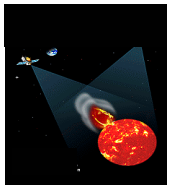


But STEREO is 3-axis stabilized!



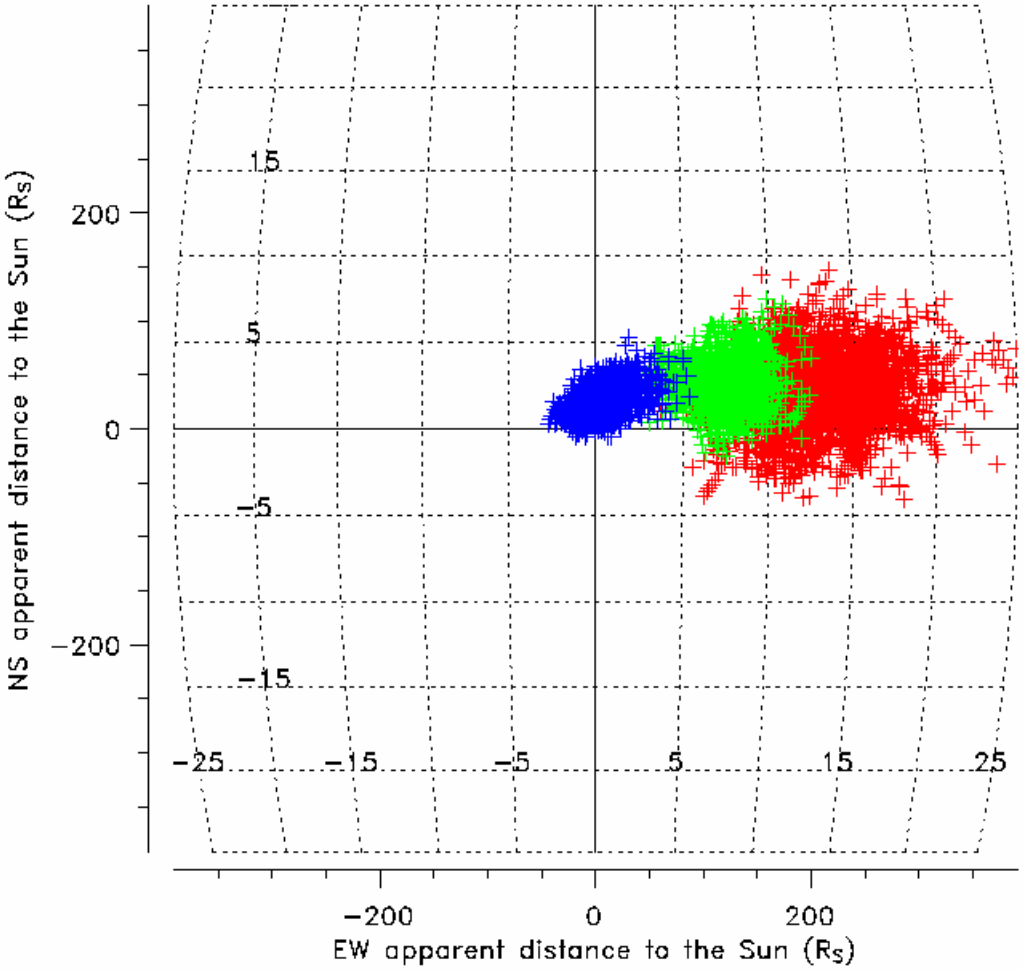
Cassini





STEREO-like Radio DFing

Cassini/RPWS **« 2D-imaging » of the radio event associated with the X17 solar flare (2003, Oct.28)**



frequency range:

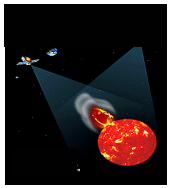
‹ 70 kHz

120-250 kHz

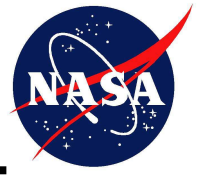
400-1500 kHz

<- (angular degrees)

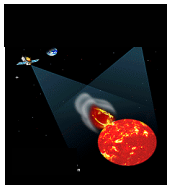
Sun-Cassini range = 8.67 AU.



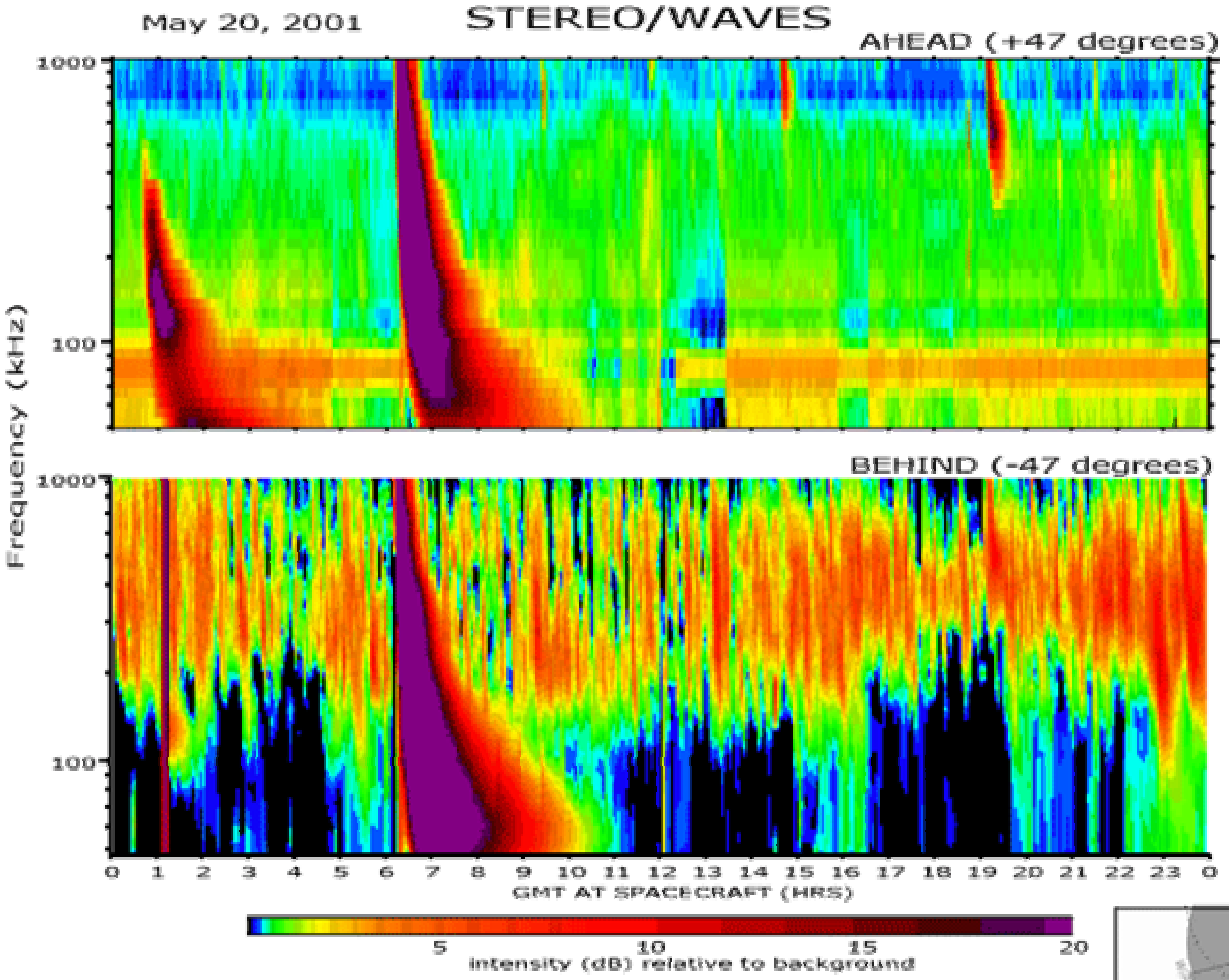
SWAVES Data Products
(available on Web 'immediately')

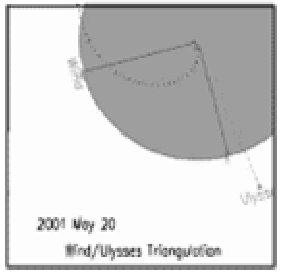


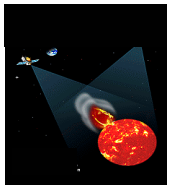
- Dual daily dynamic spectra
- Catalog of type II/IV bursts
- Selected source locations versus time
- *In situ* electron density, when possible
- Daily *in situ* waves activity index
- 1 minute averages
- Access to client software (SWAVESlib)
- Instrument browser



Daily Radio Dynamic Spectra







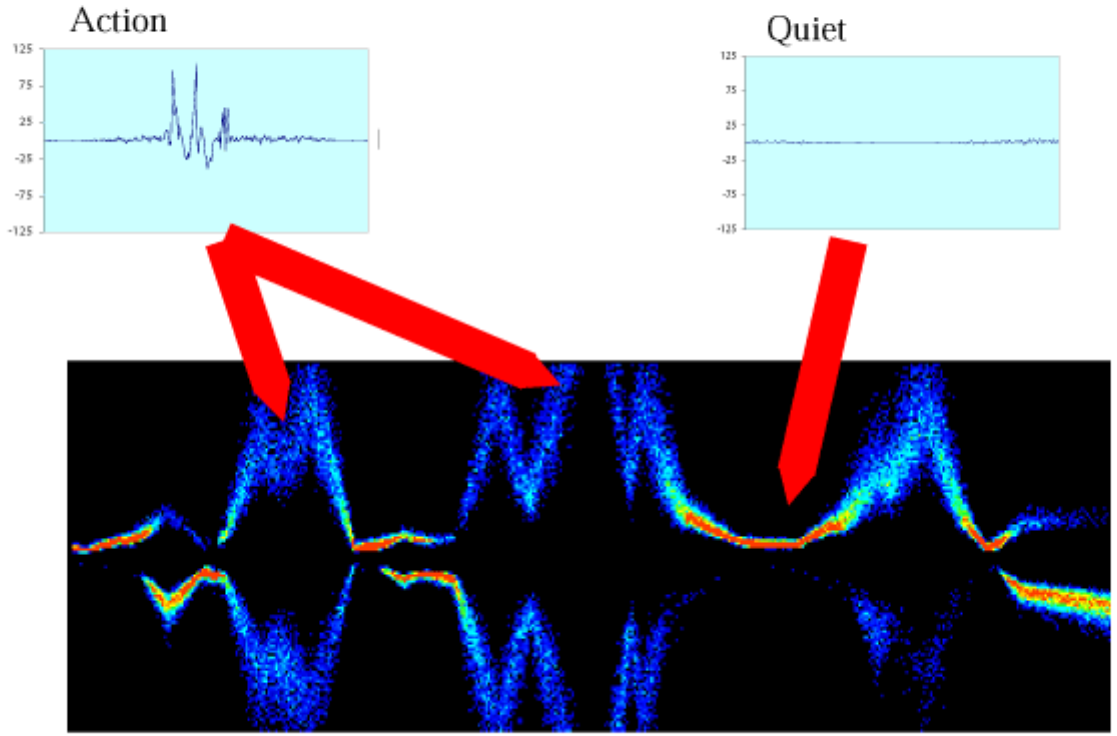
In situ wave activity

STEREO/WAVES

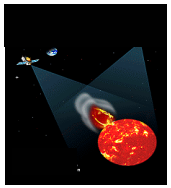
Team Meeting - 14 December 2003 - UCB

Observatoire de Paris
University of Minnesota
University of California - Berkeley
Goddard Space Flight Center
University of Colorado

Langmuir Waves Statistics spectrogram



Keith Goetz
University of Minnesota



Type II/IV catalog

http://www-lep.gsfc.nasa.gov/waves/wavesII.html --> 2003

Possible Type II and IV Radio Bursts Observed by Wind/WAVES in 2003							
No.	Start Time		Stop Time		Freq Range (kHz)	Comments	Dyn Spec
21	20031021	0410	20031021	0455	5000-1000	Intermittent tone	S
22	20031026	0700	20031026	0915	8000-1500	Multiple tones	S
23	20031026	1745	20031026	1940	14000-1500	Strong F-H followed by weak H tone	S
24	20031028	1110	20031029	2400	14000-40	Strongest WAVES event above 1 MHz	S
25	20031028	1130	20031028	1500	14000-5000	Strongest type IV observed by WAVES	S
26	20031029	0130	20031029	0400	14000-7000	Type IV	S
27	20031029	0600	20031029	1100	14000-9000	Type IV	S
28	20031029	2055	20031029	2400	11000-500	Type II difficult to observe	S
29	20031029	2115	20031029	2230	14000-5000	Type IV	S
30	20031101	2255	20031102	0050	14000-2000	Structured F-H pair	S
31	20031102	0923	20031102	1120	14000-630	Multiple components w. bright F-H	S
32	20031102	1730	20031103	0100	12000-250	Chaotic and intense	S
33	20031102	1755	20031103	1850	14000-8000	Type IV	S
34	20031103	0115	20031103	0125	3000-1500	Multiple brief tones	S
35	20031103	0210	20031103	0305	14000-9000	Type IV	S
36	20031103	1000	20031103	1230	6000-400	Complex F-H	S
37	20031103	1015	20031103	1115	14000-6000	Type IV w. drifting features	S
38	20031104	2000	20031104	2400	10000-200	Intense but indistinct	S,S
39	20031104	2020	20031104	2100	14000-10000	Type IV	S
40	20031105	0140	20031105	0310	12000-2500	Structured F-H pair	S

Author -- Michael L. Kaiser (Michael.L.Kaiser@nasa.gov)