

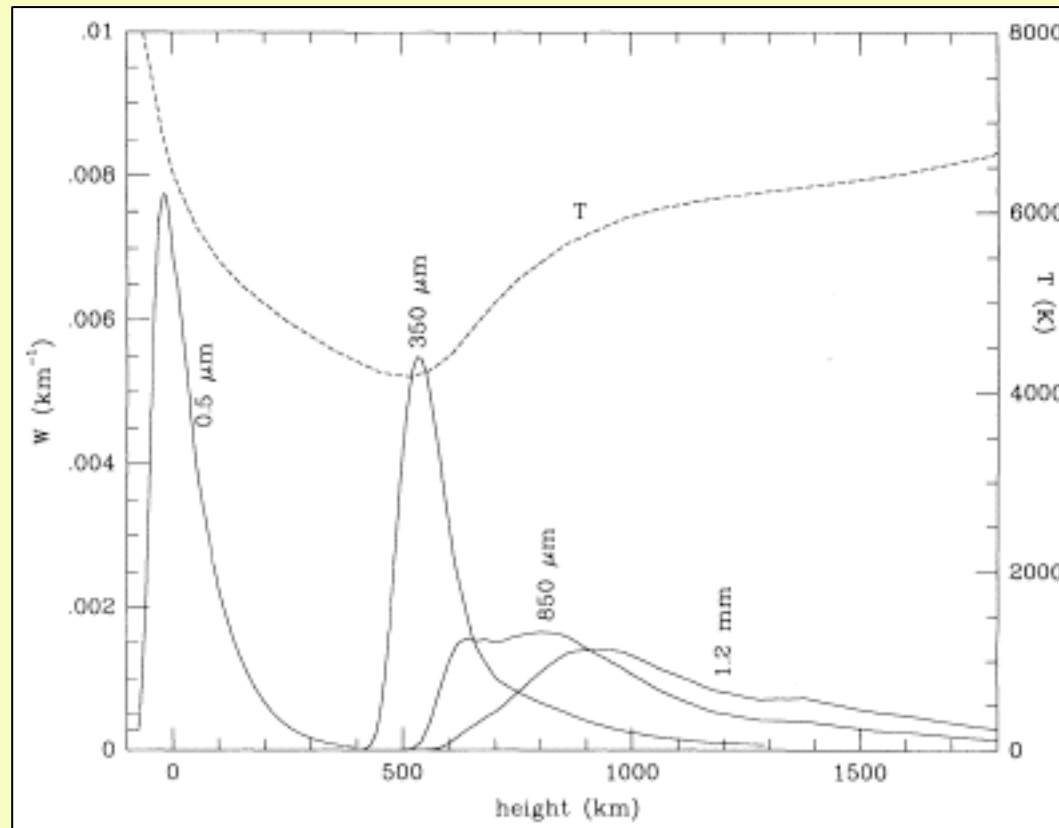
ISSI THz Overview

Hugh Hudson, Säm Krucker, Gerard Trottet

Team Members

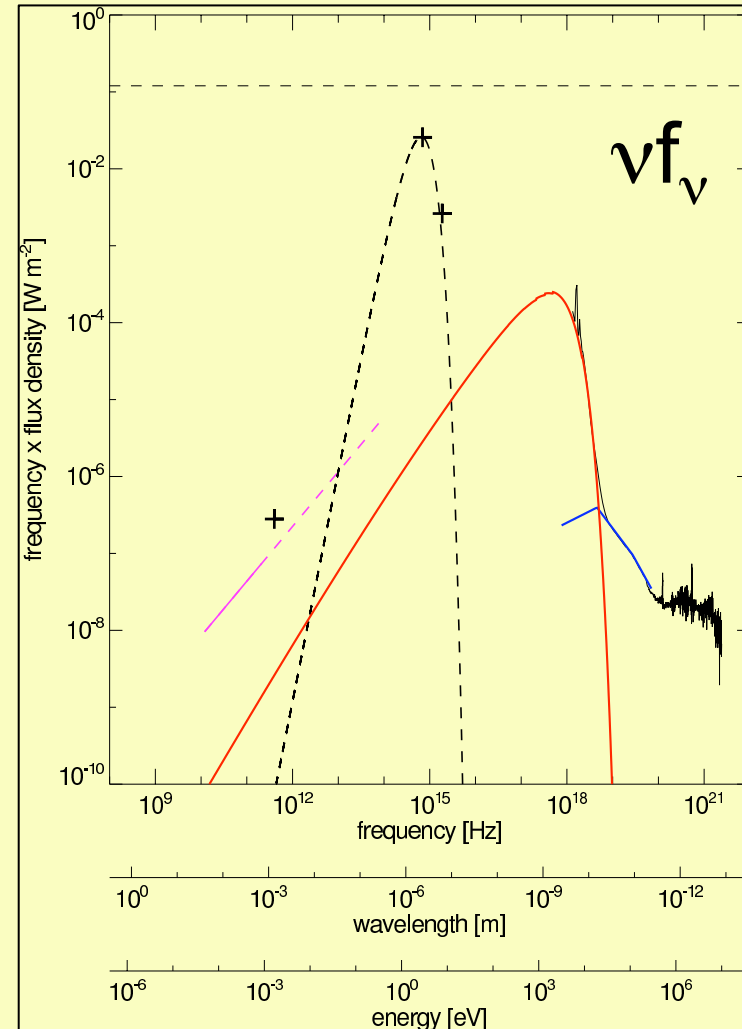
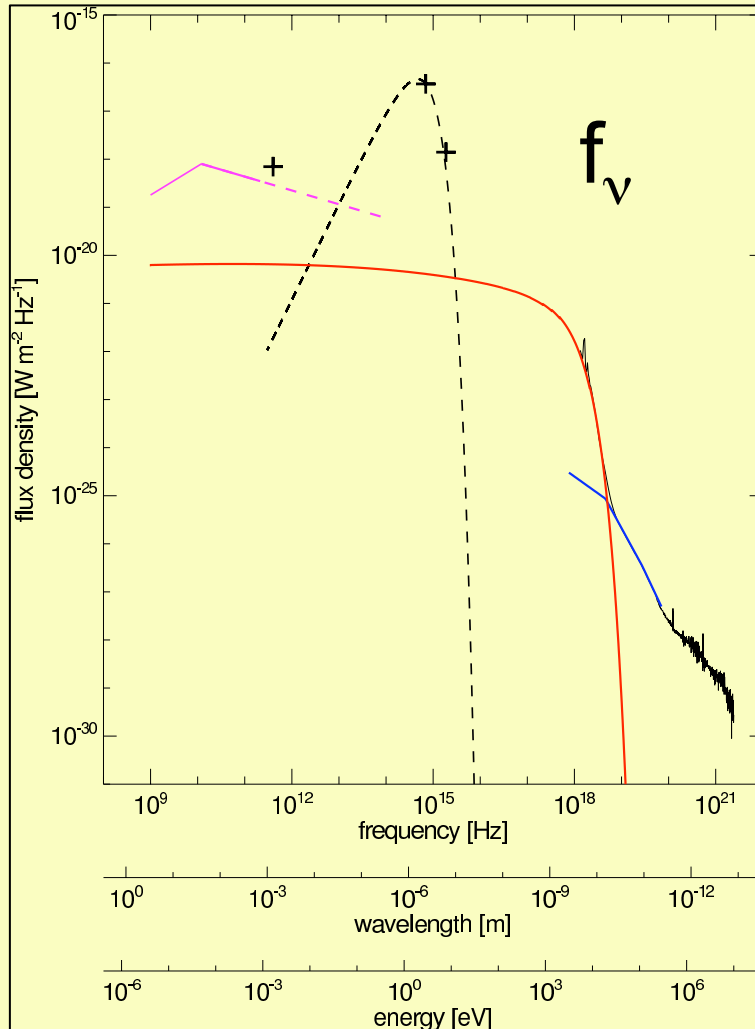
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Alec MacKinnon, U. of Glasgow, UK
Gerard Trottet, LESIA, France
Steven White, AFRL, USA

VAL-C Model Contribution Functions



Lindsey et al. 1995

Flare Spectral Energy Distribution

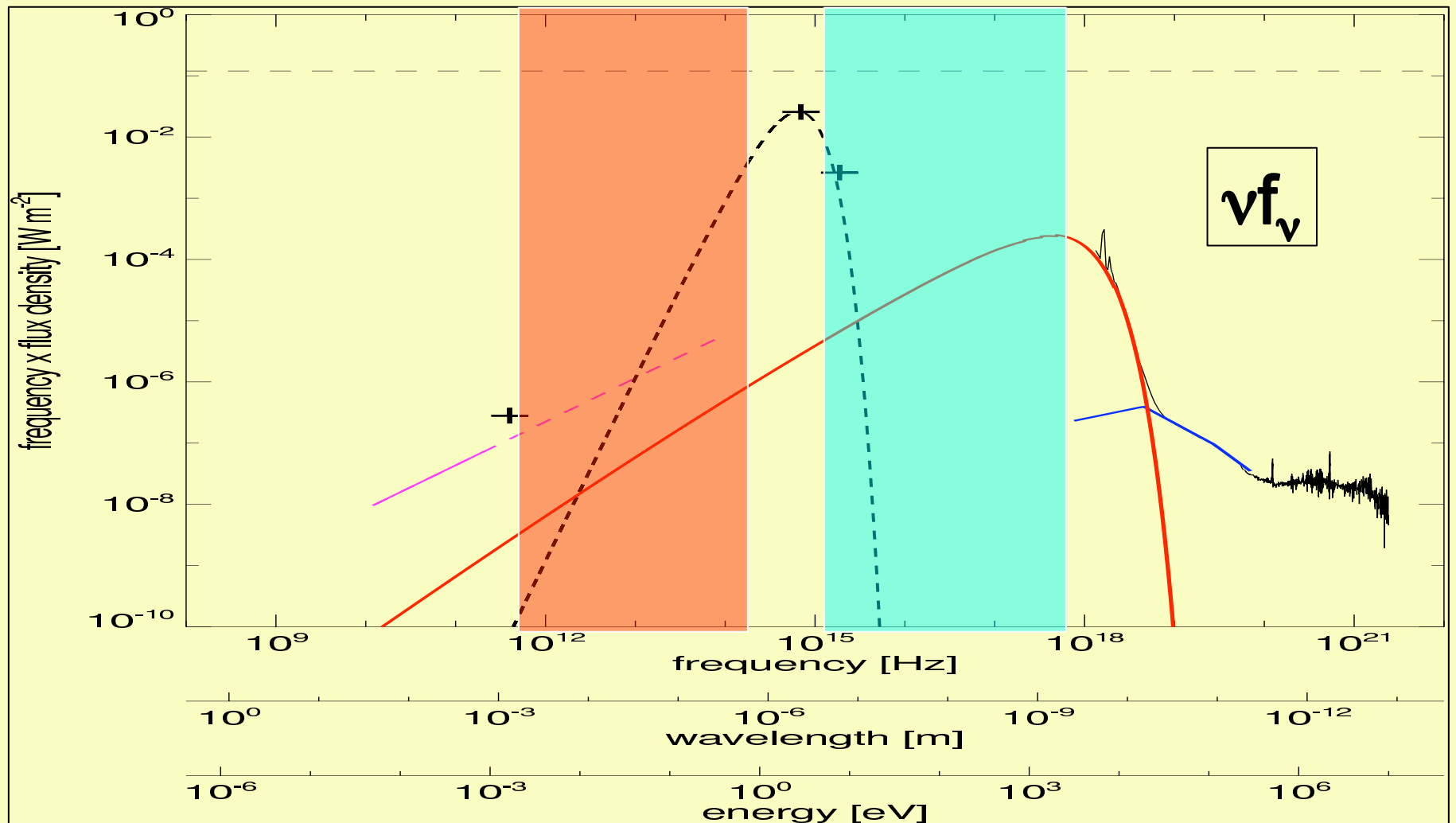


S. Krucker

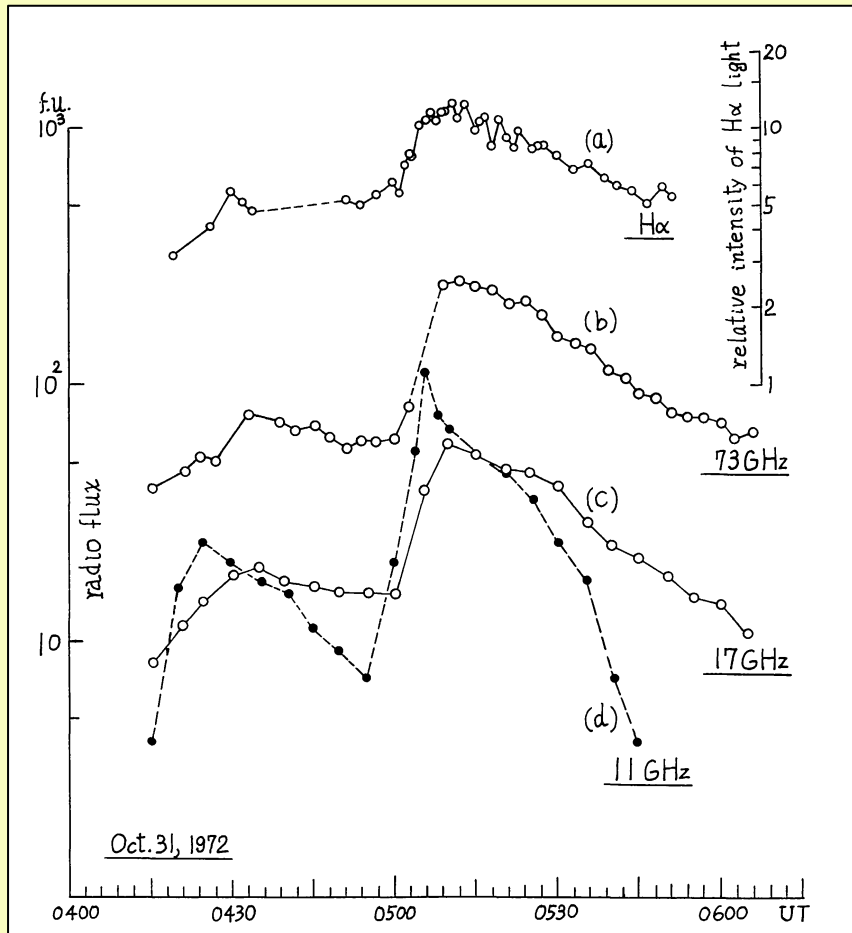
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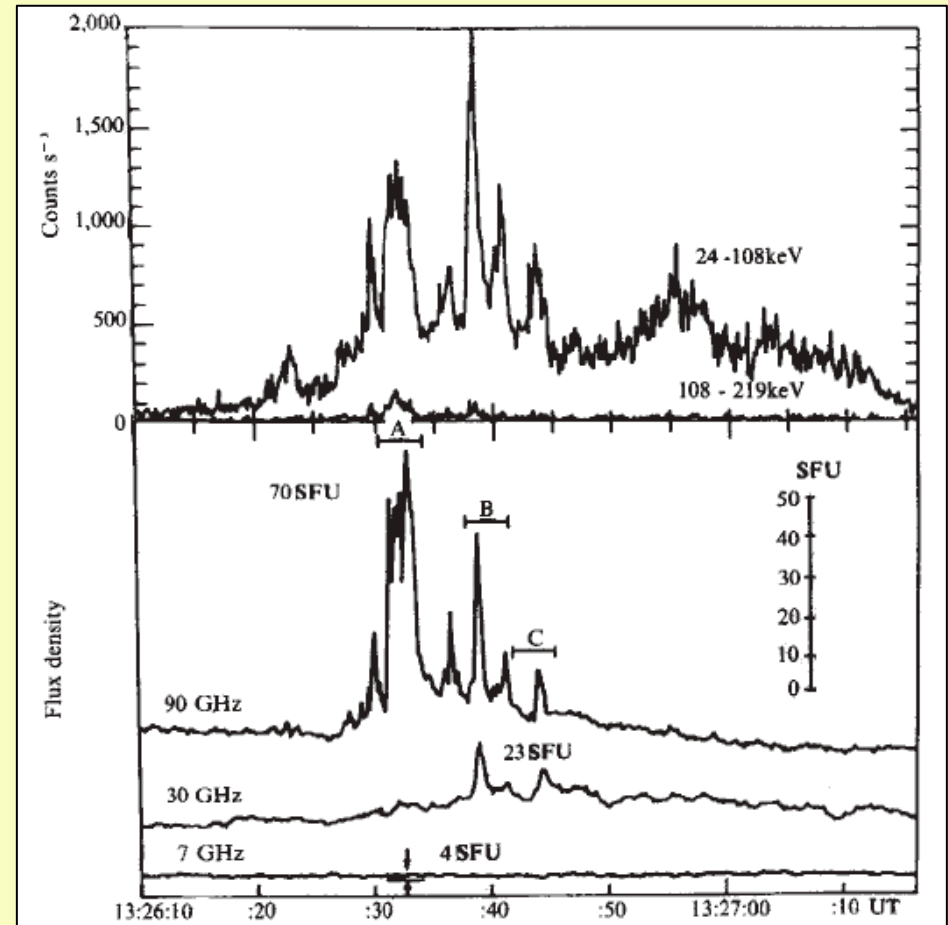
Unknown Continuum Regions



Historical Events



Akabane et al. 1973



Kaufmann et al. 1985

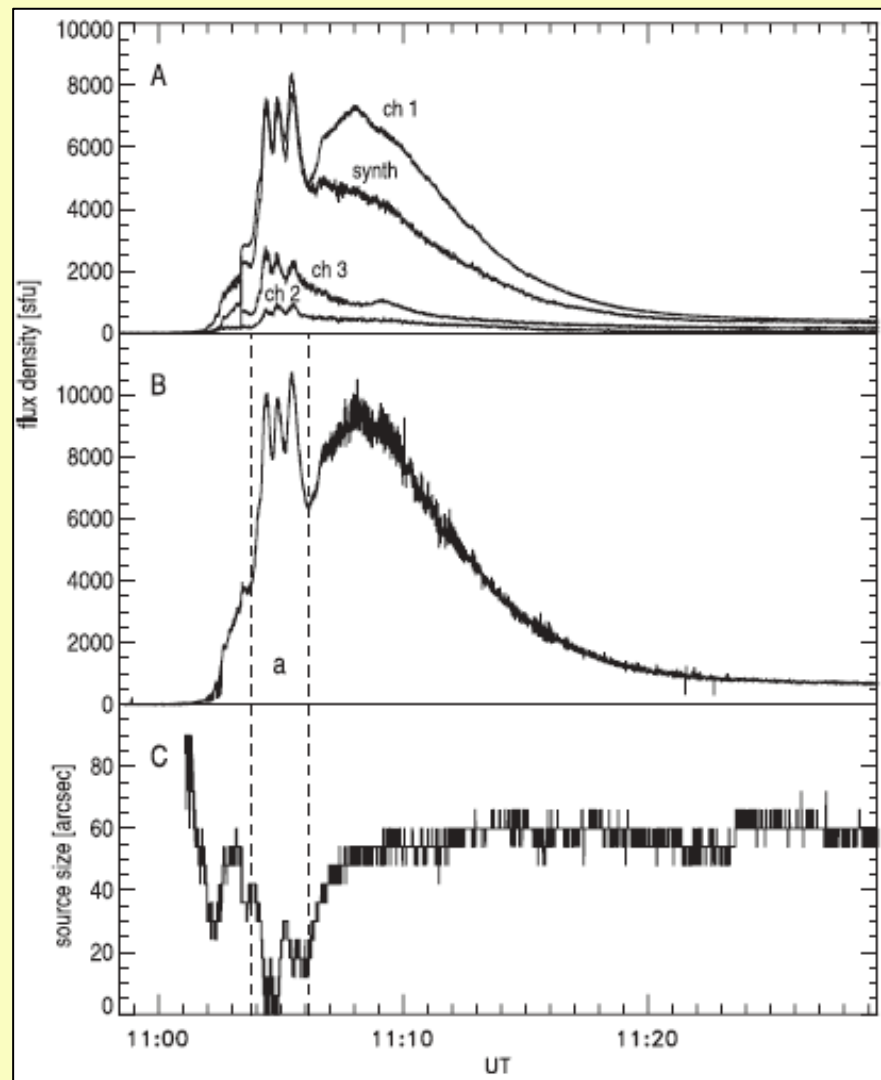
The Super-mm (sub-THz) Event Catalog, 2009

Table 1: Flare events with positive slope above 200 GHz

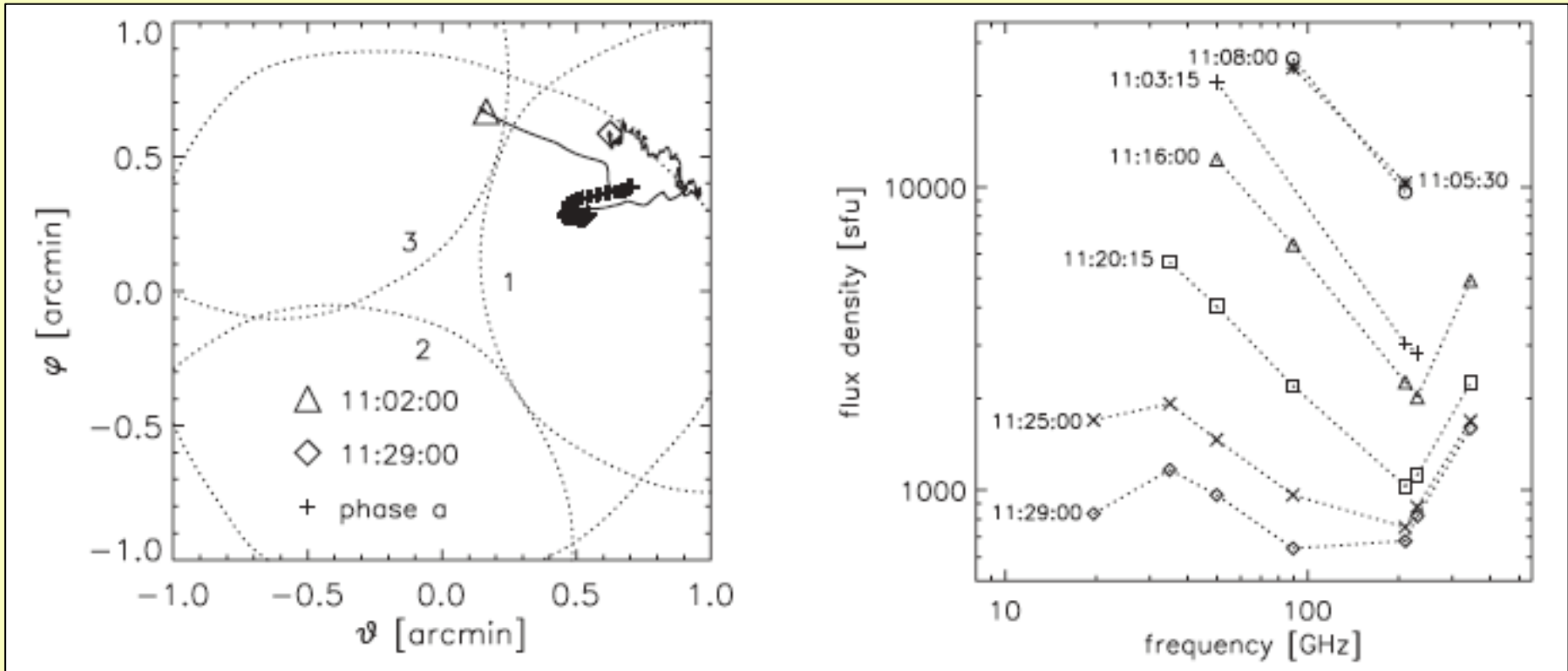
Date	GOES	Helio	Reference	P, I, G ^a	Comments
22-Mar-00	X1.1	N14W57	Trottet et al. (2002)	G?	15.4, 212
06-Apr-01	X5.6	S21E31	Kaufmann et al. (2002)	G?	OVRO, 212
12-Apr-01	X2.0	S22W31	Lüthi et al. (2004a)	I?, G	Very long duration
20-Dec-02	M6.8	S25W34	Cristiani et al. (2008)	I?	Marginal; GOES odd
28-Oct-03	X17	S16E08	Lüthi et al. (2004b)	P, I, G	Size estimates Very long duration
02-Nov-03	X8.3	S14W56	Silva et al. (2007)	I, G	Difficult photometry
04-Nov-03	>X28	S19W83	Kaufmann et al. (2004)	I, G	G off the limb?
06-Dec-06	X6.5	S06E63	Kaufmann et al. (2009)	P, I, G?	

^aPre-impulsive, Impulsive, Gradual

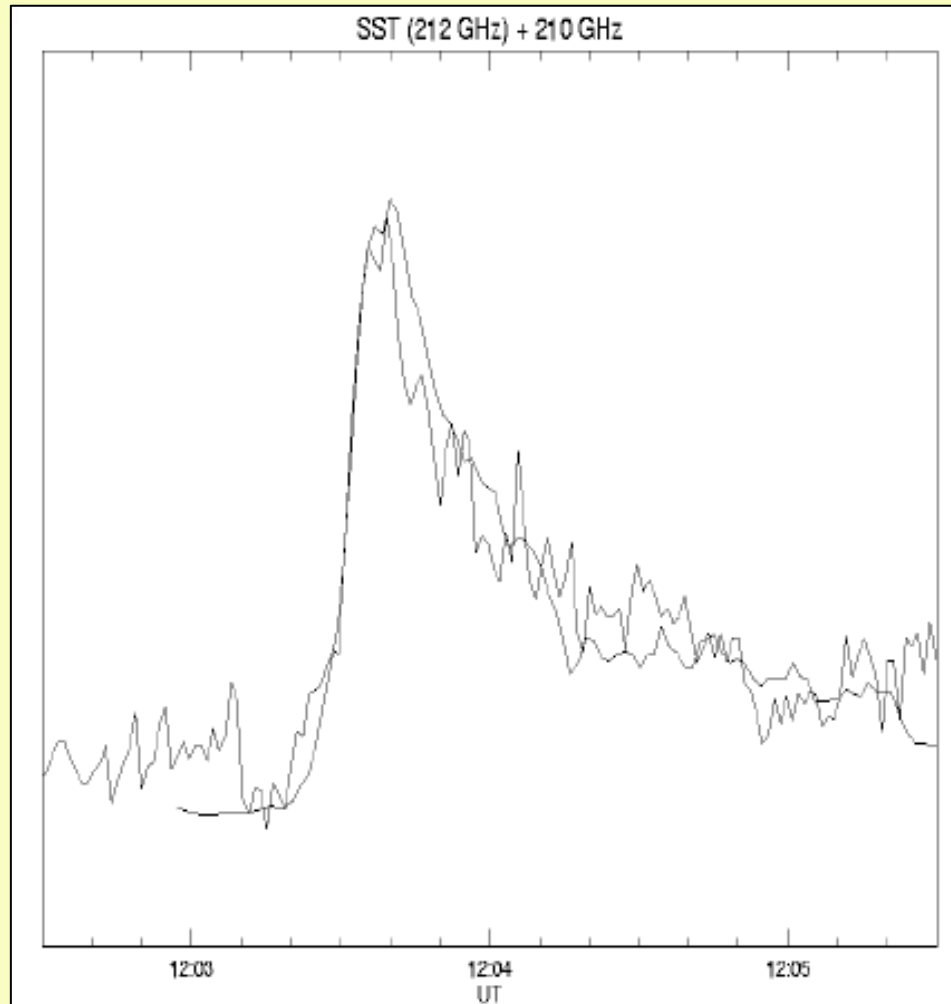
Source Sizes (Lüthi), 28-Oct-03



Positions and Spectra



SST/BEMRAK Comparison



<1>

Interpretation

- Gyrosynchrotron electrons: it would have to be different populations of electrons at radically high fields and particle energies
- Gyrosynchrotron positrons: ruled out by 511 keV?
- Thermal: it seems impossible to explain the impulsive sources this way, but maybe OK for gradual ones
- Exotic: there are several ideas capable of positive slopes in principle:
 - Coherent emission(s)
 - Cherenkov radiation
 - other

Emission Mechanisms

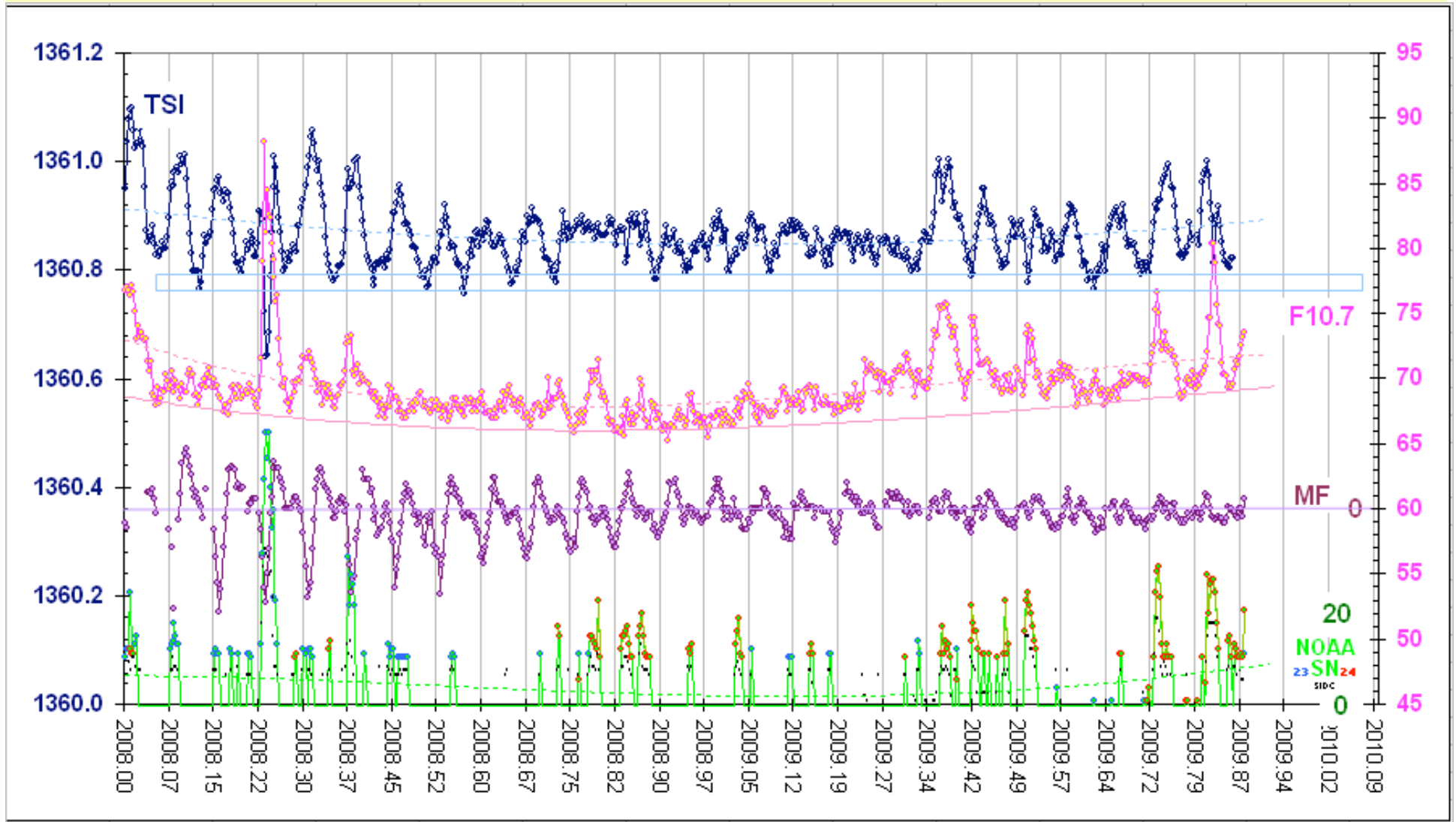
Mechanism	PRO	CON
free-free	known mechanism rising spectrum	Not viable for compact sources Fast time variations (?)
Electron synchrotron	known mechanism rising spectrum (razin or absorption) fast time variations	'extreme' parameters needed to reproduce observations
Positron synchrotron	time and space coincidence with γ - ray observations fast time variations	not enough positrons (as derived from gamma-ray observations)
Vavilov-Cherenkov	rising spectrum large fluxes rapid variations	dielectric properties of chromosphere not known (i.e. refractive index could be smaller)
Bunching	association with GHz emission	THz emission attributed to electron synchrotron (see above) setup of bunching is unclear coronal microwave sources difficult to explain
Plasma emission	correlation with γ -rays low number of particles needed	needs high densities and collisions should therefore be important not otherwise observed above 8 GHz
Diffusive radiation	Rising spectrum	Origin of high levels of long- wavelength Langmuir waves
Thermal Gyrosynchrotron	Rising spectrum	Extreme parameters Associated thermal hard X-ray emission not observed
Synchrotron Maser	Low number of particles needed	
Transition radiation	Rising spectrum	
Inverse Compton	association with GHz emission	not enough primary photons

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Conclusions

- The ISSI team's goal is to take an impartial look at the body of “sub-THz” or “super-mm” observations
- Yes, the observations are credible, at least regards spectral distribution
- No, we do not know how to explain them yet
- ALMA will be good but needs scientific interest and participation
- Dedicated observing programs, such as that at El Leoncito, will also exist – will solar activity?

Two Years of Minimum



Berkeley Nov 18, 2009

Ancient History

