Working Group 4: Radio

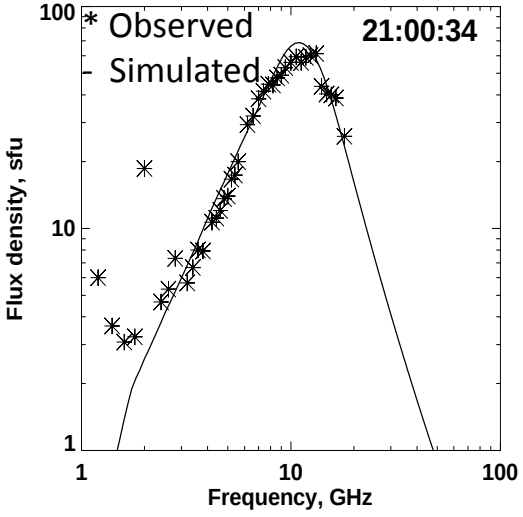
- Glesener: Accelerated electrons in a jet
- Musset: Diffusive transport model for accelerated e^-
- Narukage: e^- acceleration at an X point
- Nita: Interpreting narrowband microwave bursts
- Carley: NRH observations of a CME
- Bain: Do HXR explain flare acoustic events?
- Melnikov: HXR polarization from flaring loops
- White: Spatial structure of flares in microwaves

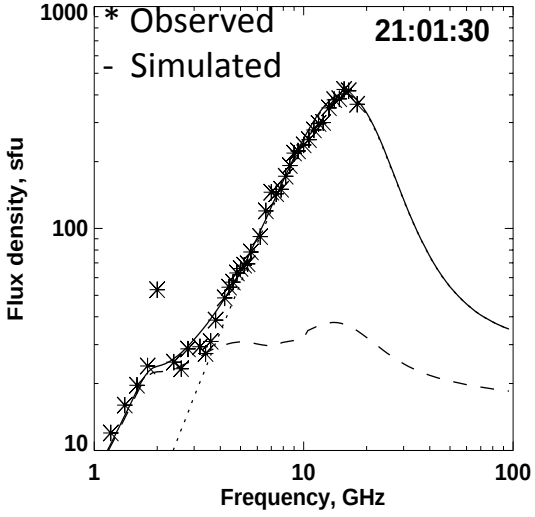
Instrumental:

- Wei Chen: POLAR and HXR polarization
- Masuda: Operation of Nobeyama Radioheliograph
- Kashapova: Siberian Multiwave Radioheliograph
- St Hilaire: Cubesat Radio Interferom. Experiment

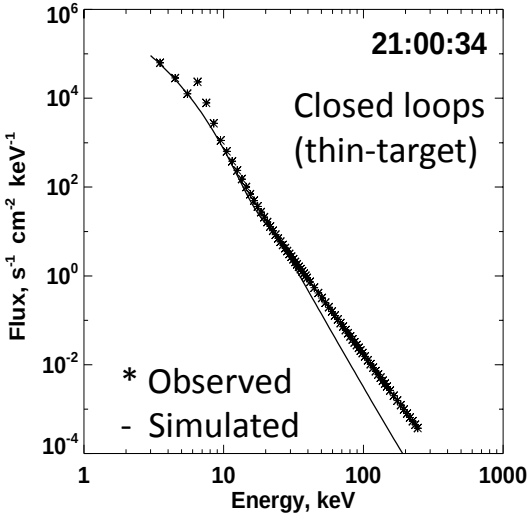
Glesener: Simulated HXR and microwave emission from a jet

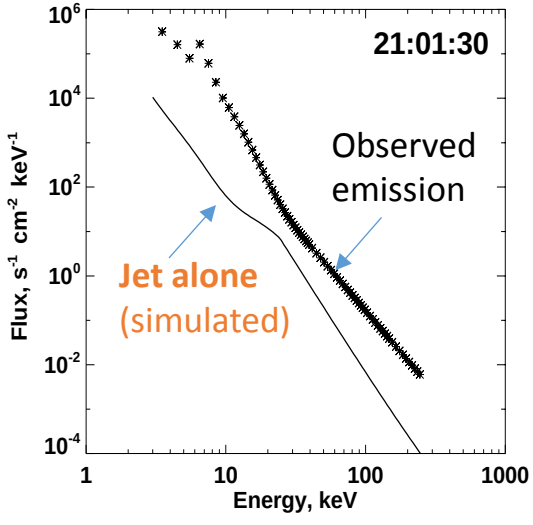
Simulated and observed microwave power spectra





Simulated and observed X-ray spectra



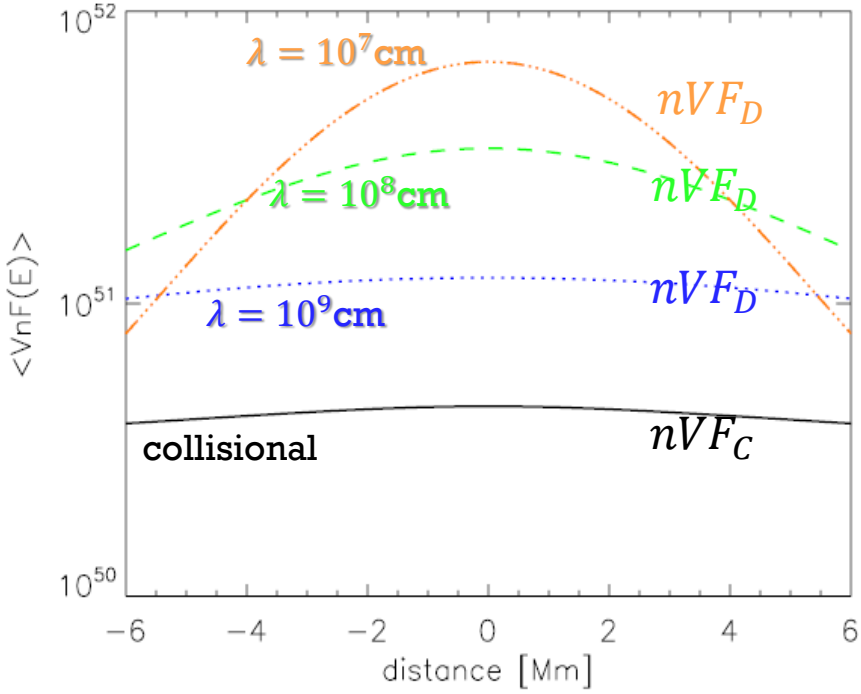


- The 2002 August 19 jet is a highly time-variable flare that displays evidence of energetic electrons on the open field.
- To our knowledge, this is the first observation of gyrosynchrotron emission from a jet.
- Best-yet *estimates* of energetic electron distribution in a jet by using constraints from HXRs and microwaves.

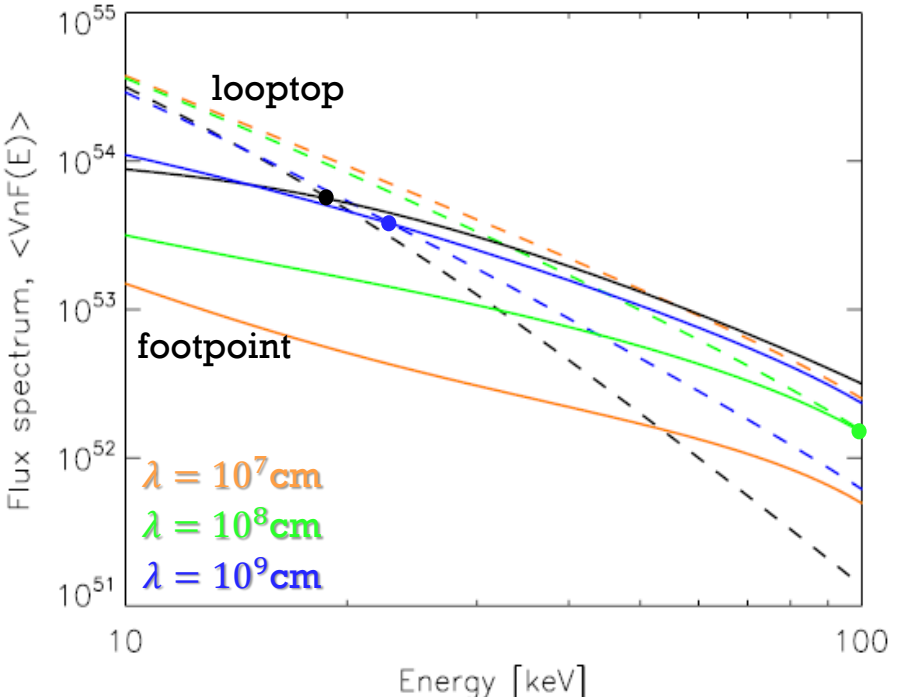
MUSSET: THE DIFFUSIVE TRANSPORT MODEL

- ✓ Imaging spectroscopy is used to study the spatial distribution of electrons and the comparison of spectral distribution in different parts of the loop
- ✓ Diffusive transport model (Kontar et al 2014) can explain the X-ray observations
- ✓ Diffusive transport model can also explain the gyrosynchrotron observations, but with a smaller mean free path
- ➔ Mean free path is energy dependant

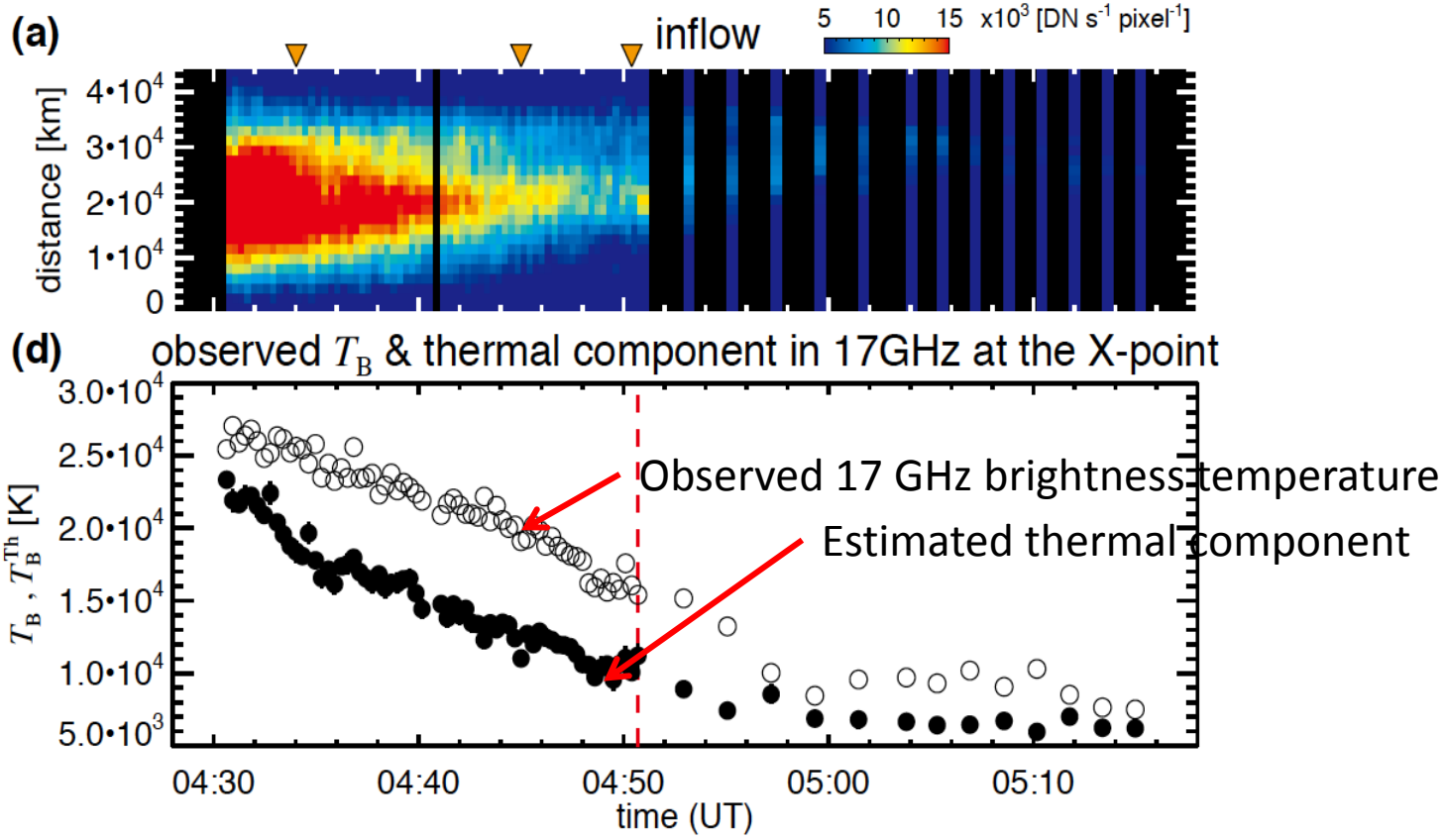
Spatial distribution of electrons at 20 keV



Looptop and footpoint spectra

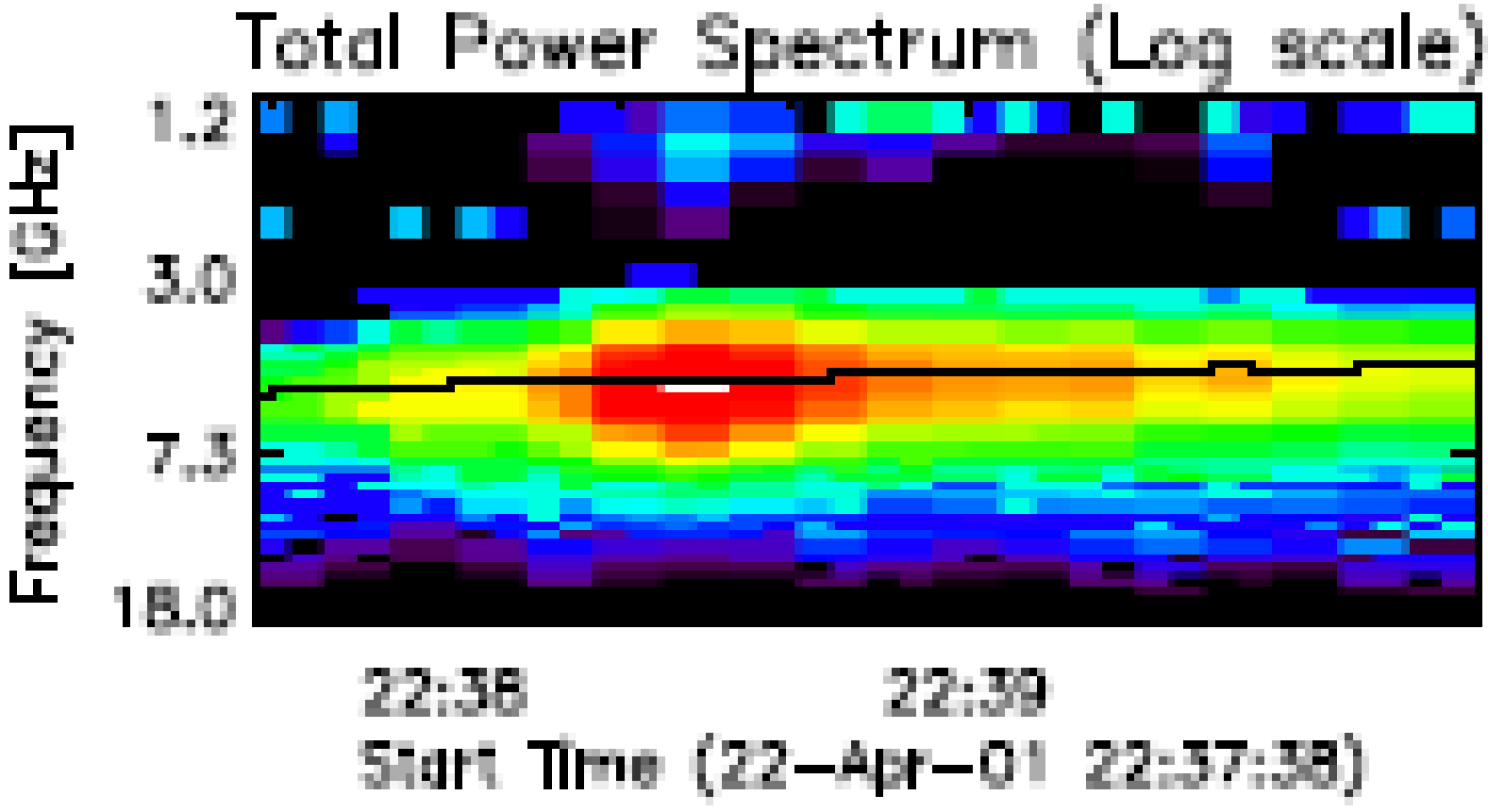


Narukage: Time evolution of the thermal component in 17GHz around the X-point



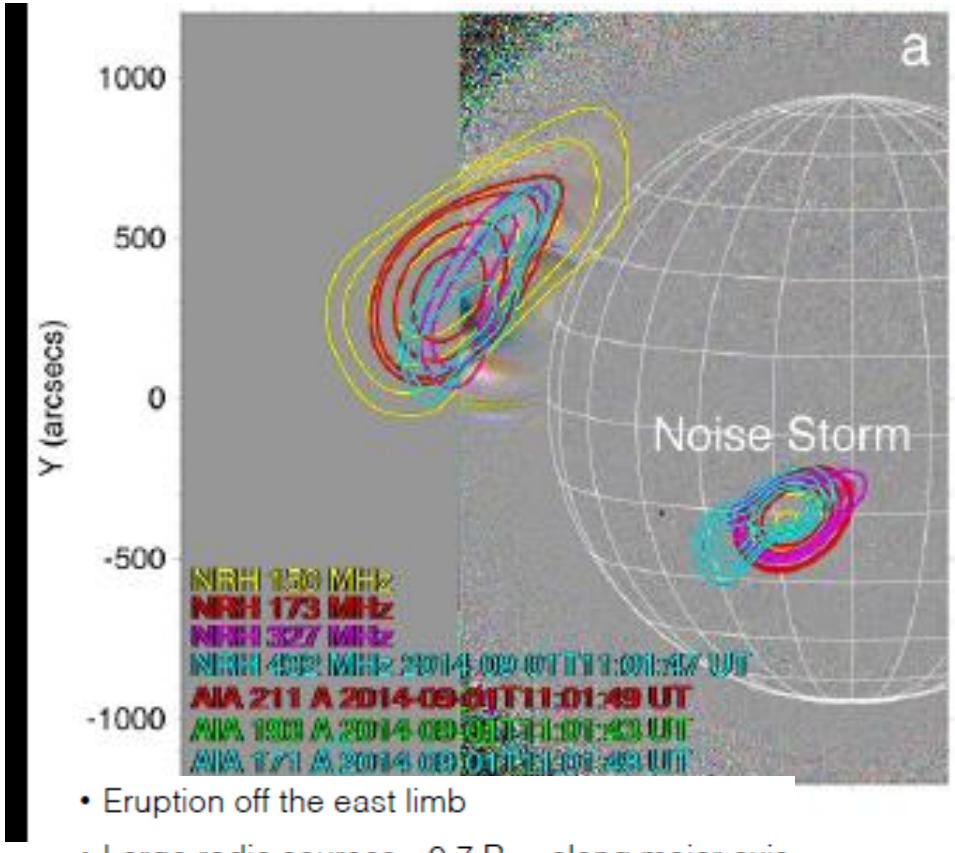
- Non-thermal microwave signal at the X-point
- Non-thermal signal increased with the inflow, and decreased after
- This suggests consistency with reconnection .

Nita: OVSA NARROWBAND BURSTS

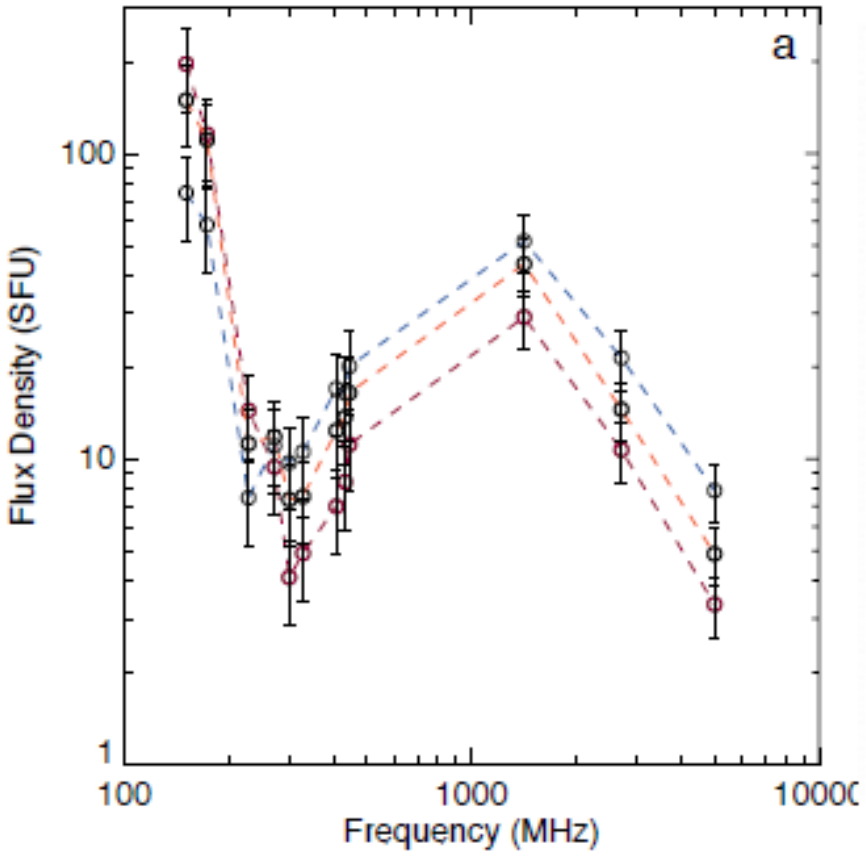


- Energy release in these flares occurred due to **interaction between at least two distinct loops**.
- One of the loops is a compact dense loop with a reasonably strong magnetic field, which is observed as a narrowband microwave source, whose physical parameters are determined through the spectral fit.
- The other loop is a more tenuous bigger loop, with a smaller magnetic field, which is seen in SXR but barely or not seen in the microwave range.

Carley: Radio Emission from a CME

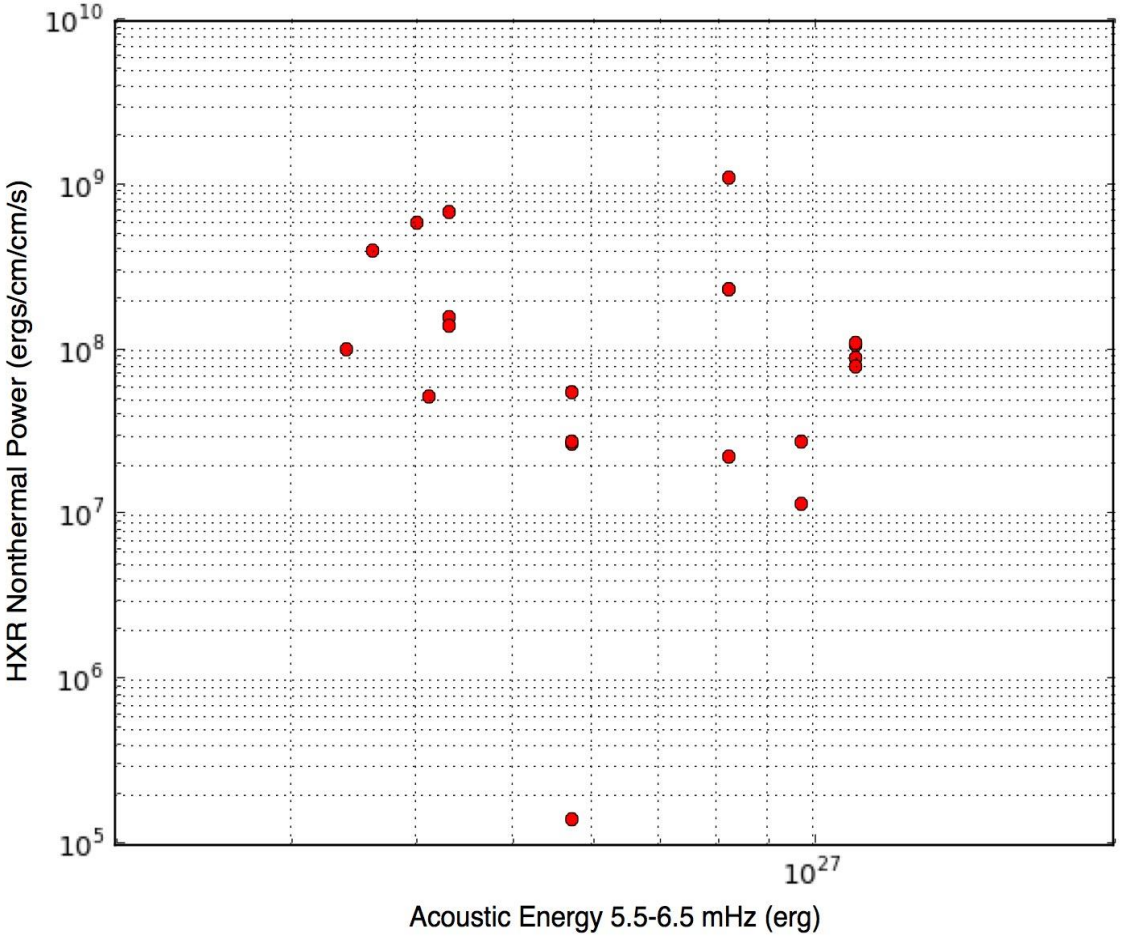


- Eruption off the east limb
- Large radio sources ~0.7 R_{sun} along major axis.
- Nearly all frequencies at same position.



- Large NRH radio source with eruption
- X-ray and radio give same electron power law
- Fit spectrum to gyrosynch: gives B=5 G at 1.2 $R_{\odot}$

Bain: Acoustic vs HXR power

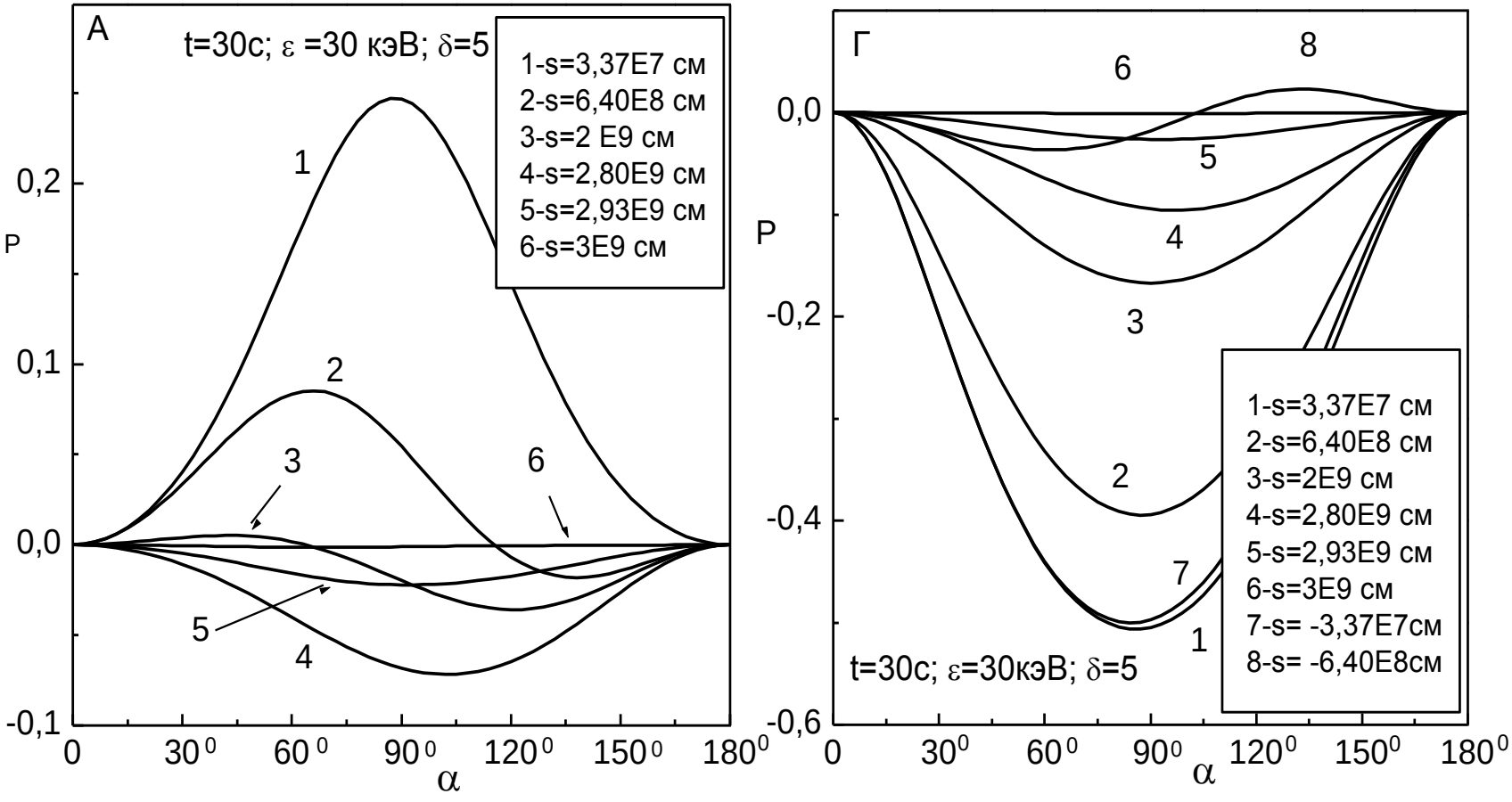


- Values are rather lower than expected. F = 10^{10} ergs cm^{-2} s^{-1} in Allred et al (2005) find that the energy deposited is balanced by radiative losses for ~1 min before triggering explosive temperature increase.
- However the area is probably overestimated for these results. Need to determine the area more carefully.

Melnikov: Angular characteristics of polarization degree of hard X-ray emission from different parts of flaring magnetic loops

Case 1: isotropic injection

Case 2: longitudinal injection



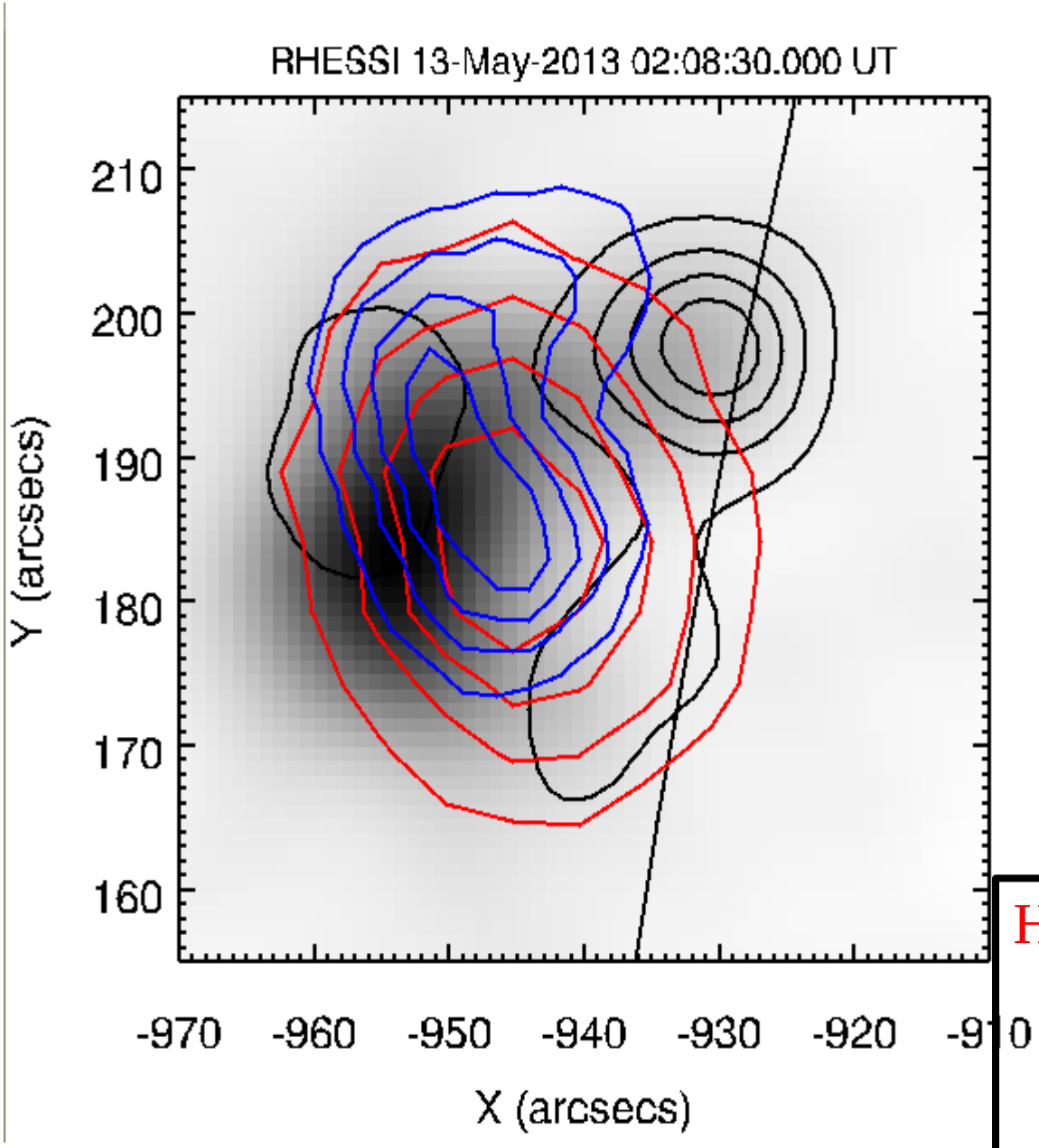
Degree of linear polarization of HXR in the case of isotropic (left hand panel) and anisotropic (right hand panel) injections.

Two spacecraft with suitable detectors can also resolve question of beaming of gamma-ray emission.

Wei Chen: POLAR and linear polarization of HXR

- Reanalyzed RHESSI polarization data, found issue with detector 6, confirm no significant detection
- Instrument POLAR to be launched in September 2016, joint GRB/solar science goals
- No spatial resolution, proof of concept for detection of linear polarization

Masuda: X1.7-class flare on 13 May 2013



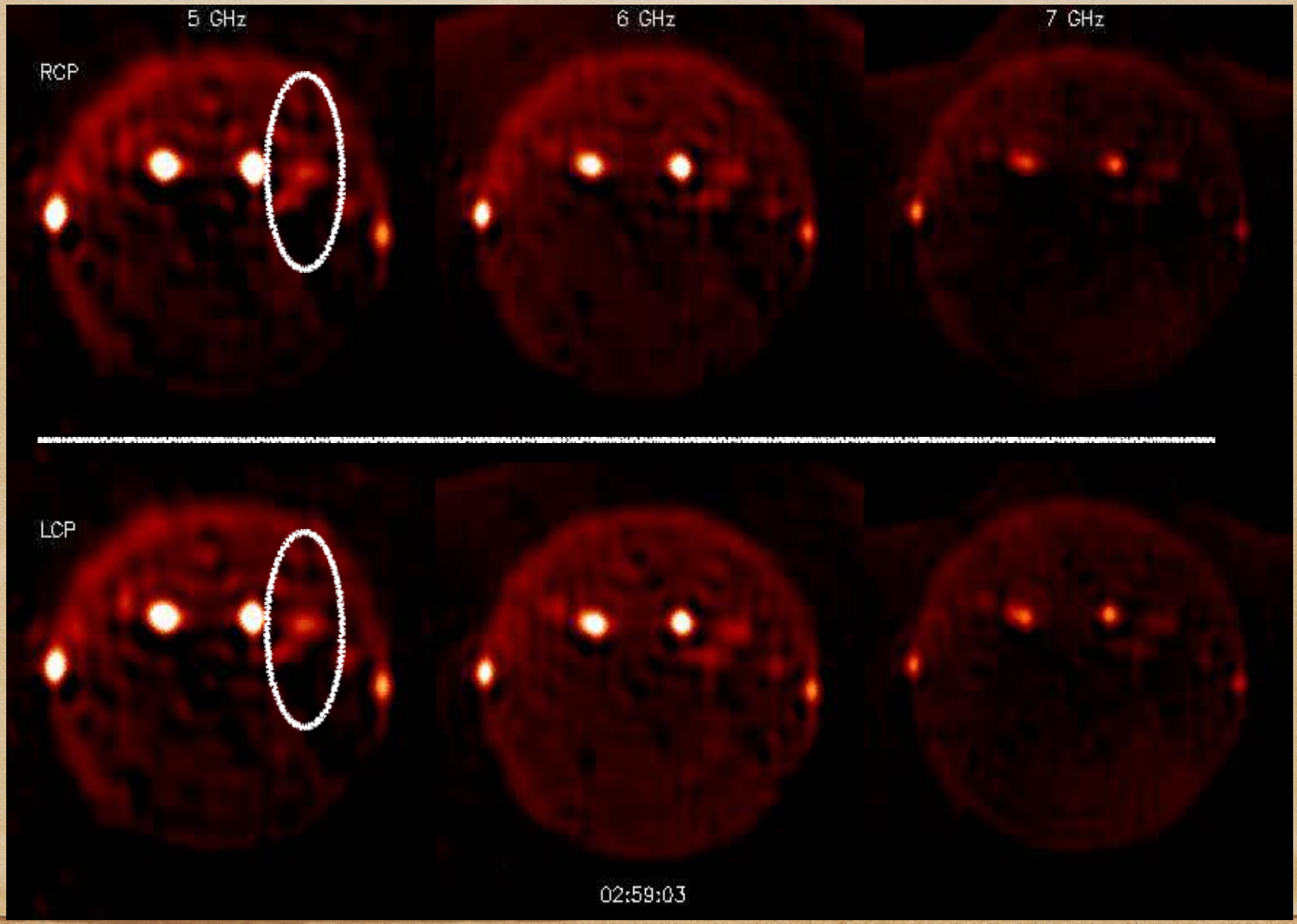
From low-energy
to high-energy electrons

Gray-scale:
① RHESSI 20-30 keV
Black:
② RHESSI 40-50 keV
Red:
③ NoRH 17 GHz
Blue:
④ NoRH 34 GHz

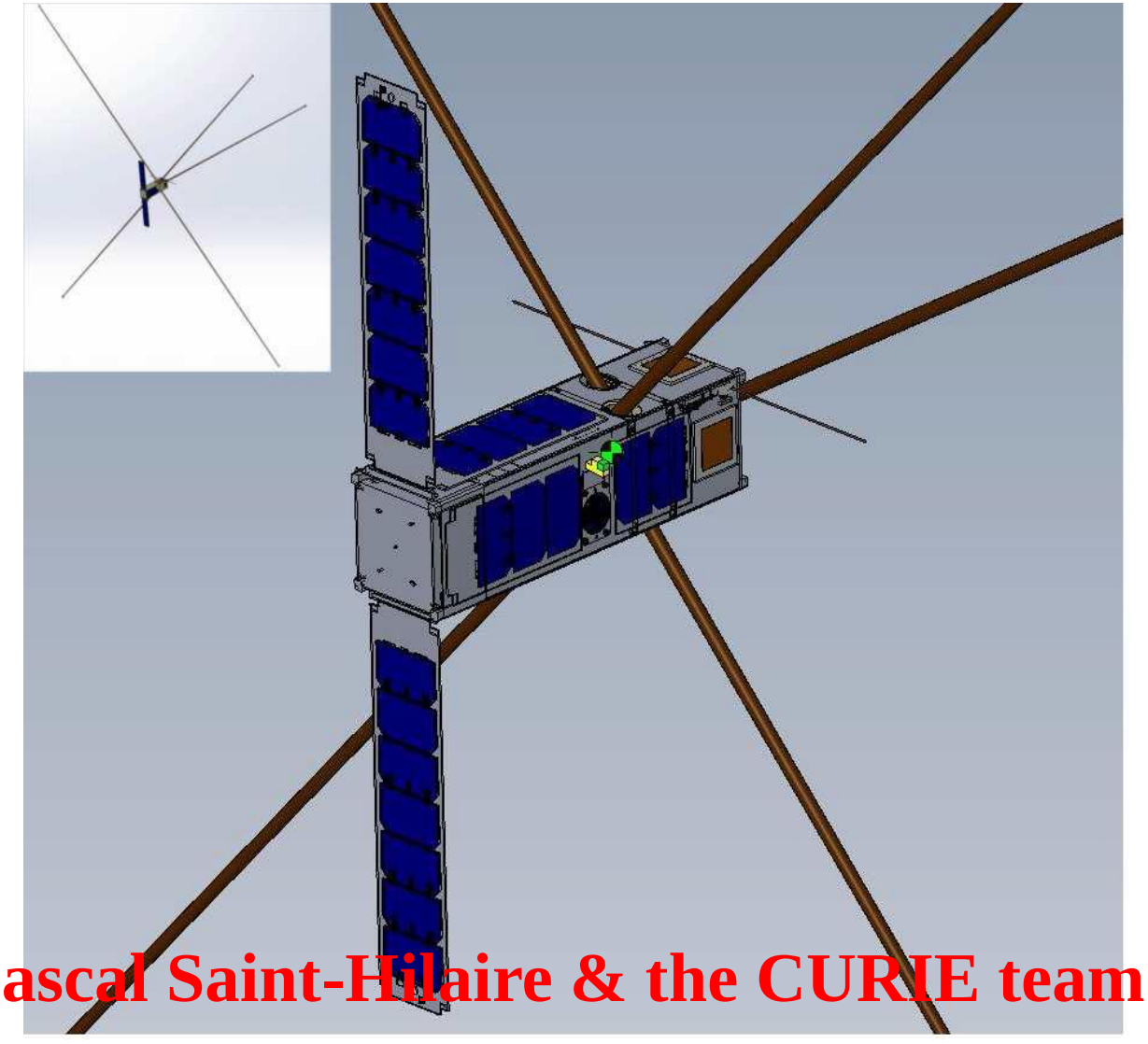
Height

High Low
② >> ① > ④ > ③

Kashapova: Siberian Multiwave Radioheliograph



CURIE: CUbesat Radio Interferometry Experiment



Pascal Saint-Hilaire & the CURIE team

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