Overview of solar instrumentation during cycle 24 and beyond

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NRH:

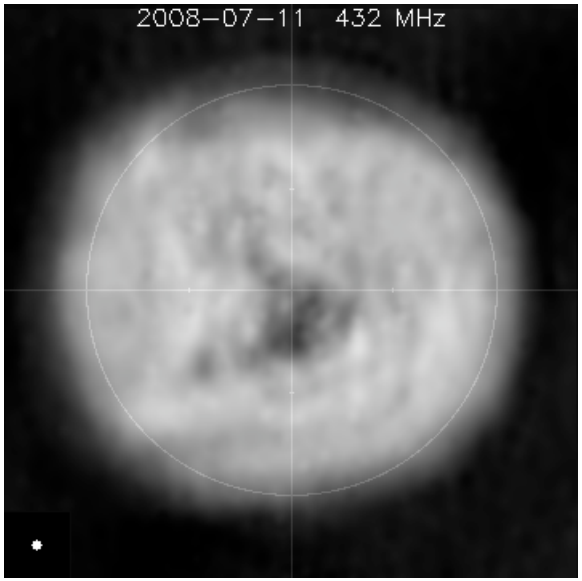
Imaging (disk + limb) of the solar corona in the 150-450 MHz range i.e., ~ 0.1 to 1 solar radii above the photosphere

Scientific topics:

- Collective emission processes
- Structure and modeling of the quiet corona
- Energetic processes such as
  - particle acceleration and transport
  - large scale disturbances

Diagnostics from NRH observations are both unique and complementary to those obtained from other remote and in-situ observations.

Quiet corona



NRH:

- geometry of coronal structures (loops, coronal holes, filament cavities, …) as a function of height
- free-free emission: N_e^2, T integrated along LOS
- Polarization measurements: B along LOS

Joint measurements

- EUV-SXR: line-band emission selective in T
- B extrapolation over large FOV: potential vs force-free
- Coronagraphs: N_e integrated along LOS (low corona)

Particle acceleration and transport

RH: Imaging of radio burst sources:

- highly sensitive signature of non-thermal e^- in the mid-corona
- Tracer of large-scale B structures that guide e^-

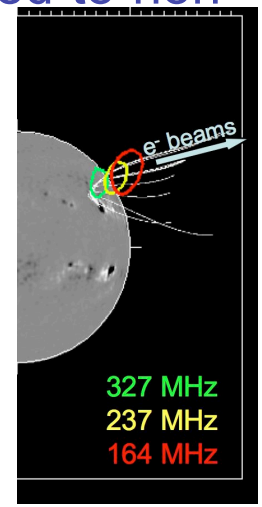
Some scientific topics:

- Large-scale B associated to γR, HXR, submm-cm sources during flares
- Long duration acceleration of e^- in large-scale B linked to non-flaring AR and associated with weak XR transients
- Tracer of open B structures: particle access to IP, origin of SEP

Joint observations:

γR, HXR, SXR, SEP,

B extrapolation over large FOV



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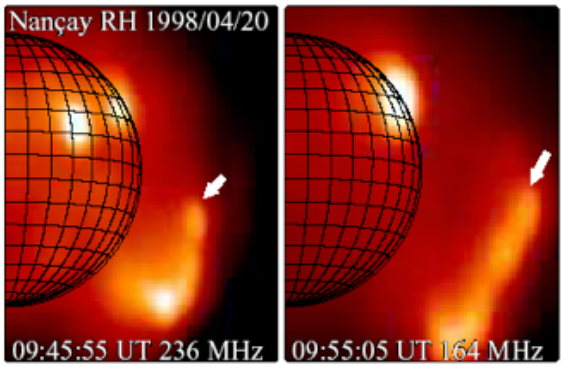
Large-scale disturbances

Some scientific topics with key observations by NRH:

- Triggering and early evolution of CMEs on the disk: filament cavities, radio bursts
- Non thermal processes associated to CMEs: radio CMEs (gyrosynchrotron); electron acceleration due to magnetic restructuring of the corona driven by filament eruptions and CMEs
- Coronal shock waves (type II)
- Radio counterpart of EIT waves



Joint observations

XR, EUV imaging over wide FOV (disk + limb)

UV spectro-coronagraph (post UVCS)

WL coronagraphs probing the low corona (LYOT, CIHR/Proba3)

Needed solar observations from ground during cycle 24 and beyond

- Full disk images in photospheric and chromospheric lines
- Full disk magnetograms
  - Solar TERrestrial Investigations and Archive: SOTERIA
  - Synoptic Optical Long-term Investigations of the Sun: SOLIS
  - Global Oscillation Network Group: GONG
- High cadence (< 1 s) chromospheric line observations during flares
- B extrapolation over wide FOV
  - PFSS and others
  - Potential, force-free: improved extrapolation algorithms

Solar observations from space during cycle 24 and beyond

Mission	γR	HXR	SXR	Opt/EUV	Coronag	SEP	SW Radio	Launch	Duration
RHESSI	■	■	■					Feb 2002	….?
HINODE			■	■				Sep 2006	
STEREO				■	■	■	■	Oct 2006	?
CORONA S-PH	■	■	■	■		■	■	Jan 2009	> 3 y
FERMI	■	■						Jun 2008	10 y
SDO				■				Oct 2009	5 y
PROBA 2				■				Nov 2009	2 y
PROBA 3					■			2014 ?	
Solar Orbiter		■	■	■	■	■	■	2017 ?	5 y ?
Solar P + PHOIBOS	■	■				■	■	2017 ?	
Solar C A or B ?								2016 ?	

Coronal-heliospheric physics is a key topic in the coming decade

Radio imaging of the corona is a unique tool for establishing the link between dynamical processes in the solar atmosphere and in situ measurements

Coverage of dm-m waves by the NRH is necessary for the optimum scientific return of projects like Solar Orbiter