

Timestamp: 10/17/2016 19:41:38

Title of Proposed Observation: ALMA-Hinode-IRIS Cycle 4 observation: Energy evaluation of micro- and nano-flaring heating events in solar active regions

Main Objective: ALMA-Hinode-IRIS coordination on an active region for estimating the amount of the energy released by each of small reconnection events

Scientific Justification:

Reconnection events in nanoflare energy range are a candidate for the heating of the corona in active regions. The number distribution of reconnection events as a function of energy is essential to evaluate the importance of nanoflares in the heating. ALMA observations would provide a new capability for newly exploring the released energy of reconnection events in the energy range around 10^{23} - 10^{24} ergs. Transient heating of the plasma at the upper chromosphere, caused by reconnection events, should be observed as the transient increase in brightness temperature. The time series of the ALMA measurements, coordinated with Hinode and IRIS observations, are investigated to establish a new method for estimating the amount of the energy released by each of small reconnection events. Hinode and IRIS observations provide a counterpart of the energy release behaviors in the corona as well as in the chromosphere and would be helpful in the energy estimation. Repeated series of SP maps are used to investigate the magnetic origin at the photosphere for reconnection events.

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Dates: Dec 2015, will be specified by the ALMA team
Time window: Will be specified by the ALMA team. Duration is 3 hours.

Target(s) of interest: Active region

SOT Requests:

Repeat SP fast maps (0.32" pixel, 3.2 sec integration, i.e., 2cycles x 2) continuously (without pause) during the time window. Maps should be continuously recorded even during SAA periods. FOV 60 arcsec x 60 arcsec minimum.

If the telemetry is limited, an additional time interval can be given in between two SP maps.

EIS Requests:

High cadence repeated scans during the time window.
One possible study is ID: 360 cam_arb_lite_v2
40" (slit 2" x 20 positions) scan x 120 pixels height
Exposure 10 sec
If EIS team has any suggestions for better study, it is welcome.

XRT Requests:

Continuous high-cadence time series of X-ray images

Al-poly+Open or similar filter

1x1 pixel, FOV 128" x 128" or 64 "x 64"

Exposure 256msec, AEC enabled

highest possible time cadence (shorter than 8 sec)

If meaningful G-band exposures can be acquired, it would be helpful for co-alignment.

If XRT team has any suggestions for better study, it is welcome.

IRIS Requests:

medium FOV (60"x60" for SJI, 60" along slit for spectra)

raster scan 2" (coarse) x 32 steps

SJI 2796/1330/1400 at high cadence

exposure 2 sec (or 4 sec)

linelist v40_00

If IRIS team has any suggestions for better study, it is welcome.

Additional instrument coordination:

ALMA

Previous HOP information:

HOP97: CORE: Nanoflaring activities in the Quiet Sun Otsuji et al. 2011 PASJ

Additional Remarks:

Accepted ALMA cycle 4 proposal

Antenna configuration C40-2

about 2 arcsec in Band 3, FOV 60 arcsec in diameter, 2 sec cadence of maps