

Timestamp: 6/16/2016 9:00

Title of Proposed Observation:

Hi-C II Sounding Rocket Support

Main Objective:

To obtain coincident data with the Hi-C sounding rocket flight in order to provide context for high resolution EUV data.

Scientific Justification:

Increases in spatial resolution provide an important avenue to understanding key physical processes by disentangling different structures and allowing them to be accurately characterized. Progress in this area has been evident in recent years in ground-based solar observations. Significant progress has also been made in X-ray (Yohkoh/SXT, NIXT, and Hinode/XRT) and UV (EIT, TRACE, and AIA, among others) instrumentation. However, even with the limited spatial resolution of these high-energy instruments (greater than 400 km), it was possible to discern that there was much unresolved spatial structure in the solar corona (Dere 2008, 2009; Warren et al. 2009; Tripathi et al. 2009).

The first flight of the High Resolution Coronal Imager (Hi-C) sounding rocket, on July 11, 2012, used a 4k x 4k detector to obtain more than 120 high-resolution images of the solar corona in order to explore the details present at smaller spatial scales than previously observed. The pixel scale was $\sim 0.1 \times 0.1$ arcsec²/pixel with an image cadence of approximately 2.5 seconds. The field of view for the full frame images was ~ 400 arcseconds. The images on the first flight were recorded through a 193Å filter with the same passband as the corresponding AIA channel. The mission launched on July 11th from White Sands Missile Range. Analysis of the retrieved data revealed significant fine-scale magnetic structure and dynamics throughout the images (Peter et al., 2013 *A&A* 556 104; Brooks et al., 2013 *ApJ* 772 L19; Morton & McLaughlin, 2014 *ApJ* 789 105; Winebarger et al., 2014, *ApJ*, 787 10), with transverse spatial-scales on the order of those previously measured in the chromosphere.

We propose to obtain coordinated observations with the Hi-C rocket flight from White Sands Missile Range on July 19th, 2016. For this flight, new detectors, with lower read noise, will be implemented. As a tradeoff for markedly improved read noise, the reflight will have a smaller field of view (~ 260 arcsec) due to a reduced detector size (4k x 4k to 2k x 2k). The bandpass filter for the observations will also be changed from FeXII 193 Å to FeIX 174 Å. We request observations with Hinode with improved pointing coordination. We propose to obtain contextual coronal images from XRT, plasma diagnostics from EIS, and high-resolution magnetic field data from SOT. These data will provide

comparisons between the low-temperature coronal data from Hi-C II, particular at active region footpoint regions, with the surface and the outer atmosphere. Combined with IRIS data, this will give a broad picture of the nature of small-scale reconnection and dynamics or magnetoacoustic oscillations.

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SSC Point of Contact: Sabrina Savage (NASA/MSFC)

Dates: 19 July 2016

Time window:

The launch window is currently 18:36 – 19:36 UT on July 19.

Target(s) of interest:

Active region. The Hi-C team will provide coordinates to the planners.

SOT Requests:

Normal SP map as near to the beginning of the launch window as possible, avoiding SAA and eclipse/twilight

High cadence SP raster covering launch window:

- cadence at the discretion of the CO pending telemetry constraints; as fast as possible

EIS Requests:

Three studies will be available for the re-flight. The Hi-C team will decide which one is most appropriate to run.

HIC_SCAN_58X512V1 (original from 2012 flight)

- 58 x 512 arcsec
- 3 arcsec steps
- 15 s exposures

HIC2_SCAN_61X512 (a finer scan with expanded linelist)

- 61 x 512 arcsec
- 2 arcsec steps

- 15s exposures

HIC2_SCAN_201X512 (a wider coarse scan with expanded linelist)

- 201 x 512 arcsec
- 10 arcsec steps
- 15s exposures

XRT Requests:

High cadence 384x384 Al-poly short/long exposures & Be-med AEC covering launch window:

- cadence at the discretion of the CO pending telemetry constraints; as fast as possible

IRIS Requests:

Slow, deep scan of the whole region (130"x175") both before and after the launch window, and focus on the dynamics of the plage during the launch window.

LT: Beginning of the launch window

Start: LT-02:15 (i.e., 16:20 UTC) - End: LT-00:25

3620010078 | Very large dense 400-step raster 131.7x175 400s Deep x
15 | 6653.60 | 10181.53 | 1.0 | 16.6+/-0.1 | 6654+/-0 | 66.5+/-
0.0 | 66.5+/-0.0 | 66.5+/-0.0 | 66.5+/-0.0

Start: LT-00:15 (i.e., 18:22 UTC) - End: LT+01:30

3633100037 | Very large dense 16-step raster 5x175 16s Spatial x 2, Spectral
x 2 | 34.87 | 102.59 | 3.4 | 2.2+/-0.1 | 34.9+/-0.1 | 8.7+/-0.0
| 8.7+/-0.0 | 8.7+/-0.0 | 8.7+/-0.0

Start: LT+01:45 (i.e., 20:22 UTC) - End: LT+03:35

3620010078 | Very large dense 400-step raster 131.7x175 400s Deep x
15 | 6653.60 | 10181.53 | 1.0 | 16.6+/-0.1 | 6654+/-0 | 66.5+/-
0.0 | 66.5+/-0.0 | 66.5+/-0.0 | 66.5+/-0.0

If activity is high, the middle OBS program exposure times should be adjusted.

Additional instrument coordination:

Hi-C II Sounding Rocket (36.314/Cirtain)
DST/IBIS; DST/ROSA; DST/FIRS [proposal accepted]

Previous HOP information:

HOP 216

18 publications for the Hi-C I sounding rocket launch on 2013 July 11. (All listed on <http://hic.msfc.nasa.gov/publications.html> although not all of the publications include Hinode data since the fields of view did not precisely match up.)

Additional Remarks:

We will alert the instrument planners once we have a more precise launch time available, likely the week prior to the anticipated launch. In order to narrow down to an acceptable launch time, we will need to know the SAA and eclipse windows at least two weeks in advance.

David Brooks is scheduled to be the EIS Chief Observing during this window and will be able to help coordinate from ISAS.

If IRIS ends up changing the OBS-ID between IHOP submission and launch of HiC, that is not a problem.