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**Introduction**

**Instrument Description**

The Jovian InfraRed Auroral Mapper (JIRAM) is a dual instrument, composed of an imager and a spectrometer that share the same telescope. This allows for acquisition of simultaneous imaging and spectral observations. The imager is equipped with L-band (3.45 μm with a 290-nm bandwidth) (for aurora observations) and M-band (4.78 μm with a 480-nm bandwidth) (for observations of thermal emissions) filters. The spectrometer covers a range of 2-5 μm in 336 spectral bins (bands) resulting in a spectral sampling of 8.9 nm per band.

The instrument was designed to map the Jovian aurora, taking advantage of strong methane absorption in the atmosphere, which results in H3+ appearing bright against the dark planet. Combining this IR data with corresponding ultraviolet data from the UVS spectrograph provides a powerful tool for understanding the auroral formation.

The dual capability of JIRAM allows for detailed mapping and probing the atmosphere down to 5-7 bars in an effort to understand convection, lightening formation, distribution of trace atmospheric components and circulation, especially at high latitude.

See Adriani, A. et al., (2017) JIRAM, the Jovian Infrared Auroral Mapper, Space Sci Rev (2017) 213:393 – 446, DOI 10.1007/s11214-014-0094-y for further information.

**Measurement Objectives**

The analysis of Jupiter's auroras is one of the main scientific objectives for which the Jovian InfraRed Auroral Mapper JIRAM was built. Among the various molecular ions that undergo emission in Jupiter’s aurora only H3+ emits powerfully in the JIRAM spectral range. The JIRAM instrument was designed to investigate the H3+ infrared emission and will be able to furnish spatial, spectral and temporal distribution of the Jovian auroras. Moreover, since limb observations of H3+ emission allow the study of the aurora’s distribution in the thermosphere, JIRAM will be able to essentially map, through the auroral emissions, precipitating energetic electrons trapped in magnetic field lines.

A primary goal of JIRAM is to probe the upper layers of Jupiter's atmosphere down to pressures of 5-7 bars at infrared wavelengths in the 2-5 μm interval using an imager and a spectrometer. JIRAM will sound the Jovian meteorological layer to map moist convection and determine water abundance and other constituents at depths that correspond to several bars of pressure as well as analyze the Jovian hot spots to determine their vertical structure.

The possibility of simultaneously obtaining images, spectra or spectral images due to the presence of the imager and the spectrometer inside JIRAM's optical head, allows great flexibility.

**Cruise and Earth Flyby Data and Jupiter Data with both PDS3 and PDS4 labels are available through perijove 14 (Note: data were not acquired during Jupiter Insertion on July 5, 2016 (perijove 0). Only gravity data was obtained at perijove 2.)**

**Useful Mission Documents**

Mission Description

Spacecraft Description

Mission Timeline (csv)

Instrument Description

Software Interface Specification Document (SIS) - Instrument and data structures description

**Jupiter Data**

Data acquisition at Jupiter is driven by the goal of obtaining maximum coverage over the planet. Observations are concentrated between 18 hours before and 6 hours after perijove passage. The baseline for JIRAM operations is during those orbits when MWR is the prime instrument. Then the spin axis of the spacecraft is orthogonal to the orbital plane and the JIRAM optical axis is in the orbital plane providing a favorable view of the planet. In addition, limited observations can be obtained during gravity orbits. Throughout the 24-hour period spatial resolution will vary rapidly. The change in resolution during an MWR perijove passage is shown in the following figure for the 1 bar level, ranging from 260km/pixel to nearly 1 km/pixel at closest approach.

Figure

Because Juno is a spinning spacecraft and the JIRAM’s despinning mirror can only compensate for a limited time for mechanical reasons, the maximum allowed integration time is 1 sec. In addition, the quality of the measurements can be reduced by environmental radiation.

Planned observational sequences involve either a L-band image and simultaneous spectrum for auroral observations or an M-band image and companion spectra for observation of thermal emissions. The organization and size of the data files are determined by the structure of the instrument. The M and L band images are taken on separate portions of the focal plane (each 128 lines by 432 samples). The JIRAM spectrometer focal plane is composed of 256 spatial (lines) and 336 spectral bands (samples). The spectrometer entrance slit is located at line 153 and spans pixels 88 to 343 within the M-band image (D. Grassi, 2017). See the following figure.

Figure

The operational modes of the imaging and spectral components are modes summarized in the following table.

JIRAM operational modes

Frame Size Date Volume

Pixels Mbits

Imaging Modes

1, Full Images 256 x 432 1.8

I2, M-Band 128 x 432 0.9

I3, L-Band 128 x 432 0.9

Spectral Modes

S1, High Spatial/High Spectral 256 x 336 1.4

S2, Medium Spatial/High Spectral 64 x 336 0.35

S3, Low Spatial/High Spectral 16 x 336 0.09

D. Grassi, et al., Analysis of IR-bright regions of Jupiter in JIRAM-Juno data: Methods and validation of algorithms (2017) Vol 202, 200-209)

**Calibrated Data**

Directory containing the RDR data files

Data Set Description

**Selecting the Data**

The calibrated 32 bit data consist of files that contain PDS binary TABLE objects for spectral data and binary IMAGE objects for the imaging data. Because this is a modified data set both PDS3 and PDS4 labels are available. The binary files are fixed-length records, stored in most-significant-byte-first (big-endian) format. Planetographic longitude and latitude are utilized and geometry is defined in the IAU 2000 system.

The tables of physical parameters for perijove and north and south pole passage can be used to isolate particular perijove passages, while the JIRAM imaging and spectral indices can be used to isolate time intervals that correspond to desired data.

Physical Parameters for Juno's Perijove and Near Equator Crossing and Reference to the Red Spot (csv)

Physical Parameters for Juno's North and South Pole Passages (csv)

Physical Parameters for Juno's Apojove and Far Equatorial Crossings (csv)

Indices for each perijove passage that span a period of +/- 5 hours of perijove and list physical parameters for 10-minute intervals are available. The parameters include apparent angular size of Jupiter, planetocentric and planetographic latitude and longitude, planetary radius and the observer distance of the subspacecraft point as well as subsolar planetocentric and planetographic longitude and latitude and phase angle.

Performance Reports - These documents describe the activities that JIRAM performed during the perijove passages with particular attention to the comparison of the expected data with that achieved. **Realign PJ2 and PJ4 on linked page**

**Main Indices Imaging (csv) or Spectral** (csv**)** This file summarizes the contents of the calibrated data archive. It lists URN, start and stop times, detailed geometry and the file size. Times of perijove are tagged.

Selecting data at the file level –need indices to construct page to allow for selection via geometric parameters or URNs

**Raw Data**

Directory containing the EDR data files

Data Set Description

Indices Imaging (csv) or spectral(csv)

Selecting Data at the file level

**Galilean Satellite Data**

**Calibrated Data**

Directory containing the RDR data files <https://atmos.nmsu.edu/PDS/data/PDS4/juno_jiram_bundle/data_calibrated/>

Data Set Description <https://atmos.nmsu.edu/PDS/data/PDS4/juno_jiram_bundle/document/DATASET_RDR.CAT>

**Selecting the Data**

The calibrated 32 bit data consist of files that contain PDS binary TABLE objects for spectral data and binary IMAGE objects for the imaging data. Because this is a modified data set both PDS3 and PDS4 labels are available. The binary files are fixed-length records, stored in most-significant-byte-first (big-endian) format. Planetographic longitude and latitude are utilized and geometry is defined in the IAU 2000 system.

Performance Reports can be used to isolate specific orbits that acquired satellite data - These documents describe the activities that JIRAM performed during the perijove passages with particular attention to the comparison of the expected data with that achieved.

**Detailed indices and selection at the file level** Links to new page

Raw Data

Directory containing the EDR data files <https://atmos.nmsu.edu/PDS/data/PDS4/juno_jiram_bundle/data_raw/>

Data Set Description

<https://atmos.nmsu.edu/PDS/data/PDS4/juno_jiram_bundle/document/DATASET_RDR.CAT>

Indices Imaging (csv) or spectral(csv)

Selecting Data at the file level

**Lunar Data During Earth Flyby Data (temporarily unavailable)**

During the Earth Flyby JIRAM observed the Moon. Those observations provided a basis for verifying and refining the radiometric calibration of the instrument.

Adriani, A.; Moriconi, M. L.; Mura, A.; Tosi, F.; Sindoni, G.; Noschese, R.; Cicchetti, A.; Filacchione, G., Juno's Earth flyby: the Jovian infrared Auroral Mapper preliminary results, (2016) Astrophysics and Space Science, Volume 361, Issue 8, article id.272, 8 pp.

Calibrated Data - Directory containing the RDR data files

Data Set Description

Main Indices Imaging (csv) or Spectral (CSV) This file summarizes the contents of the raw data archive.

Selecting Data at the file level

Raw Data - Directory containing the EDR data files

Data Set Description

Indices Imaging (csv) or spectral(csv)

Selecting Data at the file level - Use Index to determine start and stop times or to generate a list of URNs

**Citing Data Sets for Publications**

Jupiter Data

Calibrated

CITATION\_DESC = EDR: Noschese, R. and A. Adriani, JNO-J-JIRAM-2-EDR-V1.0, NASA Planetary Data System, 2017.

Raw data

CITATION\_DESC = RDR: Noschese, R. and A. Adriani, JNO-J-JIRAM-3-RDR-V1.0, NASA Planetary Data System, 2017.

Lunar Data

Calibrated

CITATION\_DESC = Adriani, A. and R. Noschese, JUNO JIRAM RDR DATA RECORDS V3.0, JNO-L-JIRAM-3-RDR-V3.0, NASA Planetary Data System, 2016.

Raw data

CITATION\_DESC = Adriani, A. and R. Noschese, JUNO JIRAM EDR DATA RECORDS V3.0, JNO-L-JIRAM-2-EDR-V3.0, NASA Planetary Data System, 2016.

**Bibliography** - A listing of team members to facilitate literature searches

**SPICE** - Archived Juno SPICE ancillary data providing observation geometry (positions, orientations, instrument pointing, time conversions, etc.) are available from the PDS NAIF Node.

**Assessing and Selecting Data**

The operational modes of the imaging and spectral components are modes summarized in the following table.

JIRAM operational modes

Frame Size Date Volume

Pixels Mbits

Imaging Modes

1, Full Images 256 x 432 1.8

I2, M-Band 128 x 432 0.9

I3, L-Band 128 x 432 0.9

Spectral Modes

S1, High Spatial/High Spectral 256 x 336 1.4

S2, Medium Spatial/High Spectral 64 x 336 0.35

S3, Low Spatial/High Spectral 16 x 336 0.09

D. Grassi, et al., Analysis of IR-bright regions of Jupiter in JIRAM-Juno data: Methods and validation of algorithms (2017) Vol 202, 200-209)

The following indices will allow you to assess the data by sorting and selecting the appropriate files. Once you have made a selection you can insert a list of URN values below and retrieve the desired files.

Callisto (csv)

Ganymede (csv)

Europa (csv)

Io (csv)

Insert the name of the product in question (i.e. urn:nasa:pds:juno\_jiram:data\_rclibrated:jir\_img\_rdr\_2018090t164035\_v01)

A box goes here like in MAVEN NGIMS

View data

Reset

Retrieve Results