CHANDRAYAAN-1

INDIA's maiden mission to MOON

Indian Space Research Organisation (ISRO)
Department of Space, Government of India

CHANDRAYAAN-1

In National Language: चंद्रयान

Meaning: Moon-vehicle

The unmanned lunar exploration mission includes a lunar orbiter and an impactor.

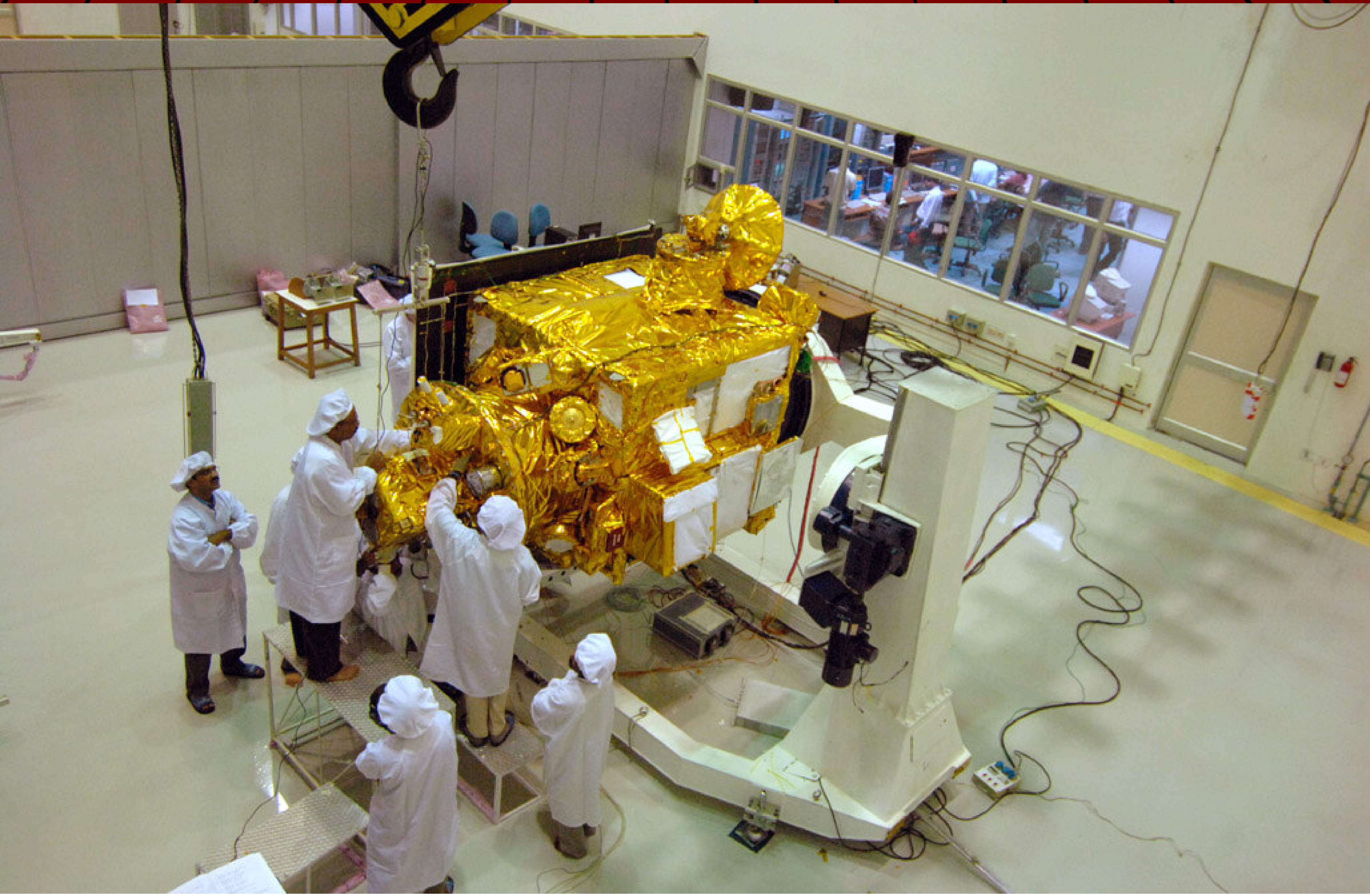
Launched on 22 October 2008

Launch Vehicle: PSLV C11 from Satish Dhawan Space Centre/ISRO.

Chandrayaan-1: Goals

- Expand scientific knowledge about the moon
- Upgrade India's technological capability
- Provide challenging opportunities for planetary research
- Achieve high resolution remote sensing of the moon
- Preparation of a 3-dimensional atlas of the lunar surface
- Chemical mapping of lunar surface

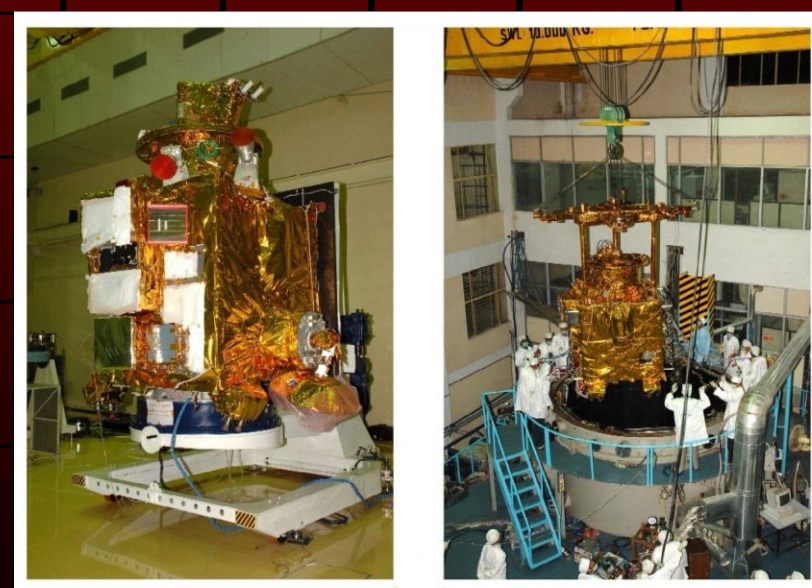
CHANDRAYAAN-1



CHANDRAYAAN-1

Chandrayaan-I Impactor : MIP

CHANDRAYAAN-1



Satellite Integration and Thermovac testing

CH1 Payloads

Carrying 11 Scientific Payloads

TMC

HYSI

LLRI

HEX

SARA

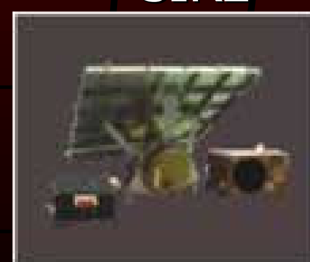
MIP

C1XS

MMM

MiniSAR

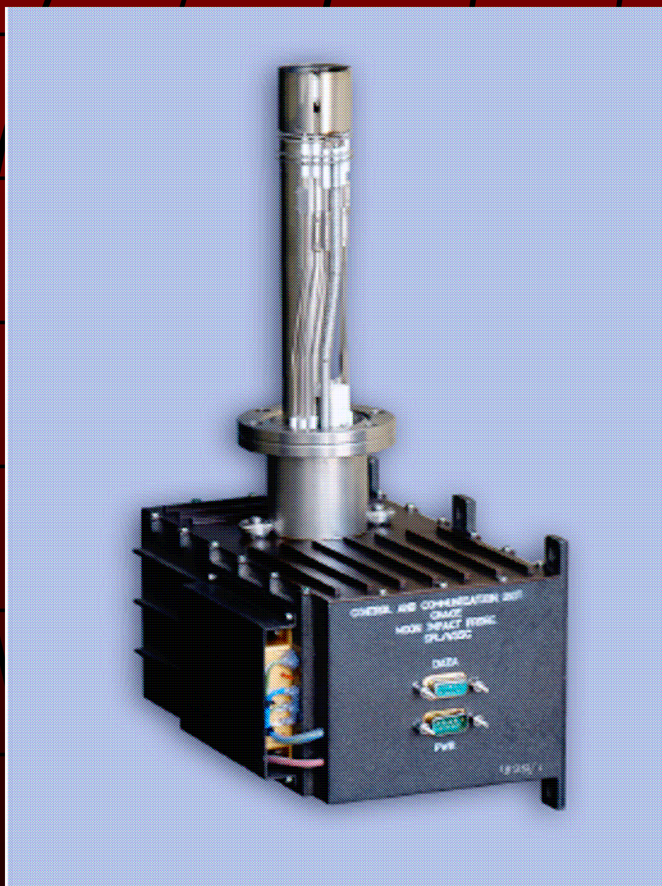
SIR2

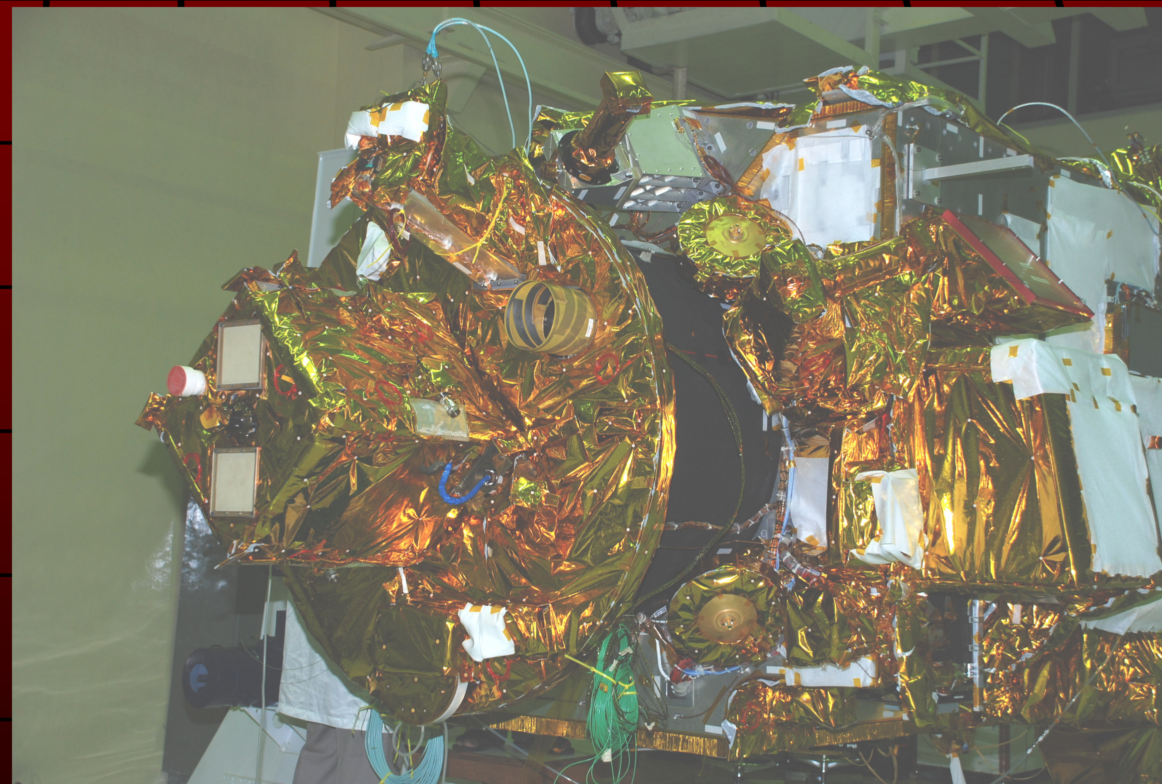


RADOM

Chandrayaan-I

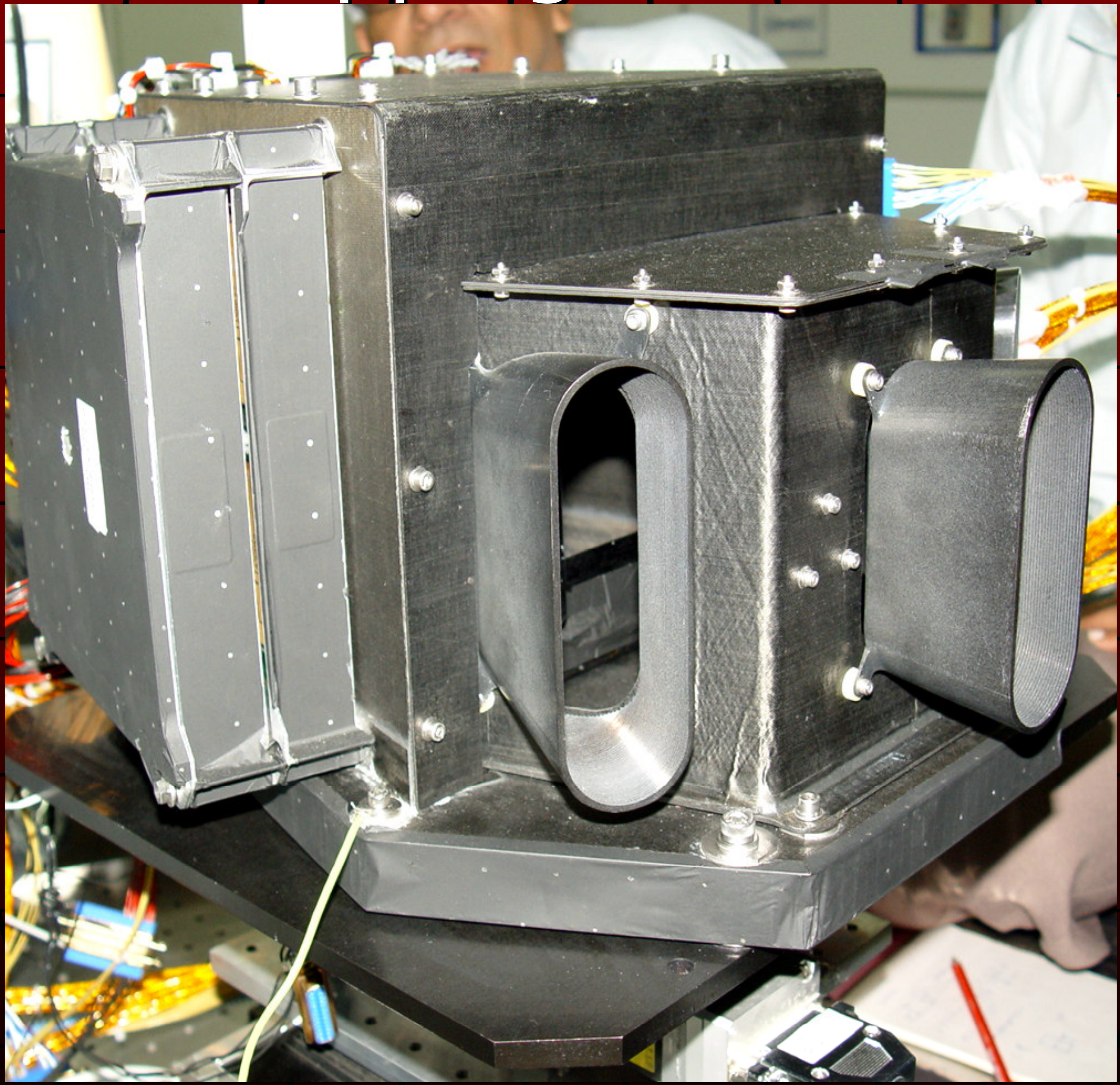
Moon Impact Probe : MIP





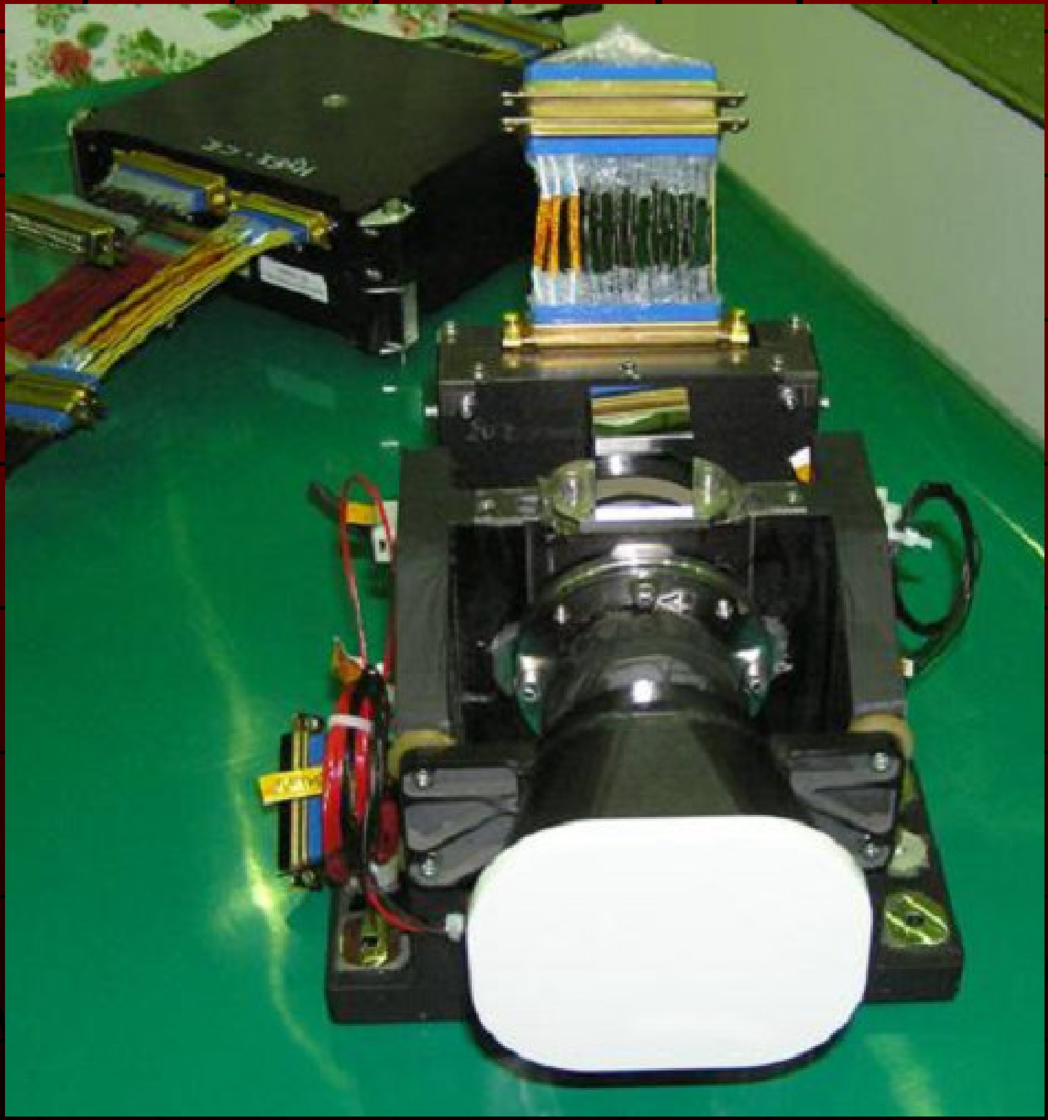
Chandrayaan-I

Terrain Mapping Camera : TMC



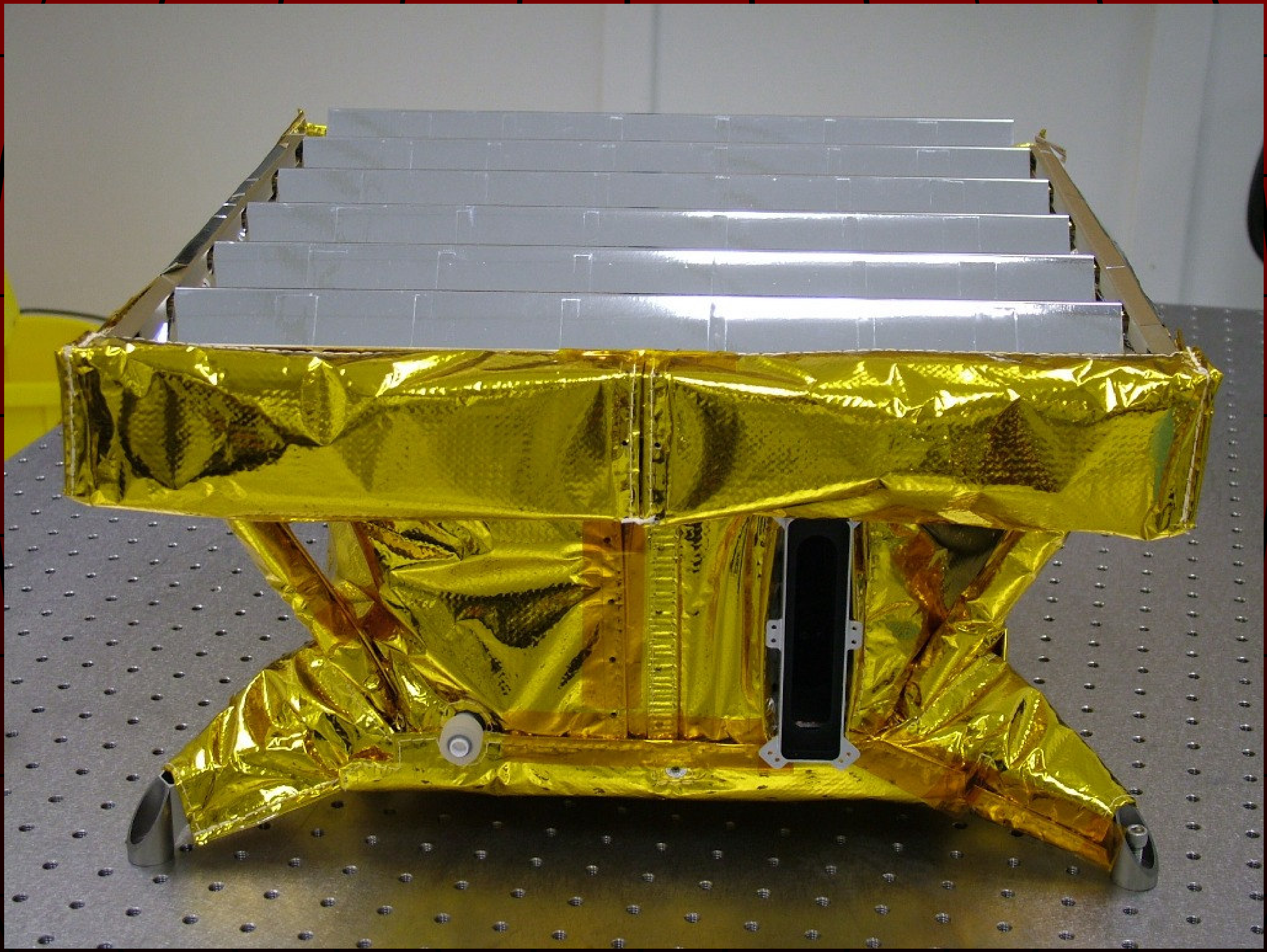
Chandrayaan-I

Hyper Spectral Imager : HYSI



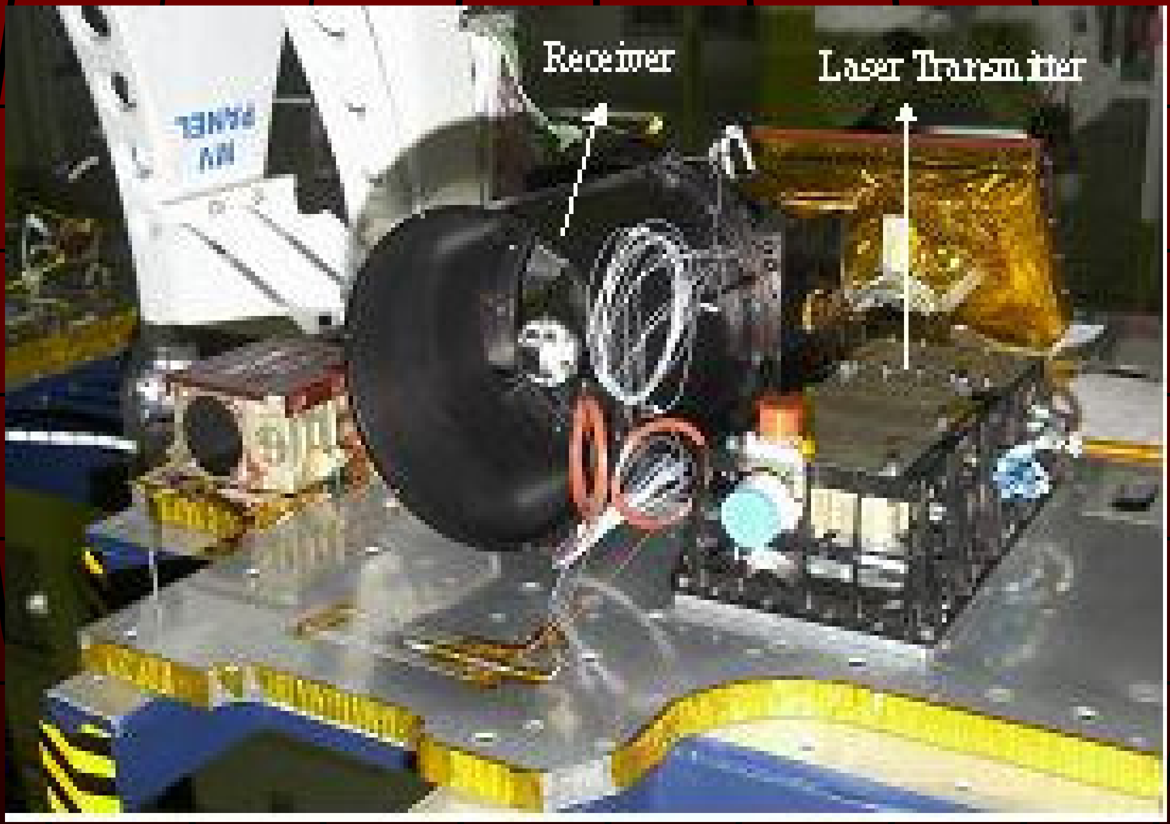
Chandrayaan-I

Moon Mineralogy Mapper : MMM



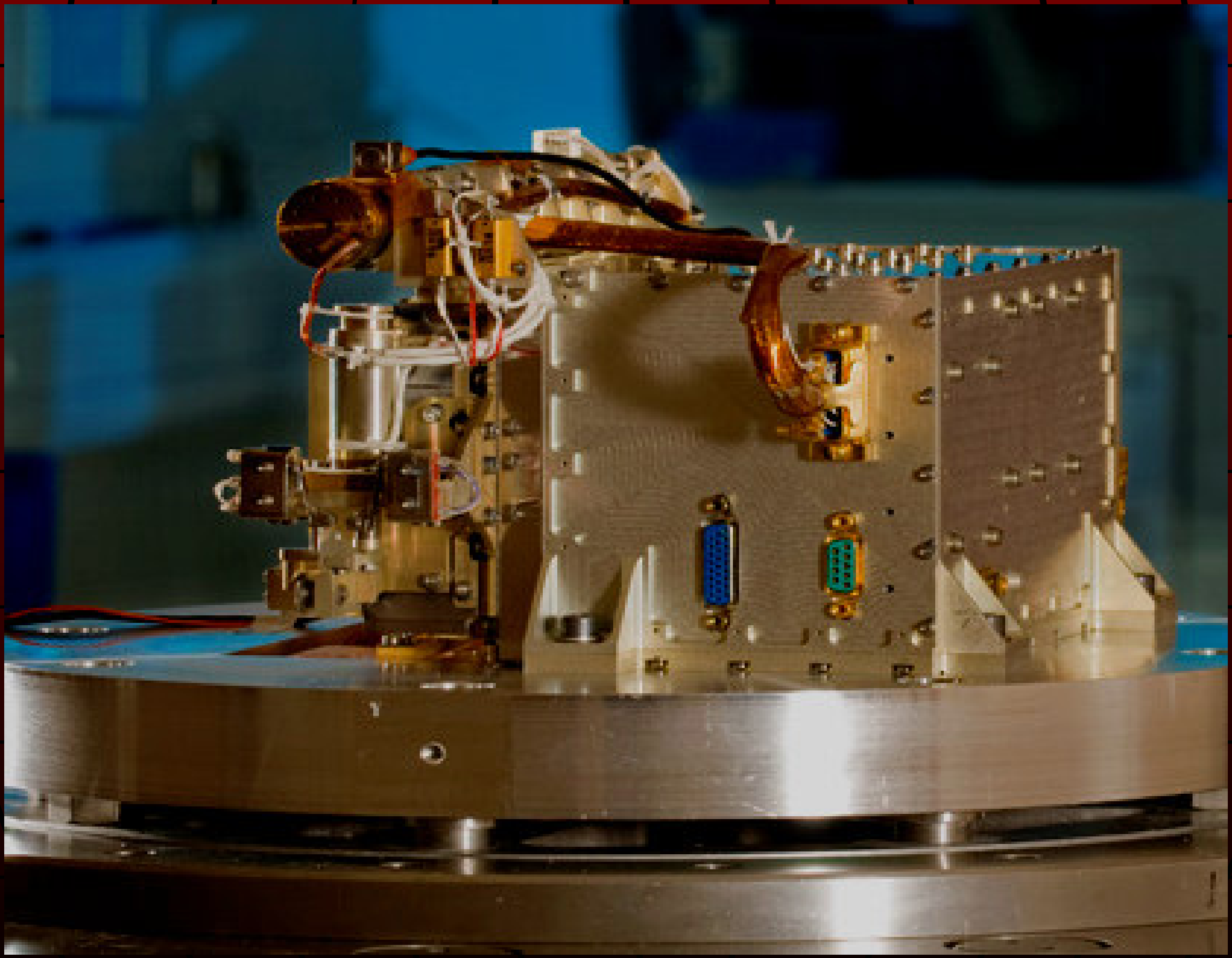
Chandrayaan-I

Lunar Laser Ranging Instrument : LLRI



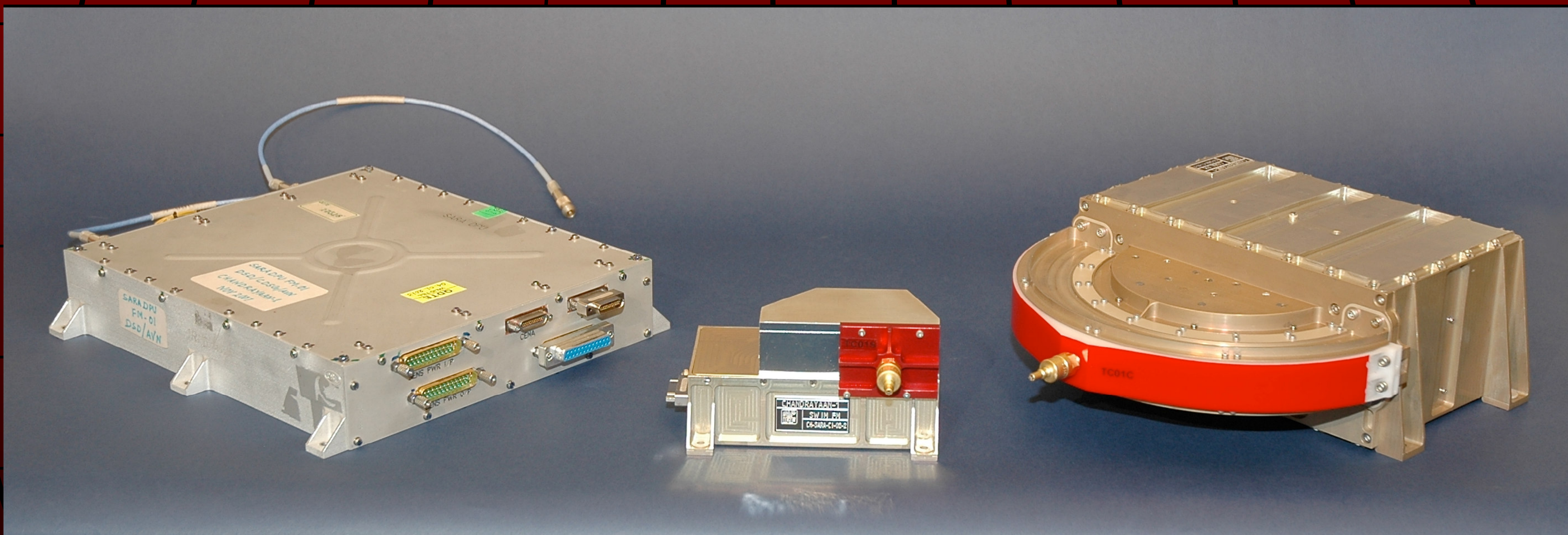
Chandrayaan-I

Chandrayaan-1 Imaging X-ray Spectrometer : C1XS



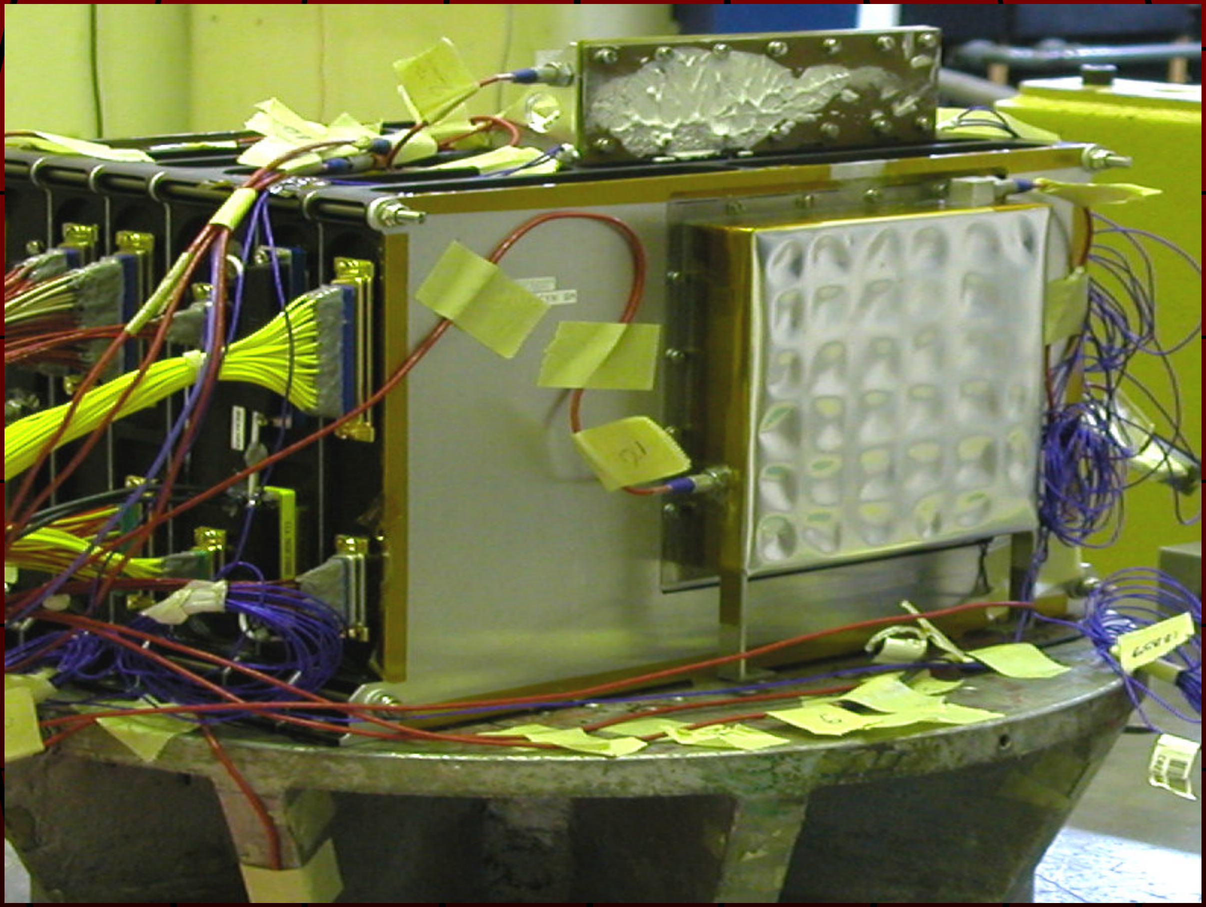
Chandrayaan-I

Sub keV Atom Reflecting Analyser : SARA



Chandrayaan-I

High Energy X-ray Spectrometer : HEX



Chandrayaan-I

MiniSAR

Chandrayaan-I

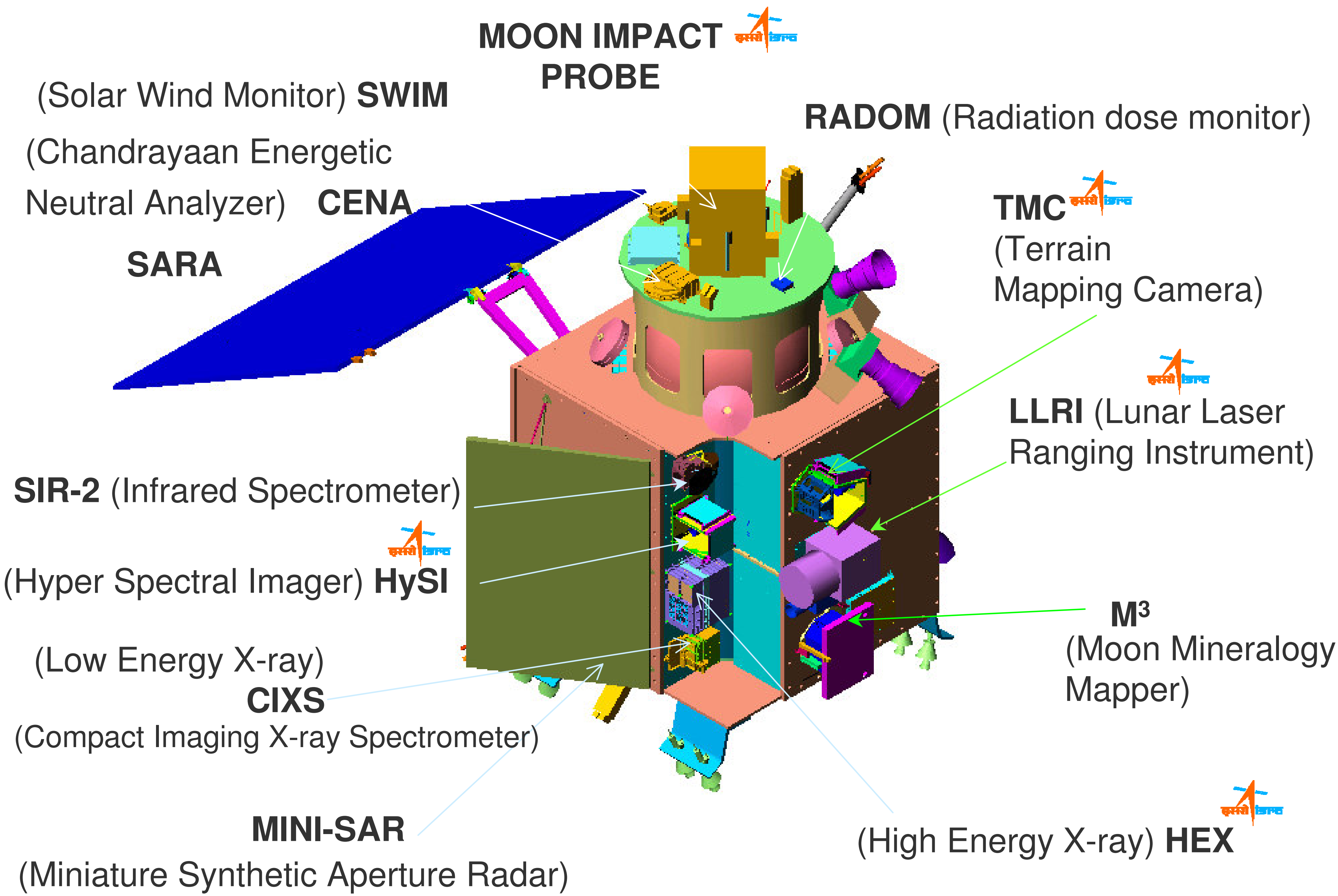
RADOM

Chandrayaan-I

SIR2

Chandrayaan-I

All Payloads

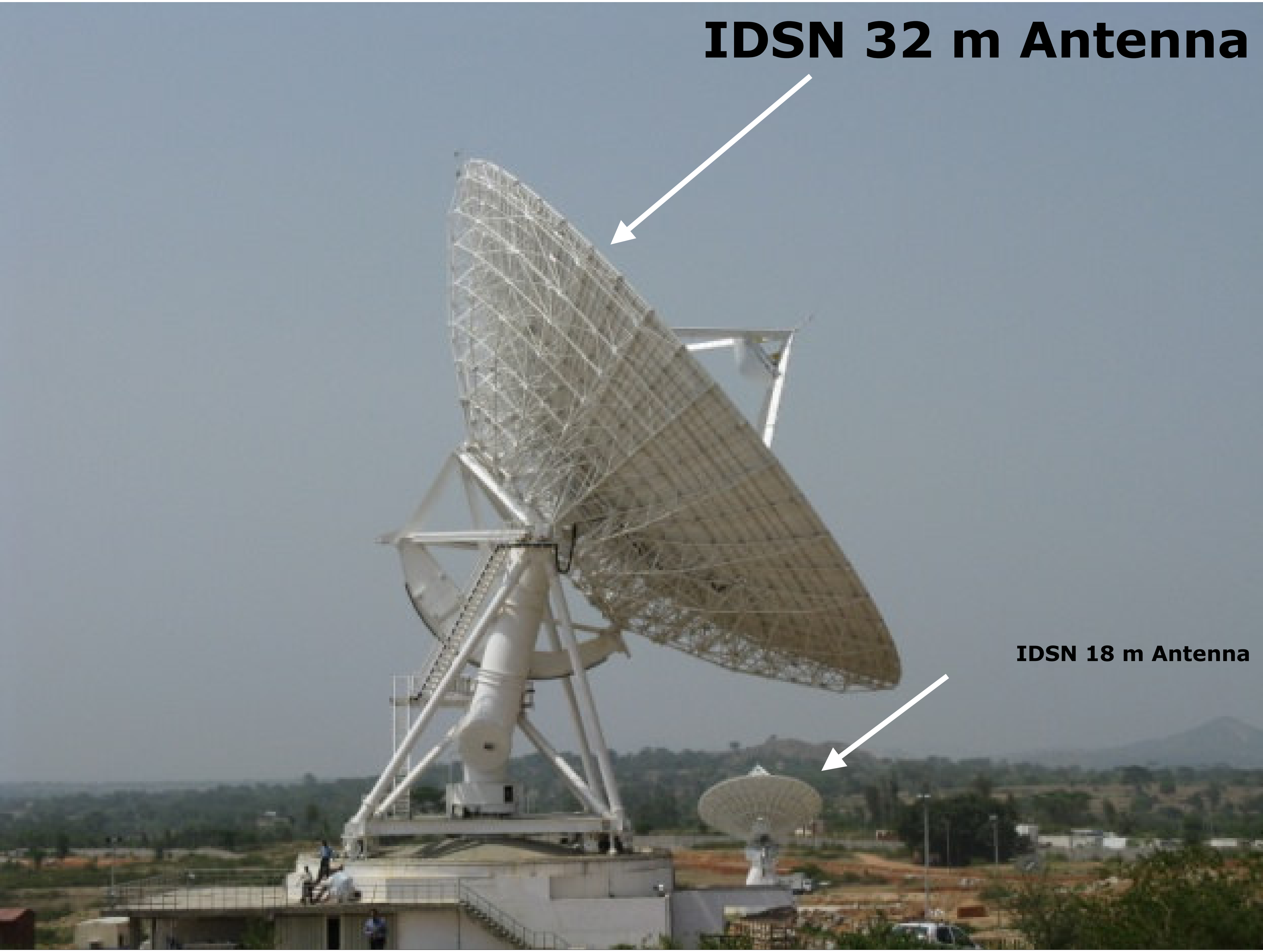


CHANDRAYAAN-1 PAYLOADS

Indian Deep Space Network

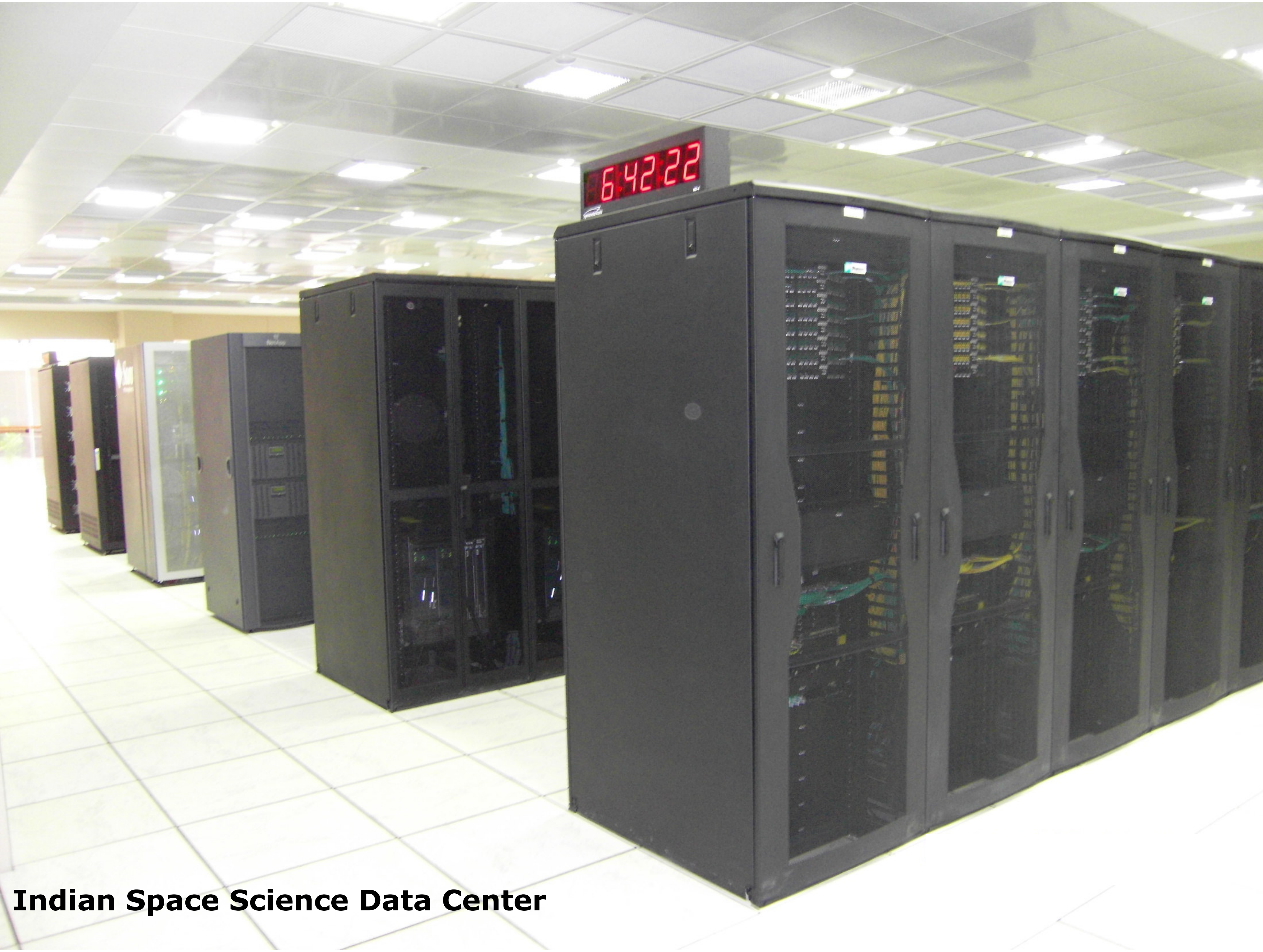
India’s gateway to deep space

DSN-32


IDSN 32 m Antenna
IDSN 18 m Antenna

Indian Space Science Data Center

ISSDC



Indian Space Science Data Center

Indian Space Science Data Center

Spacecraft Control Center (SCC)

Spacecraft Control Center

(SCC)

PSLV C11

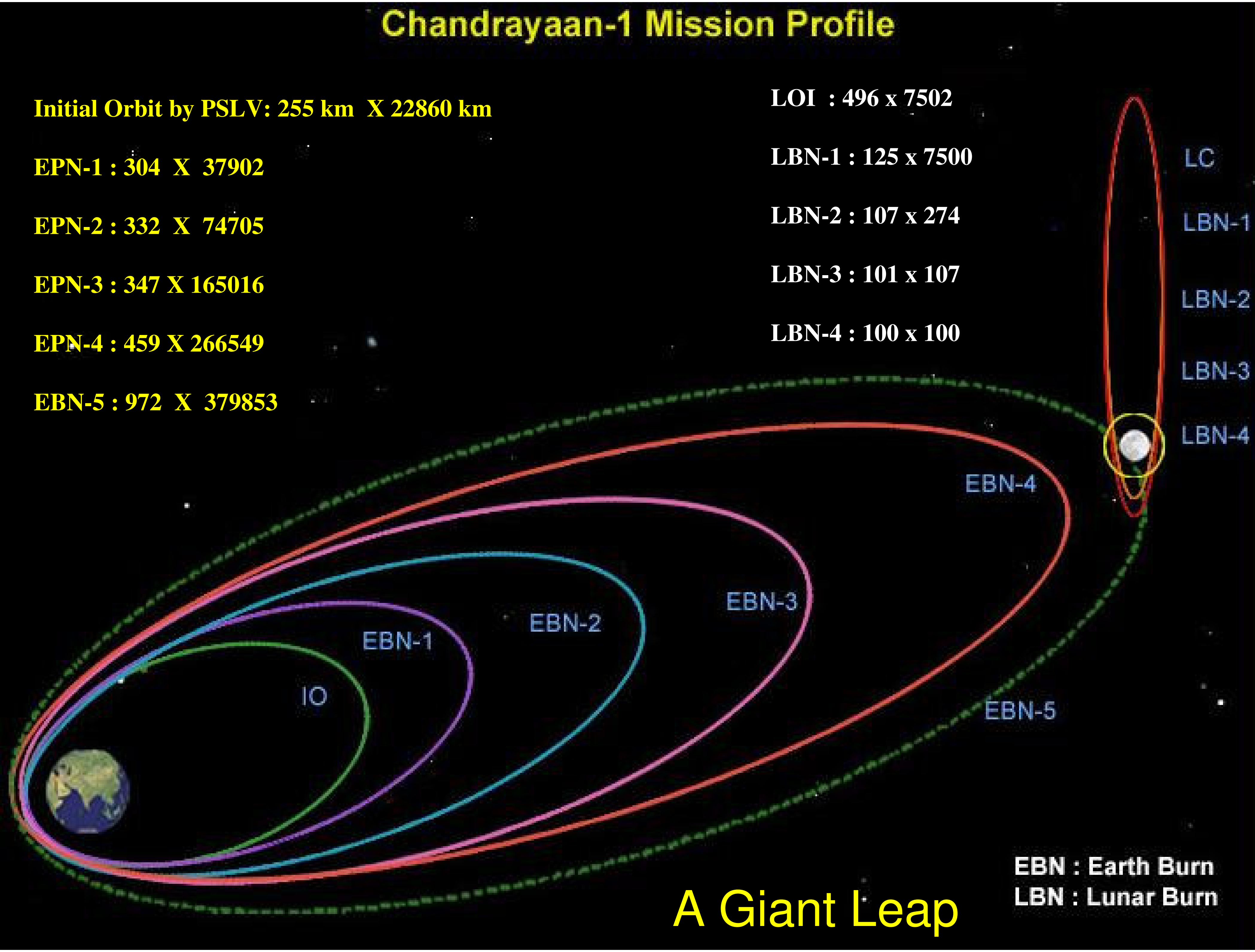
Its on way to Vehicle Assembly Building

PSLV – C11

Spaceport of India

PSLV – C11: Lift Off

22nd October 2008

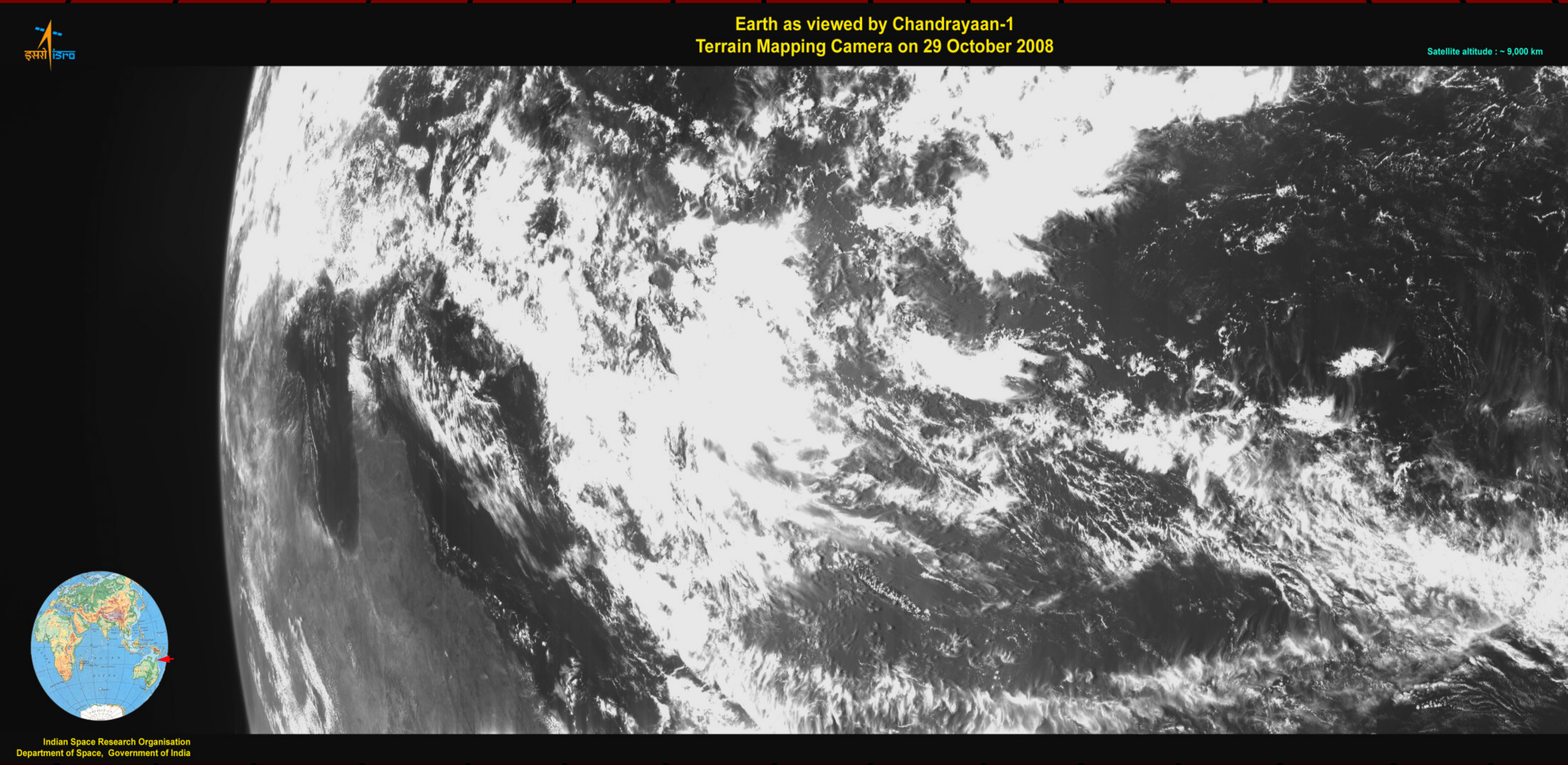

Chandrayaan-1 Mission Profile
Initial Orbit by PSLV: 255 km X 22860 km
EPN-1 : 304 X 37902
EPN-2 : 332 X 74705
EPN-3 : 347 X 165016
EPN-4 : 459 X 266549
EBN-5 : 972 X 379853
LOI : 496 x 7502
LBN-1 : 125 x 7500
LBN-2 : 107 x 274
LBN-3 : 101 x 107
LBN-4 : 100 x 100
LC
LBN-1
LBN-2
LBN-3
LBN-4
EBN-4
EBN-3
EBN-2
EBN-1
IO
EBN-5
EBN : Earth Burn
LBN : Lunar Burn
A Giant Leap

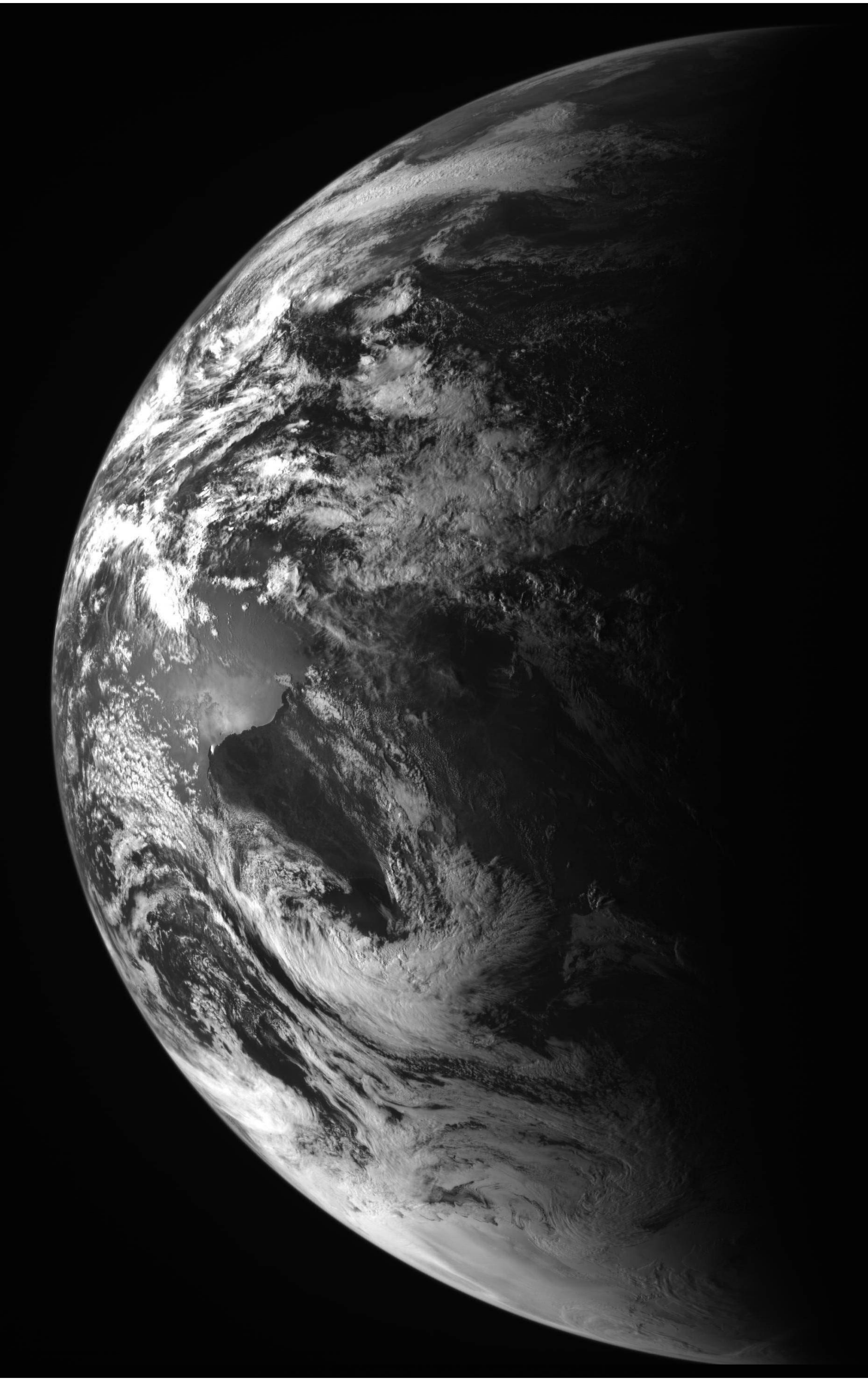
Chandrayaan-I

Earth Images
Enroute to Moon

(29th October 2008)

During Lunar Transfer Trajectory (LTT)





Earth viewed by Chandrayaan-1 on 29th October 2008

Chandrayaan-I

Lunar Orbit Insertion (LOI)

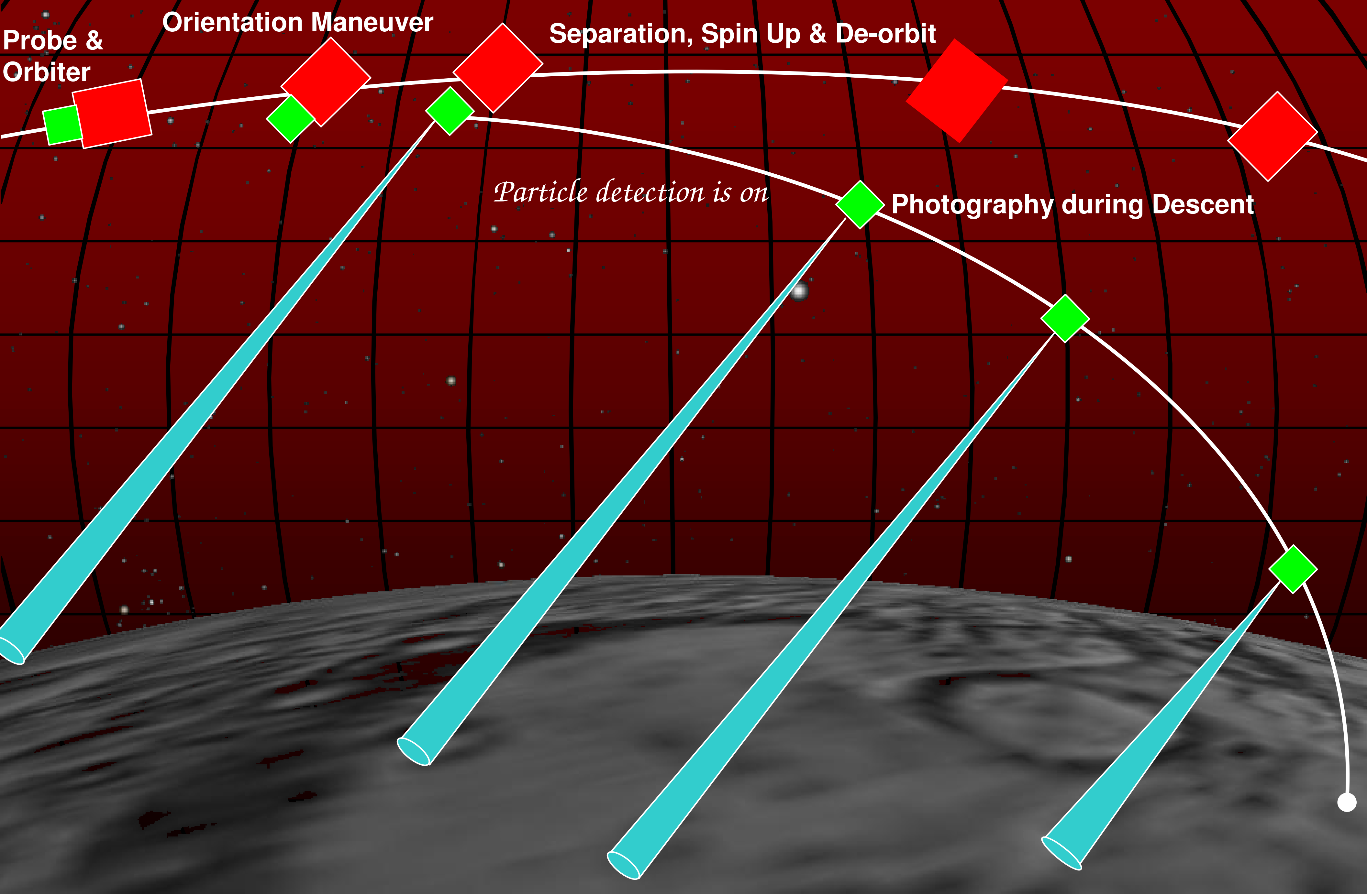
(08th November 2008)

Chandrayaan-I

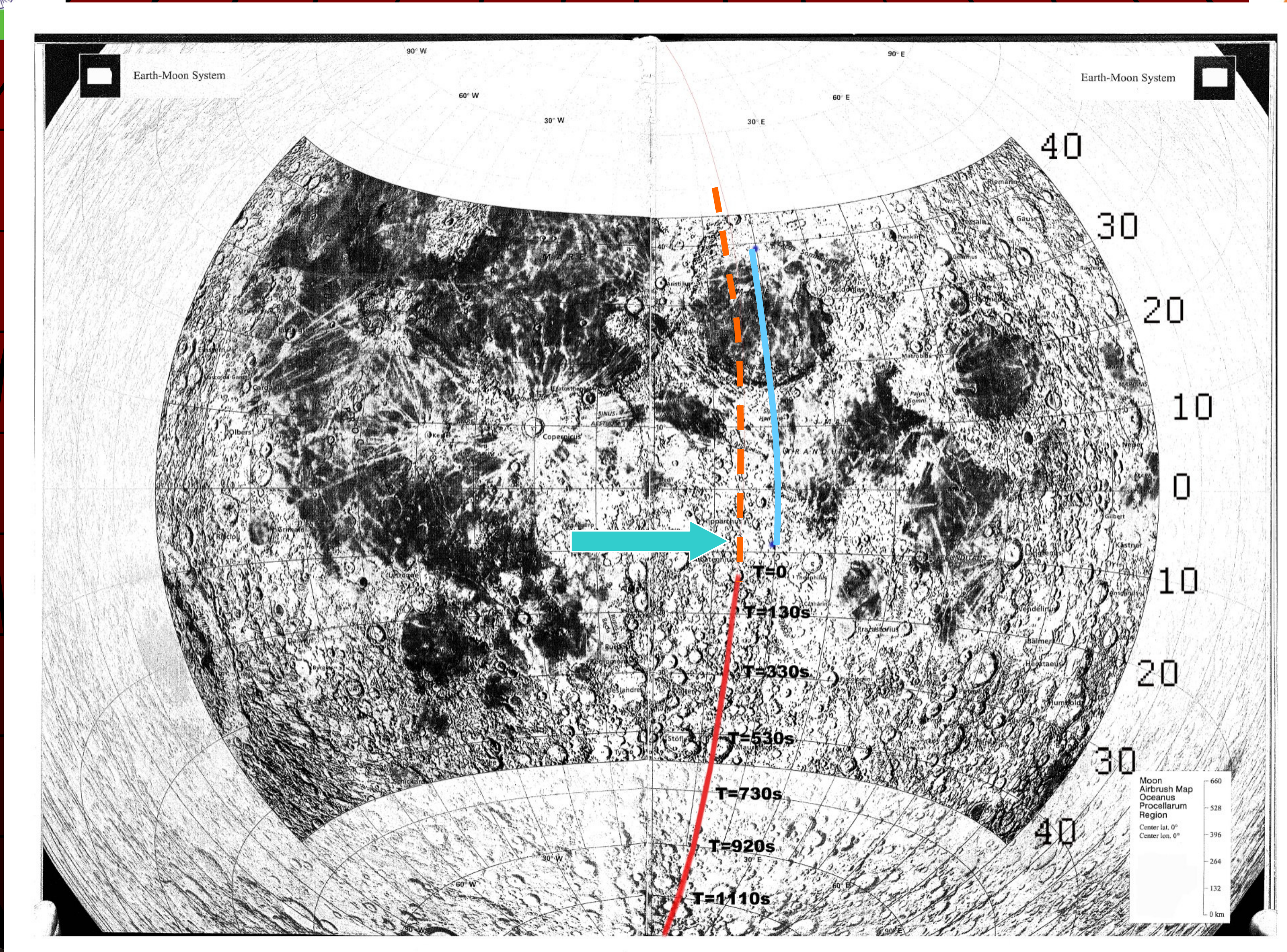
Moon Impact Probe (MIP)

(14th November 2008)

MIP : The first man made object from India on Lunar Surface



Ground Track of the MIP

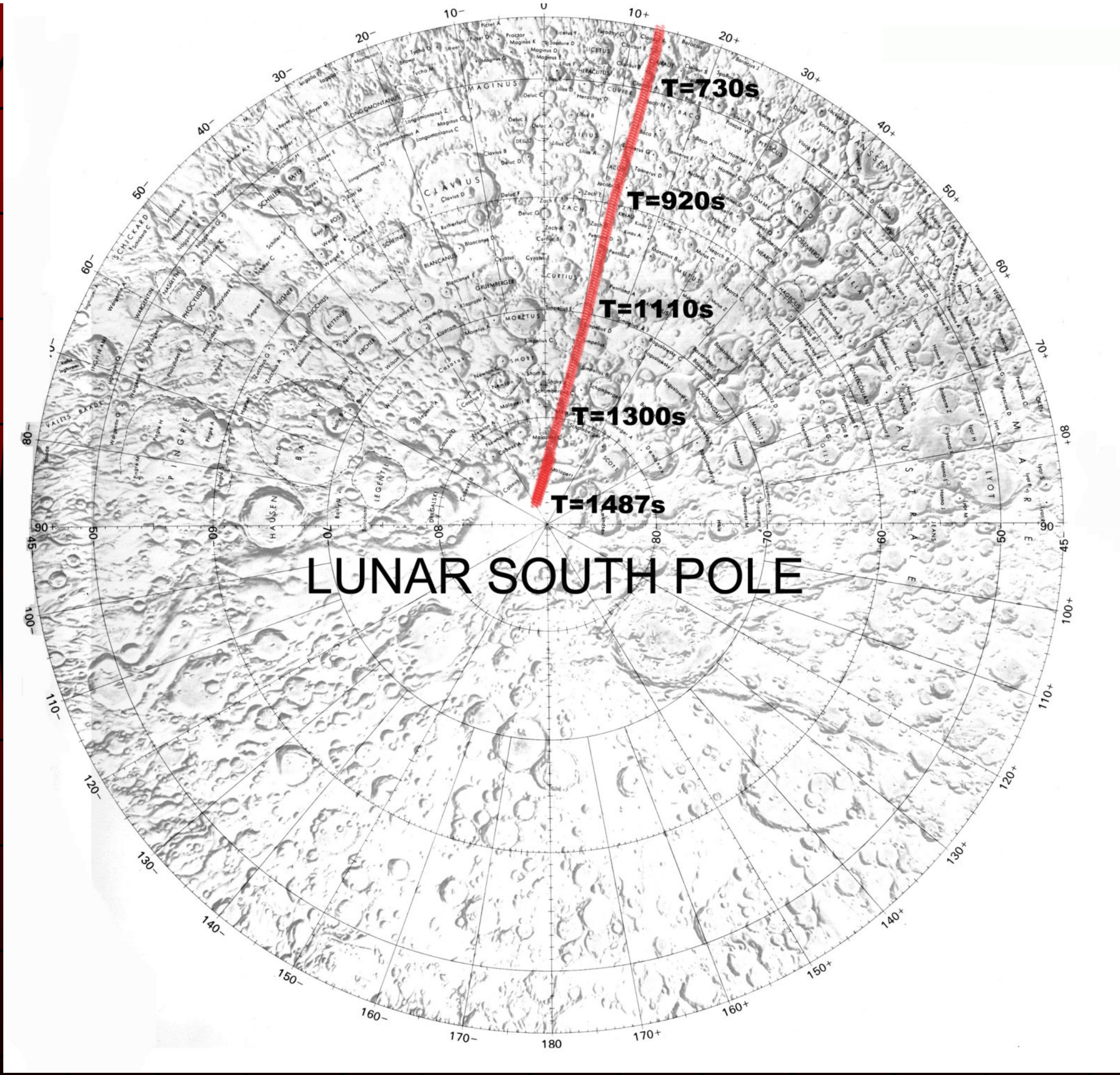


During rehearsal

During mission, before MIP separation

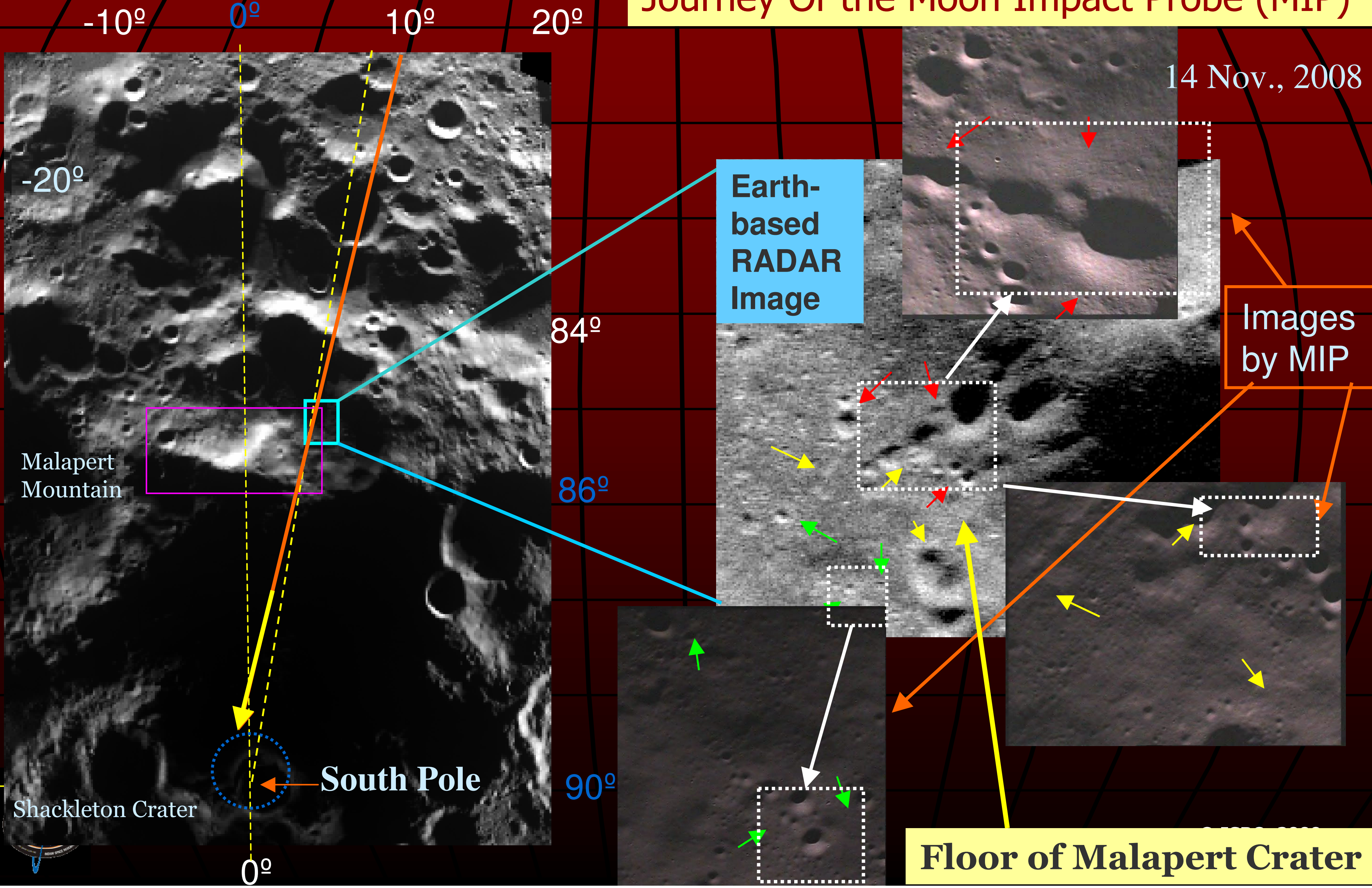
During mission, after MIP separation

Ground Track of the MIP at the higher latitudes

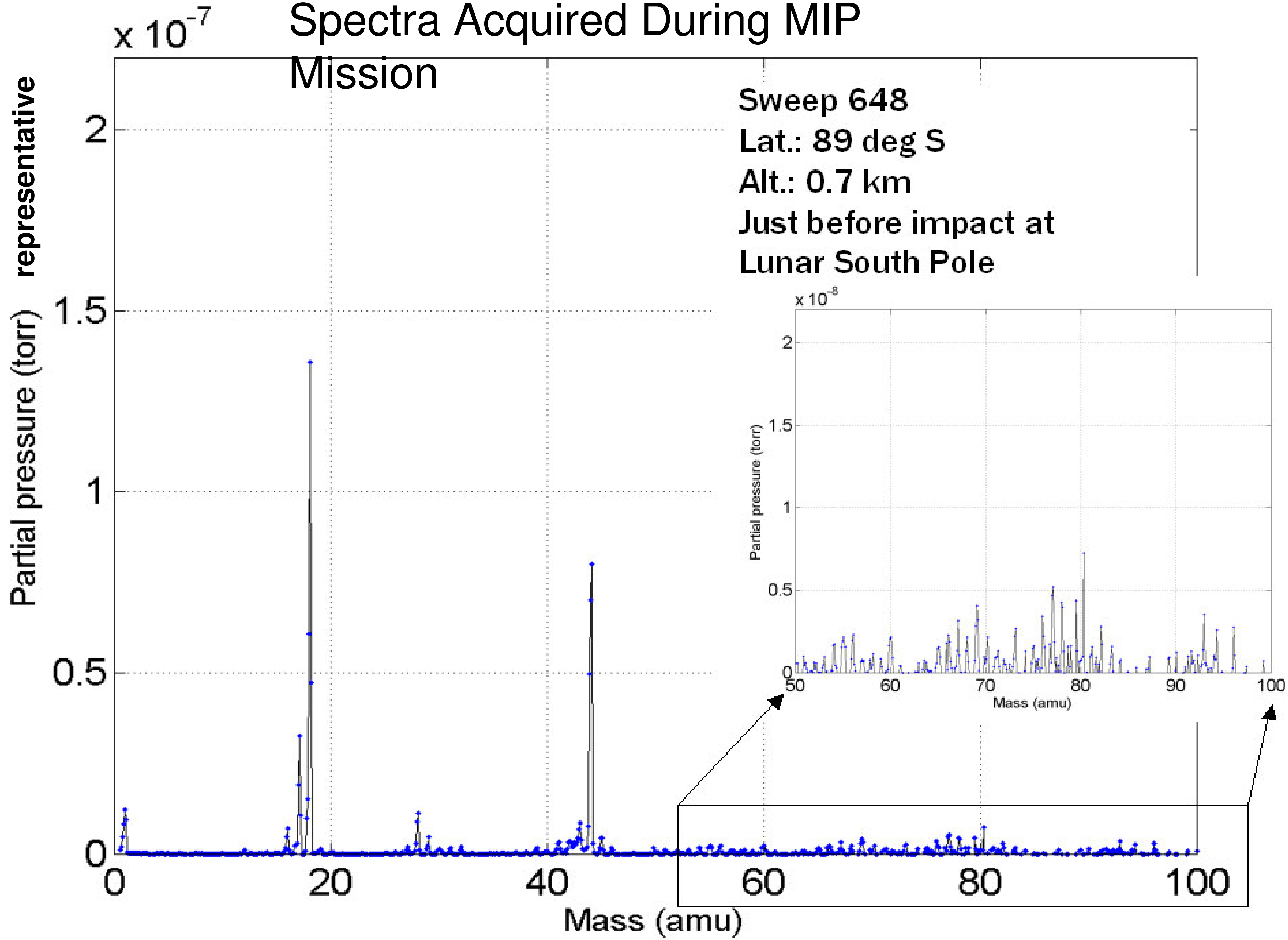


MIP

Journey Of the Moon Impact Probe (MIP)



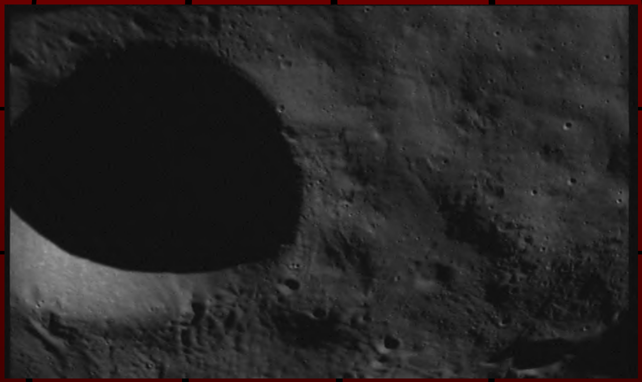
Spectra Acquired During MIP Mission



MIP Image Frames

Images captured by MIP before touch down

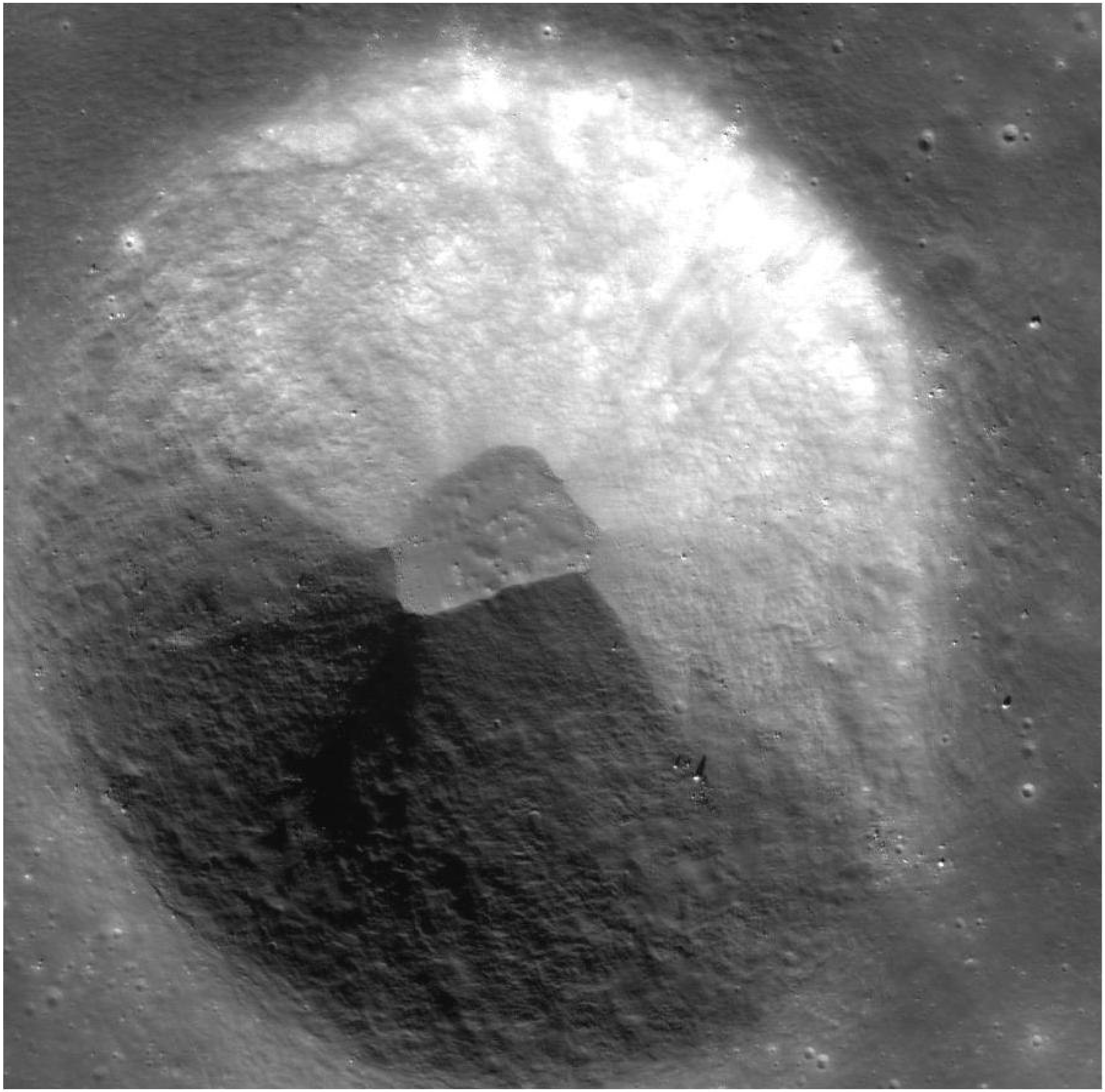
MIP Image Frames



Prior to Impact


Near Side image of Lunar Surface by TMC

Far Side Image of Moon captured by TMC on 24th Nov 2008

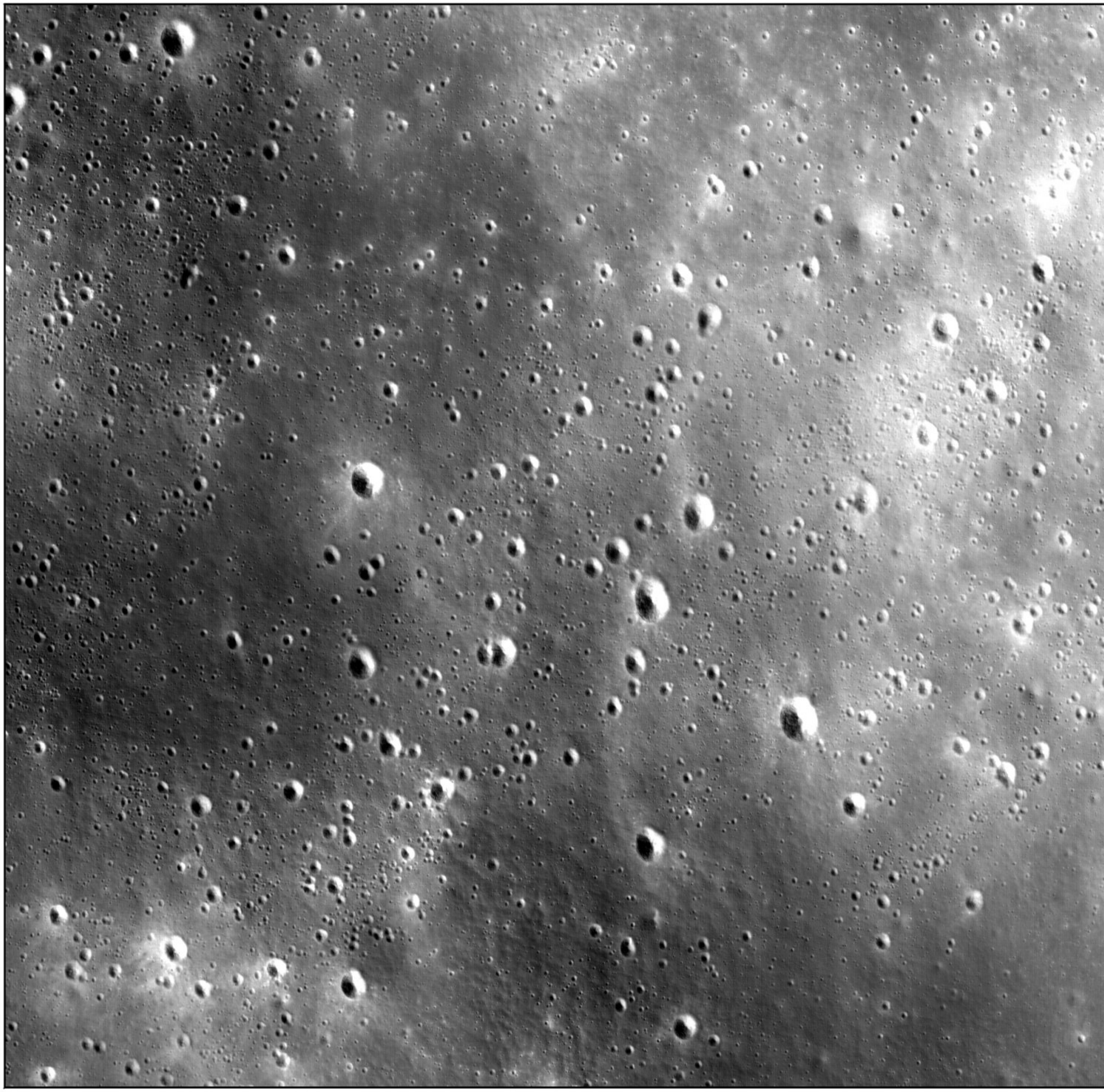


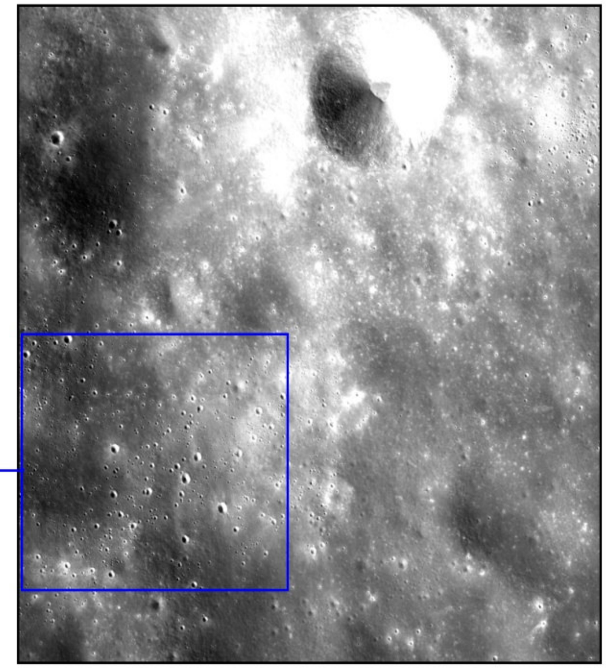
COULOMB CRATOR (Sel Lat 55.45 Sel Long -110)

Indian Space Science Data Center (ISSDC), ISTRAC/ISRO

Far Side Image of MOON captured by TMC, Chandrayaan

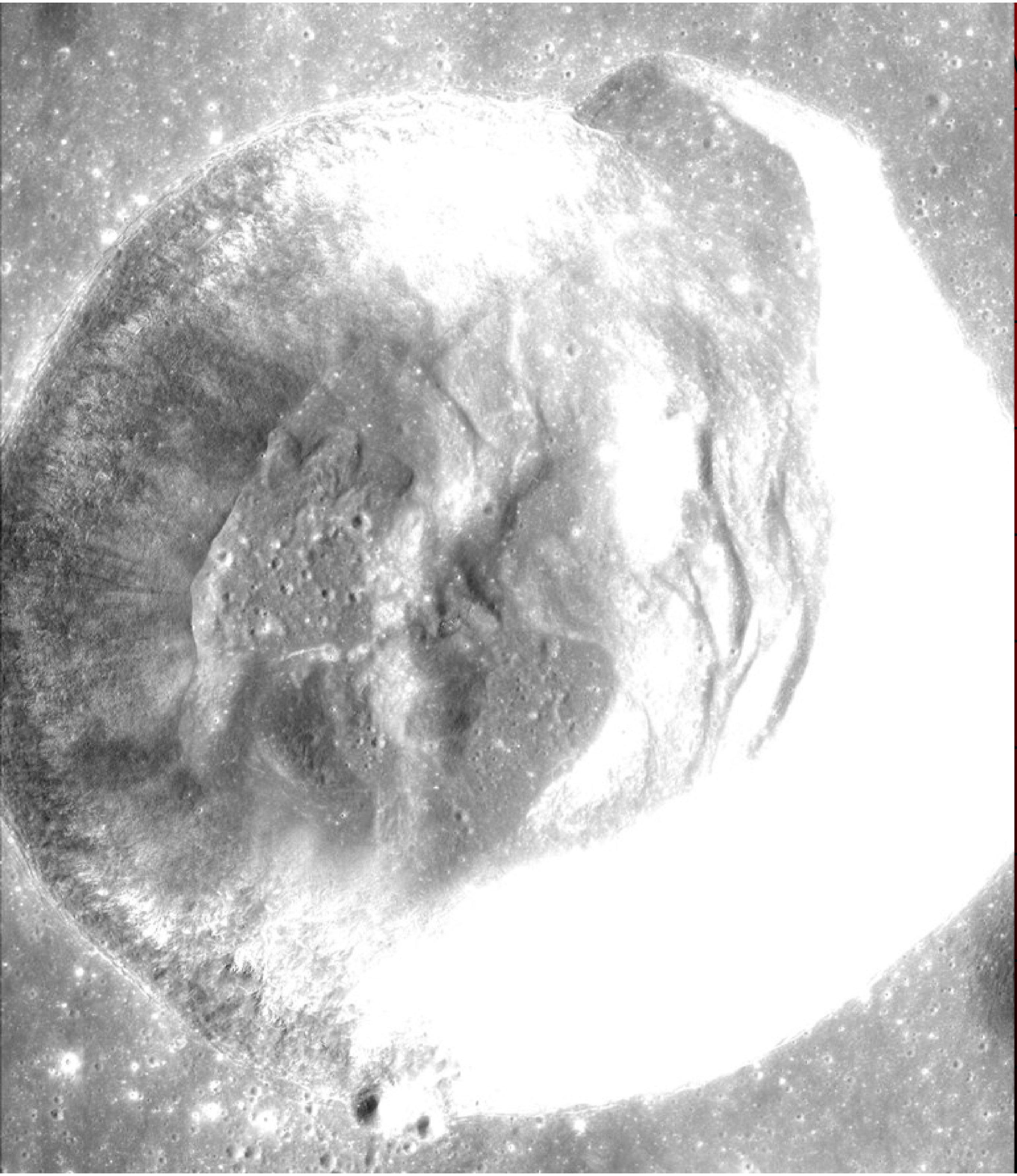
Far Side Image of MOON captured by TMC, Chandrayaan-I





Sel. Long 139..35 E Sel. Lat 27.3
Date 26th Jan 2009 Orbit# 949

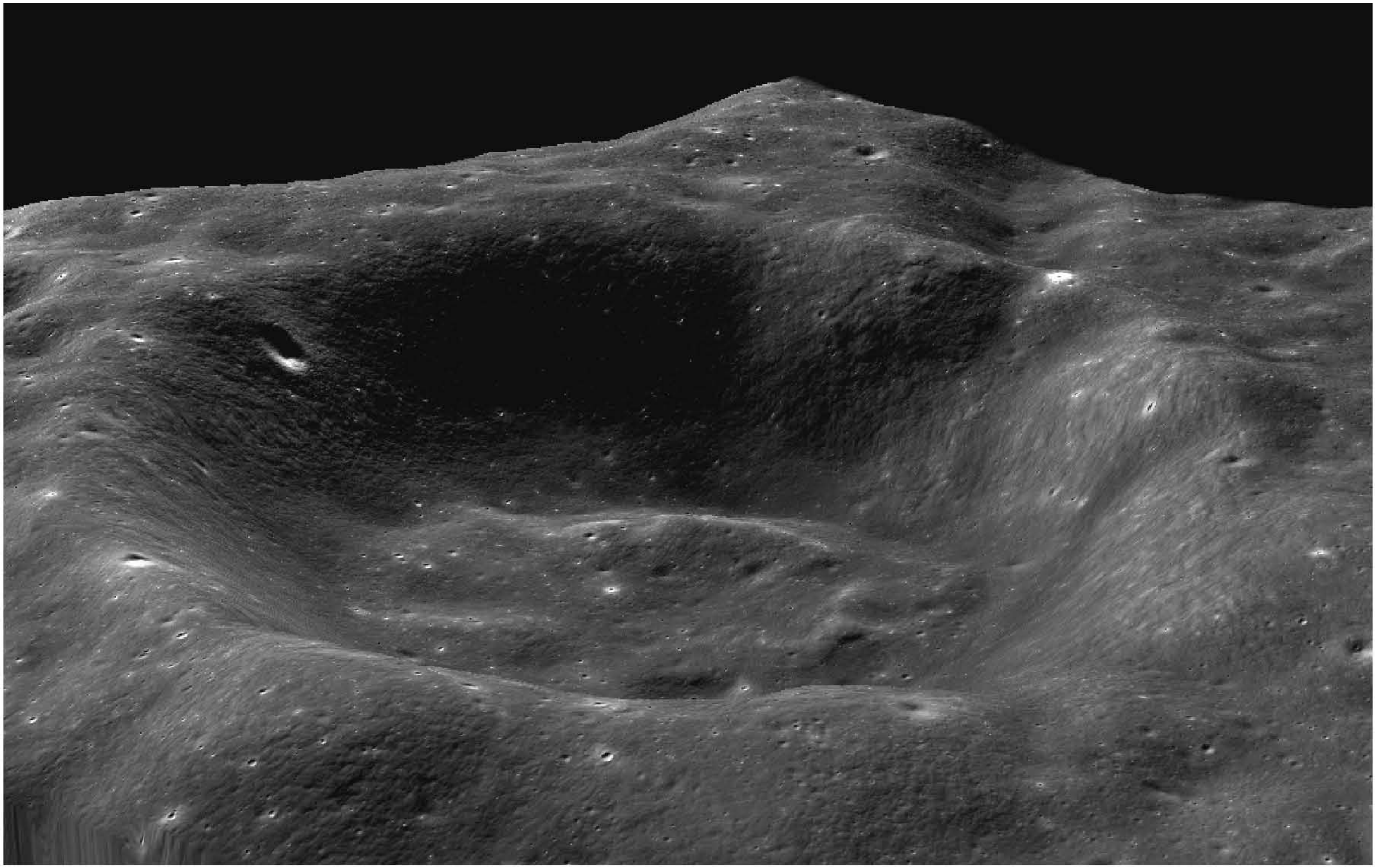
Indian Space Science Data Center (ISSDC)
ISRO, Dept. of Space, Govt. of India



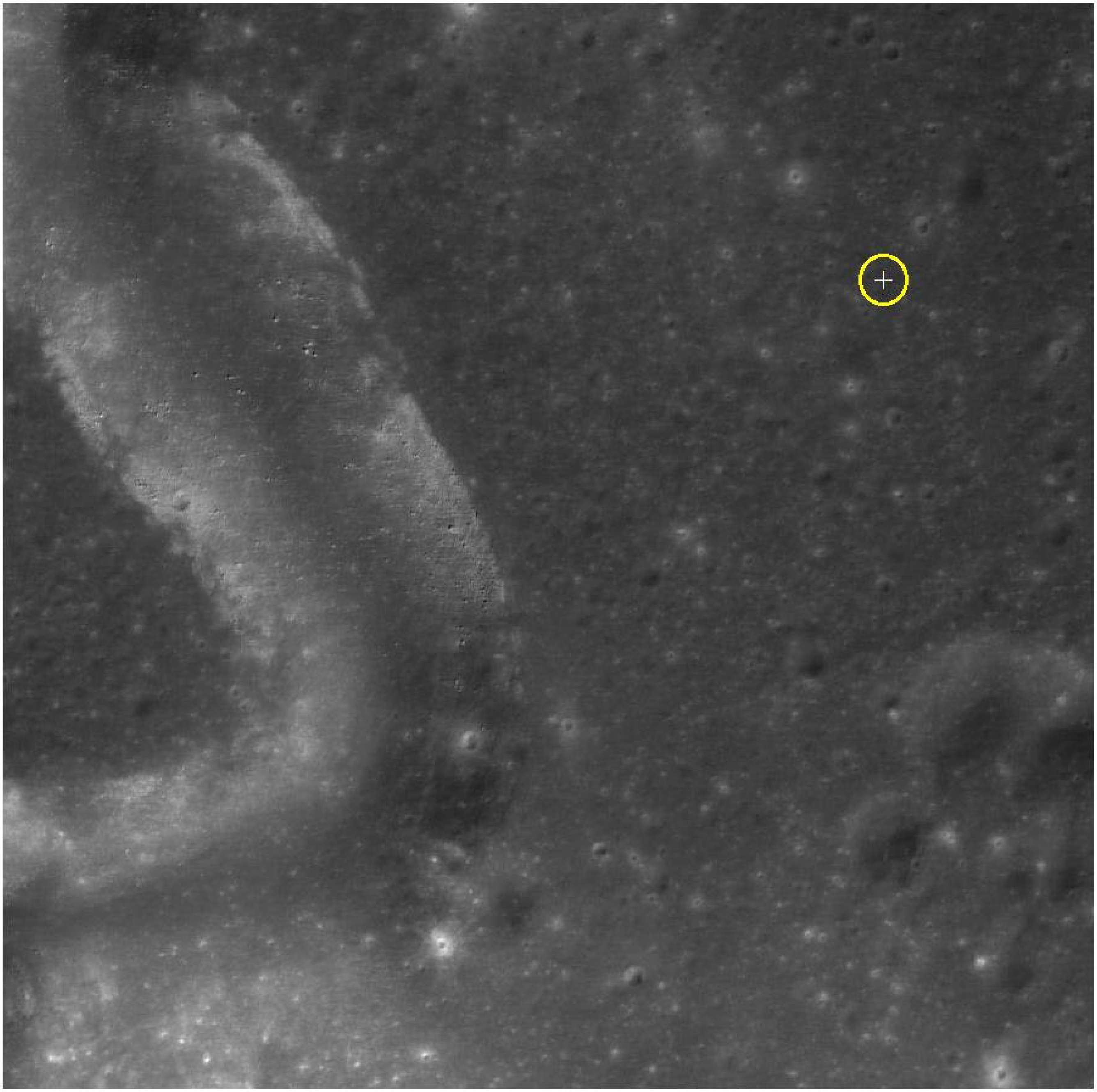
Far Side Image of MOON captured by TMC, Chandrayaan

Near Side Image of MOON captured by TMC, Chandrayaan

2.5D Visualisation (Coulomb C Crater)



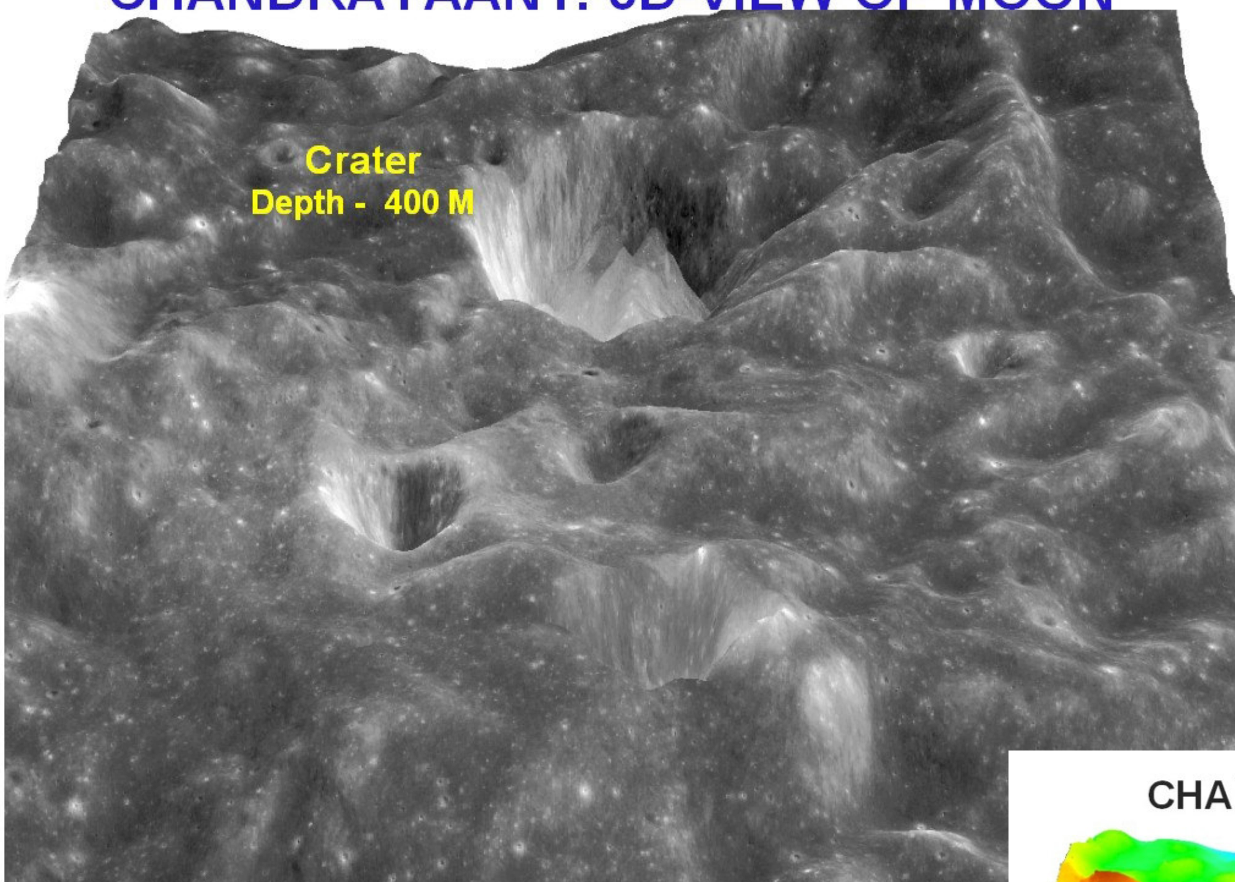
Apollo-15 Landing Site Captured by TMC of Chandrayaan-I on 9th Jan 2009



[Sel Lat 26.15 Sel Long 3.74 Orbit Number 737]

Indian Space Science Data Center [ISSDC], ISTRAC/ISRO

CHANDRAYAAN1: 3D-VIEW OF MOON



Terrain Mapping Camera
5M resolution

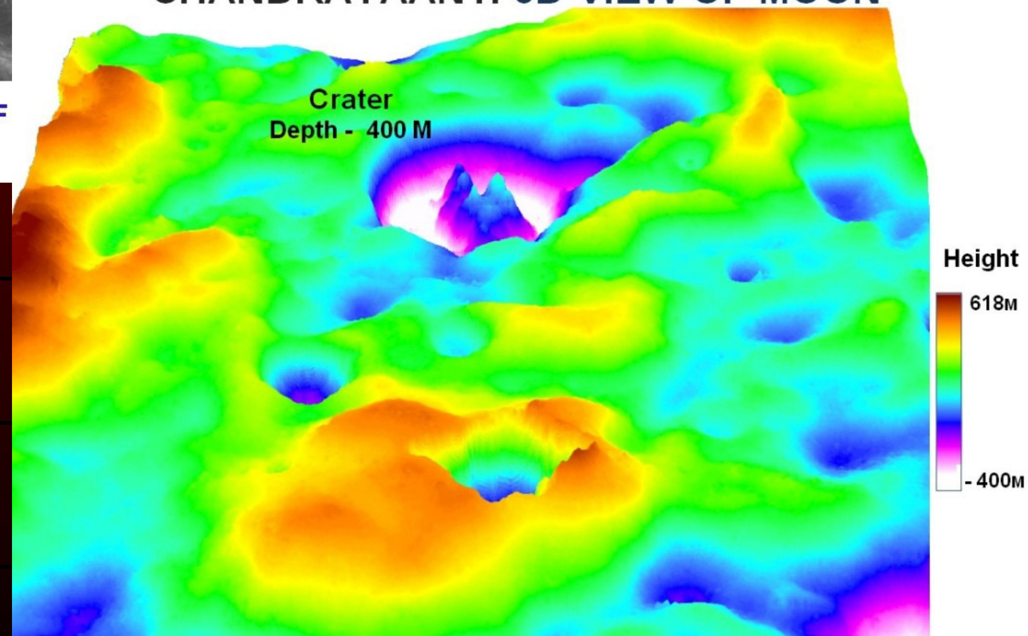
Area – 10 X 10 km

DATE OF

TMC

3 D Imaging

CHANDRAYAAN1: 3D-VIEW OF MOON

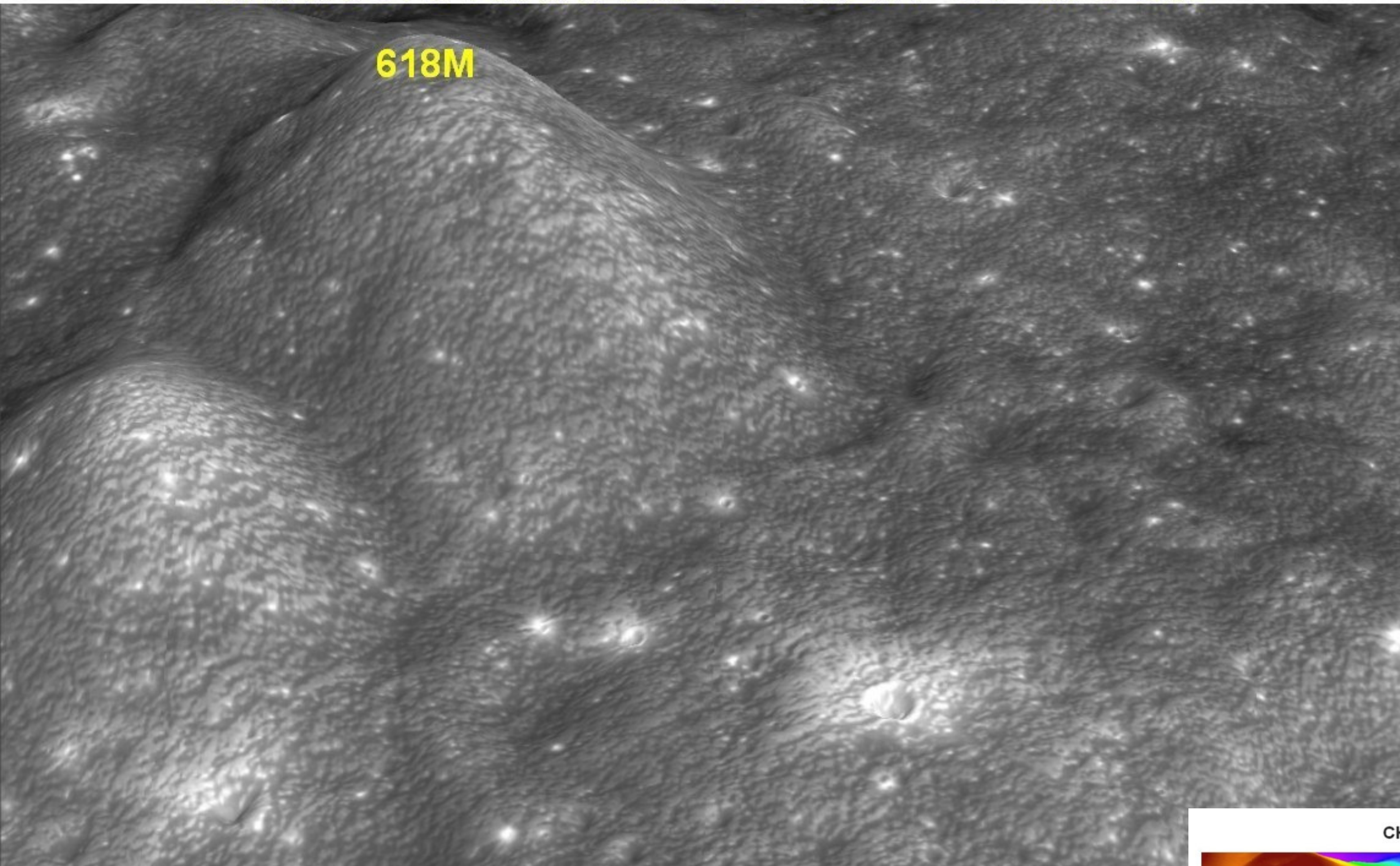


Terrain Mapping Camera
5M resolution

Area – 10 X 10 km

DATE OF PASS - Nov 23, 2008

CHANDRAYAAN1: 3D-VIEW OF MOON



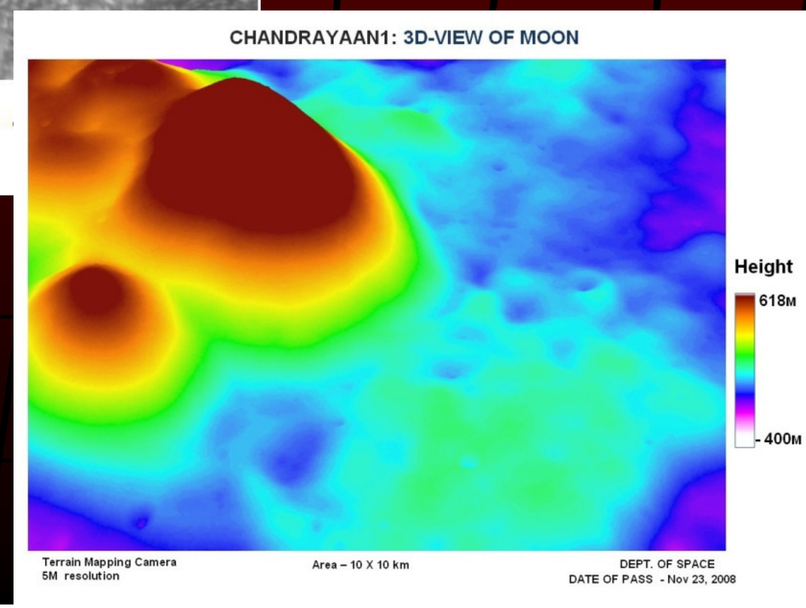
Terrain Mapping Camera
5M resolution

Area – 10 X 10 km

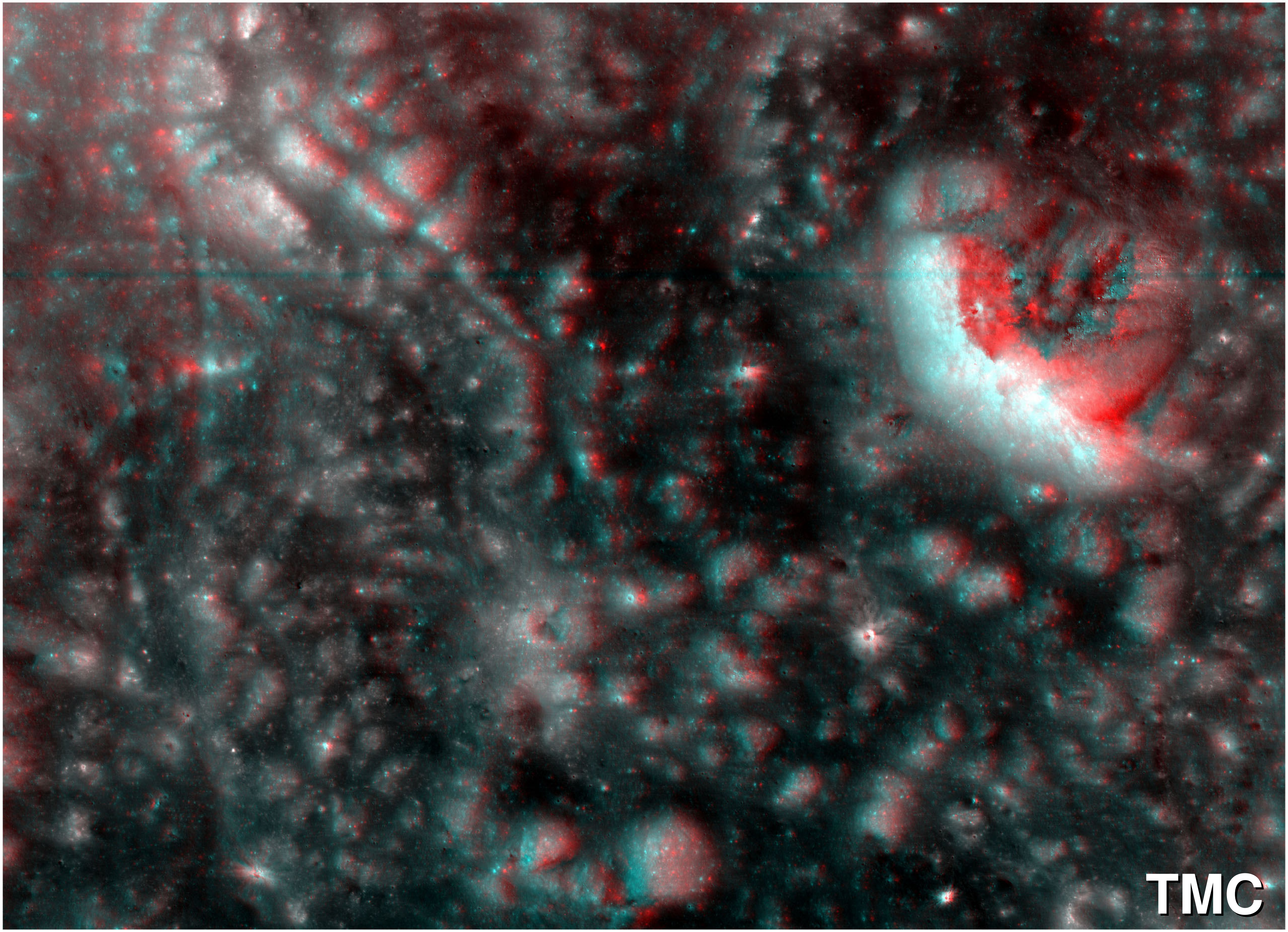
DATE OF PASS

TMC

3 D Imaging

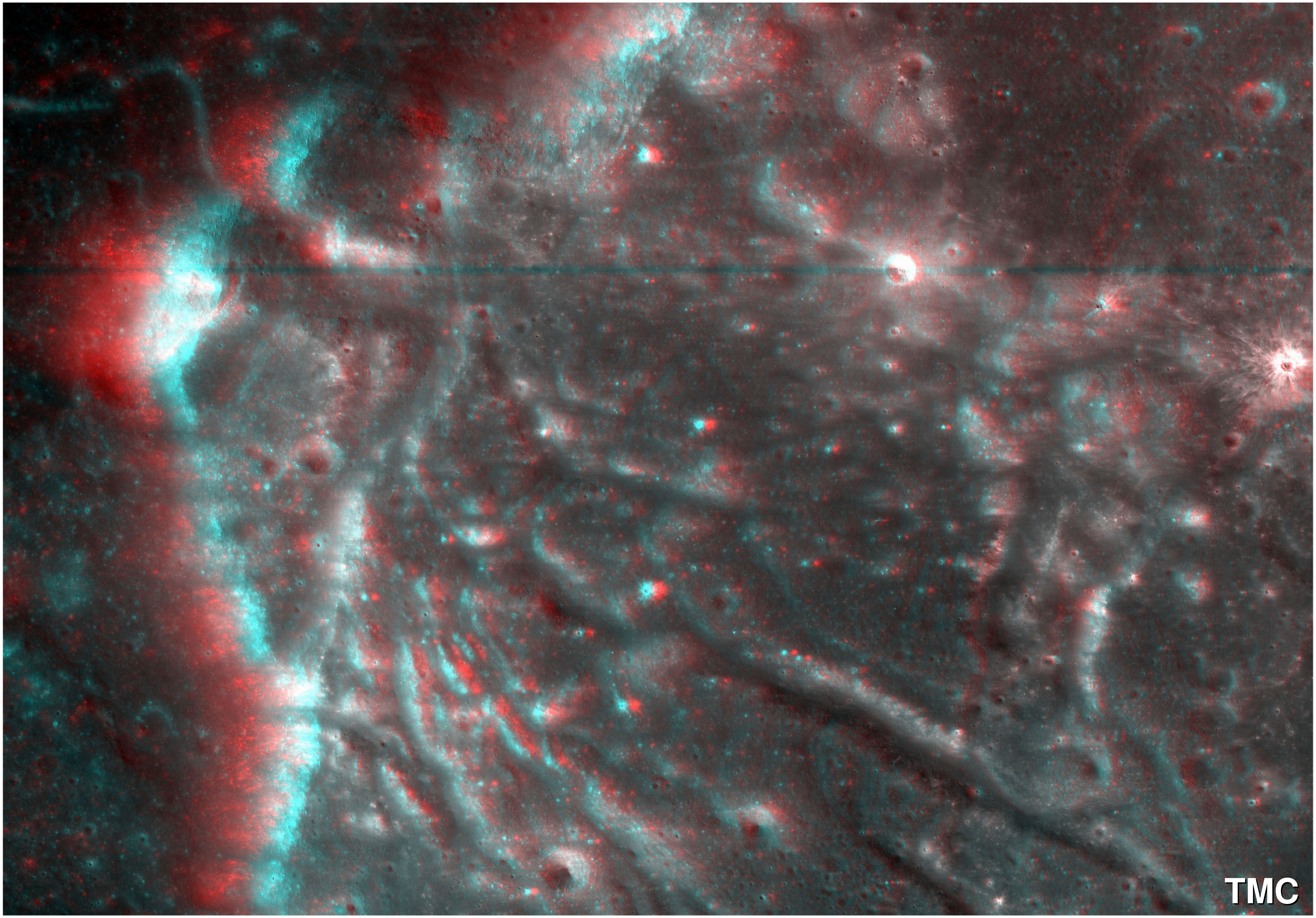


MOON ANAGLYPH



SCALE = 1:30000

MOON ANAGLYPH



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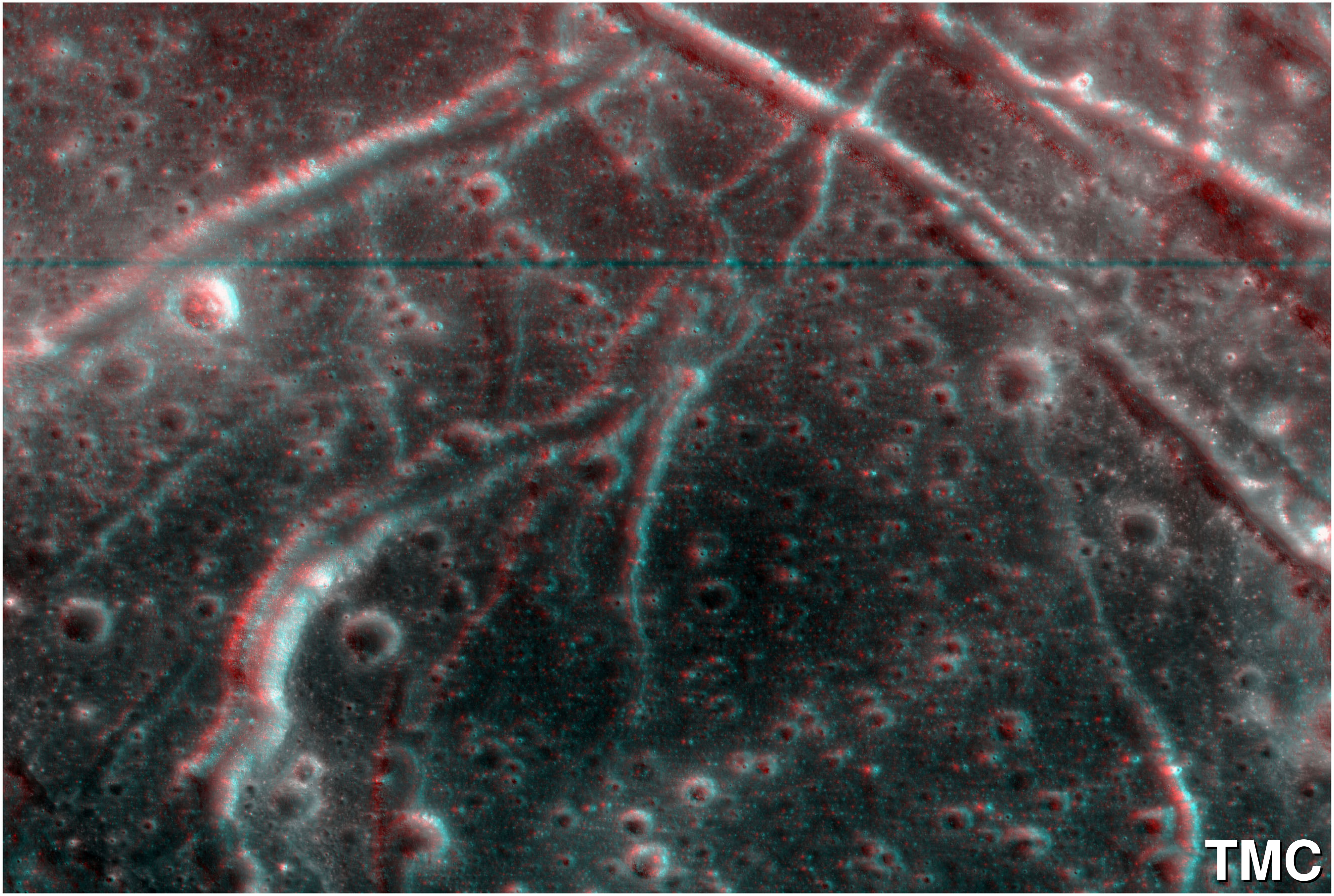
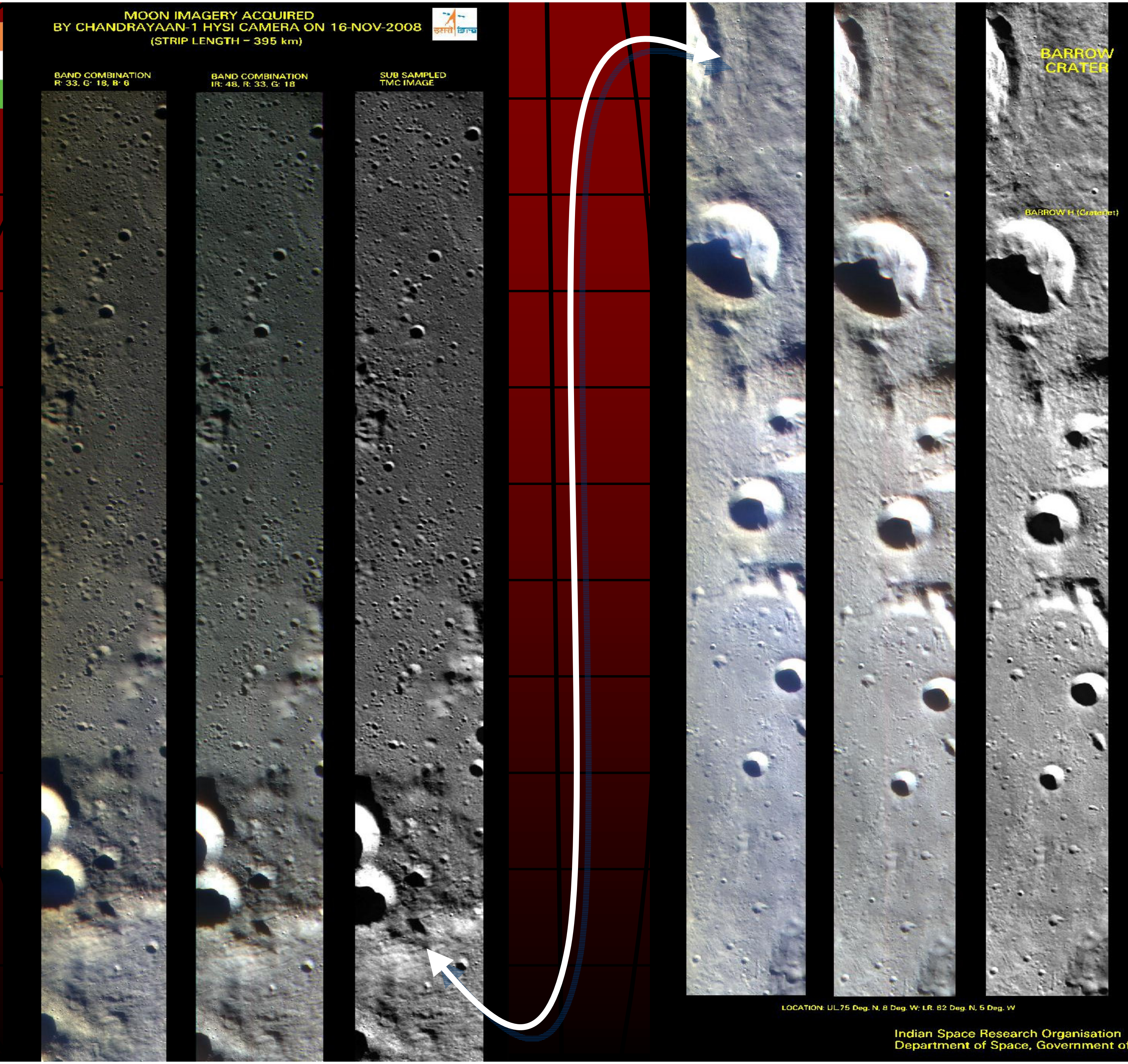
MOON ANAGLYPH



SCALE = 1:30000

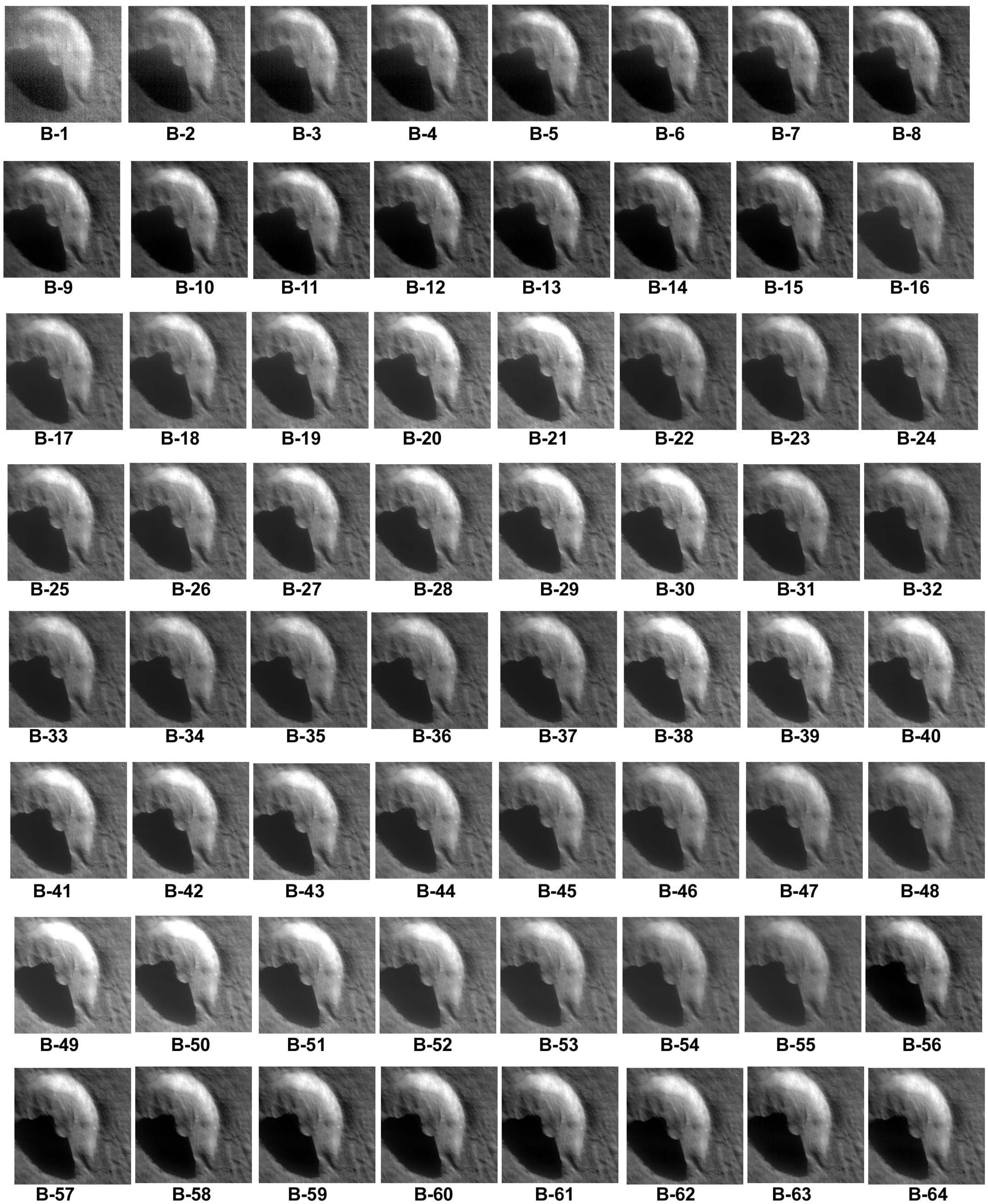
HYSI



MOON IMAGERY ACQUIRED
BY CHANDRAYAAN-1 HYSI CAMERA ON 16-NOV-2008
(STRIP LENGTH – 395 km)
BAND COMBINATION
R: 33, G: 18, B: 6
BAND COMBINATION
IR: 48, R: 33, G: 18
SUB SAMPLED
TMC IMAGE
BARROW
CRATER
LOCATION: UL.75 Deg. N, 8 Deg. W; LR. 62 Deg. N, 5 Deg. W
Indian Space Research Organisation
Department of Space, Government of

O, 2009

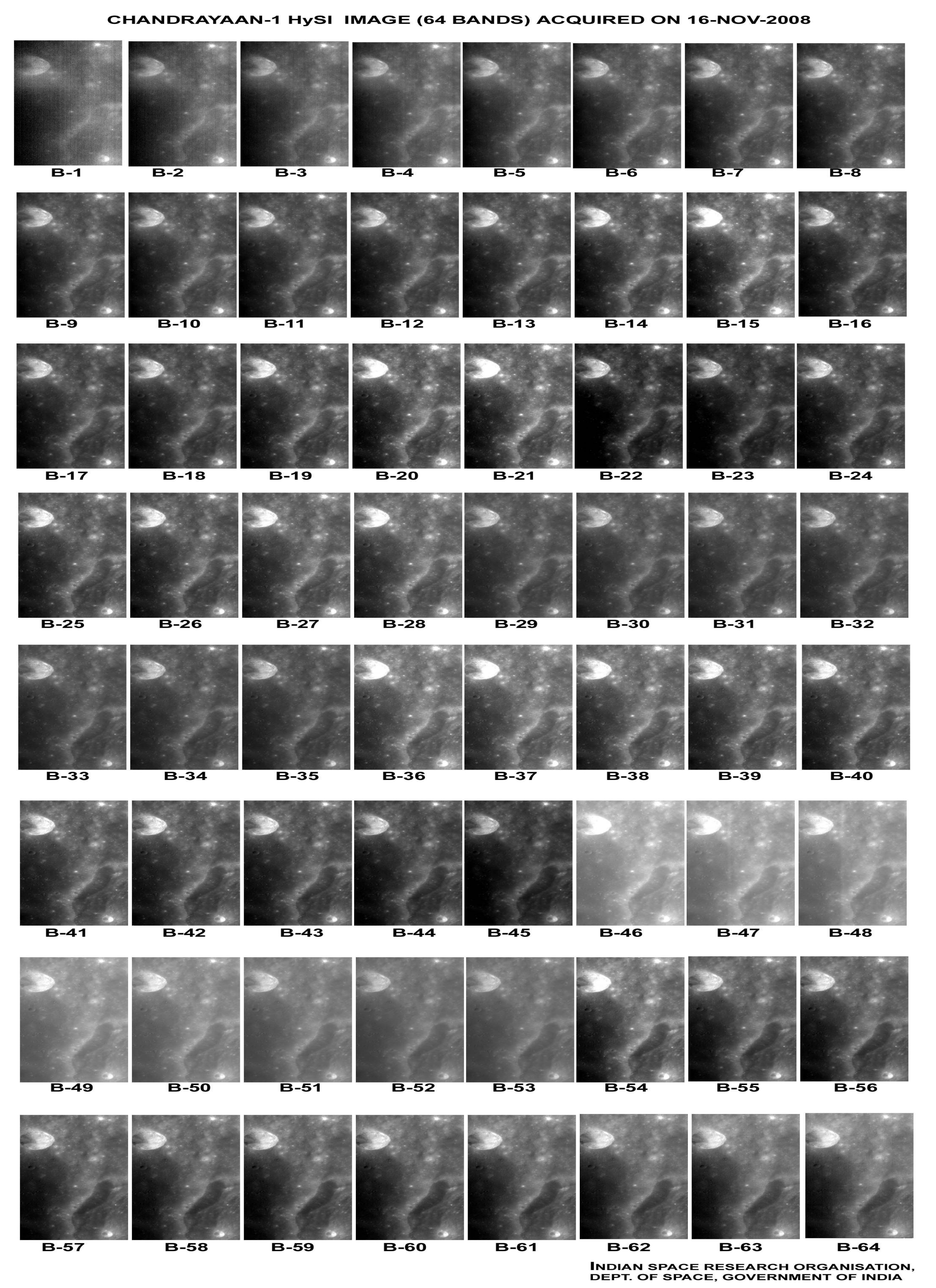
LUNAR CRATERLET (BARROW H) IMAGED BY CHANDRAYAAN-1 HYSI CAMERA (64 BANDS) ON 16-NOV-2008



INDIAN SPACE RESEARCH ORGANISATION,
DEPT. OF SPACE, GOVERNMENT OF INDIA

HYSI

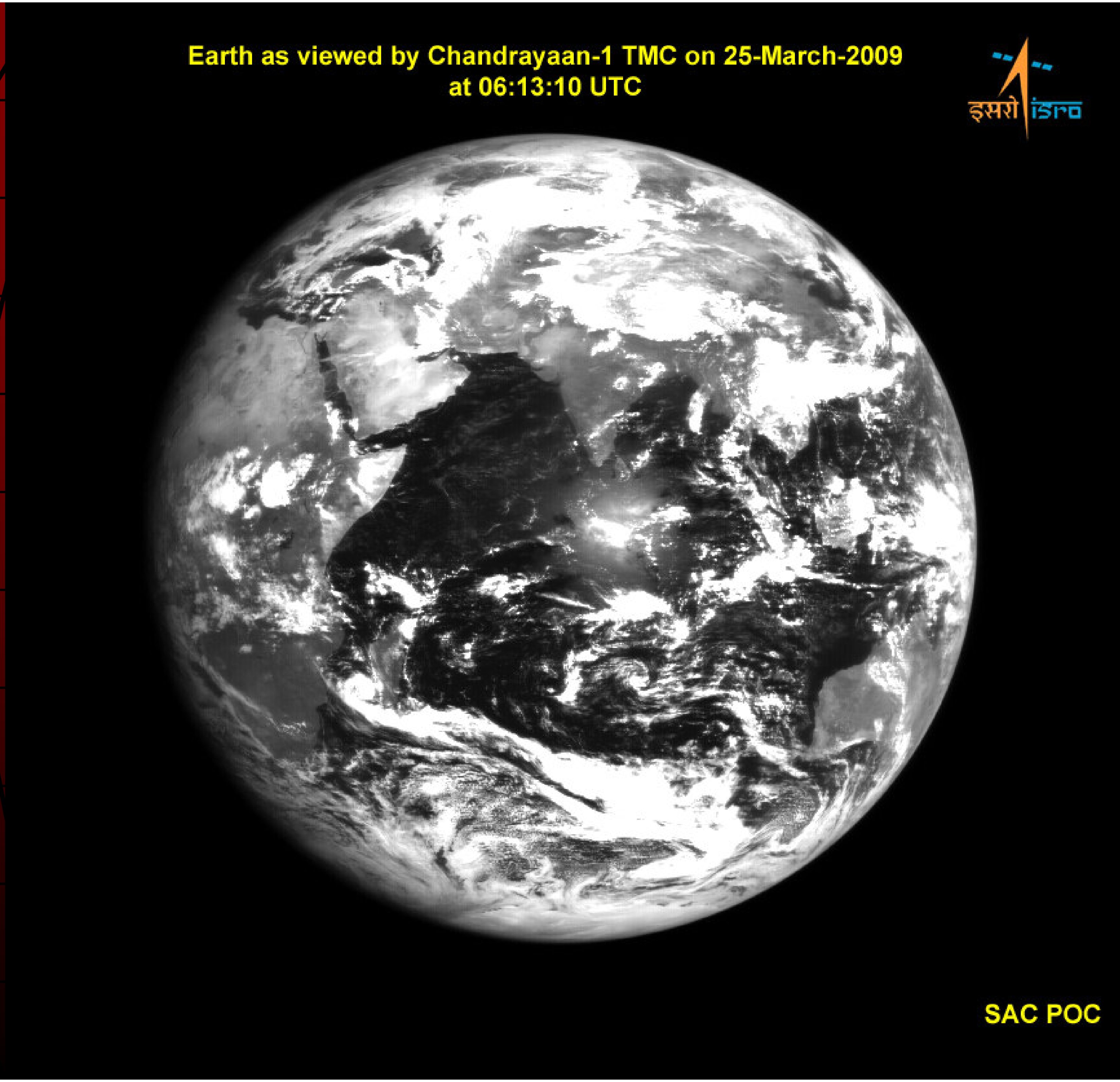
All 64 bands



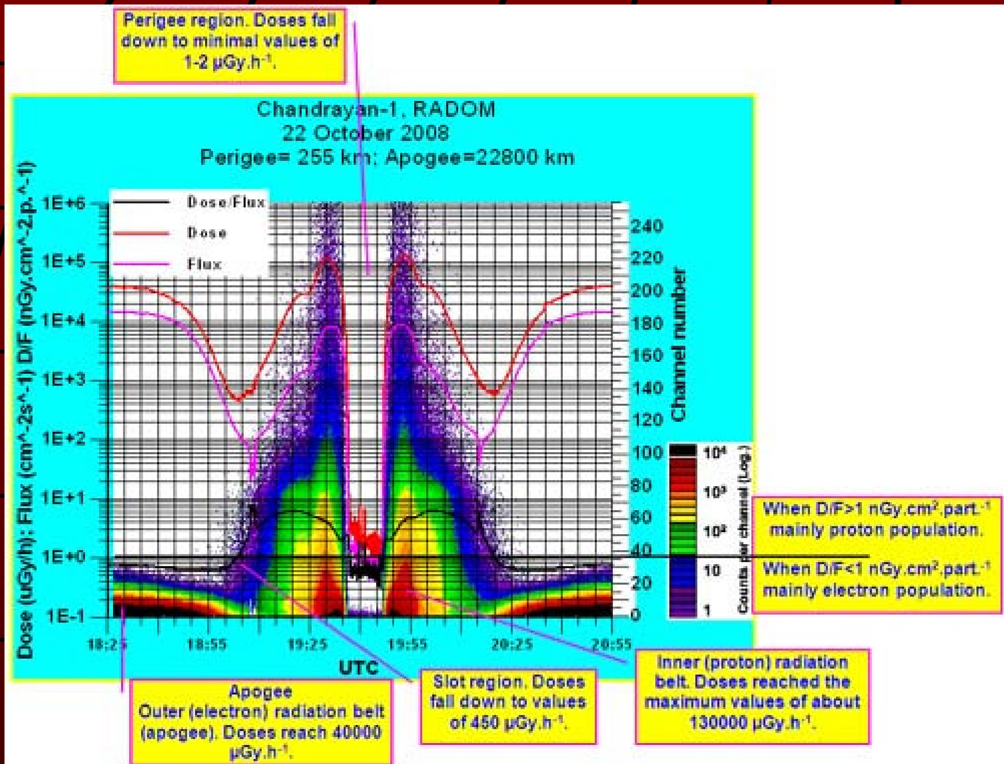
HYSI

All 64 bands

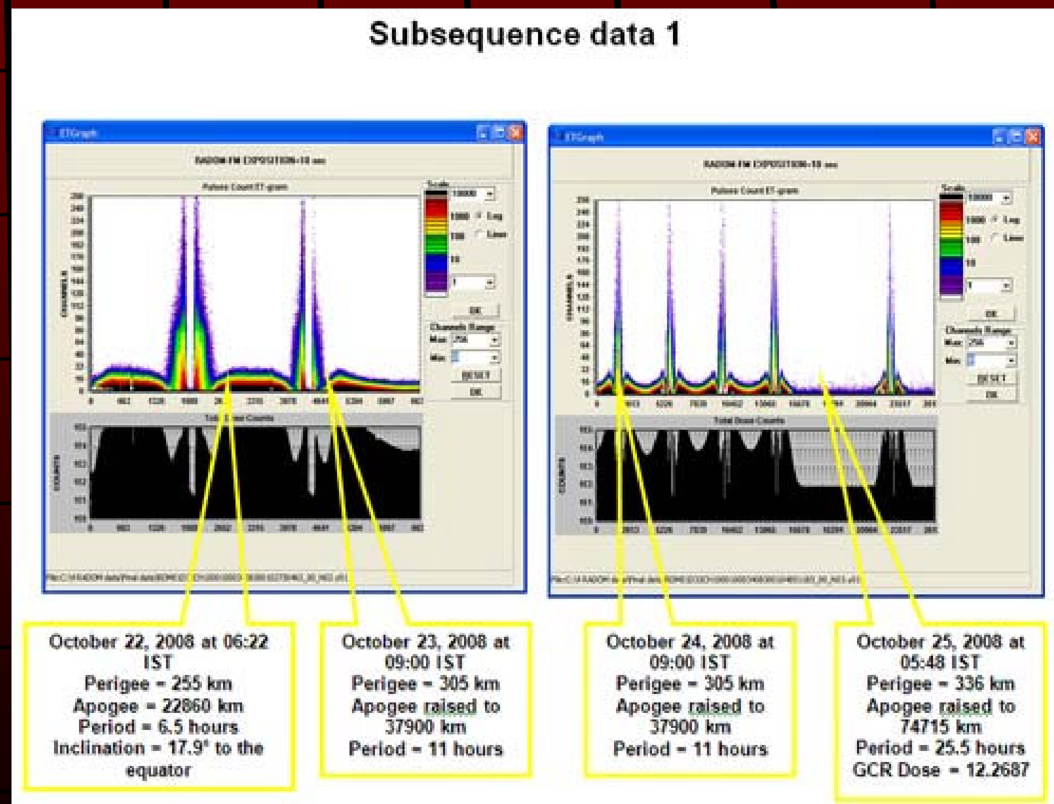
While orbiting around the MOON (100km x 100km)



RADOM



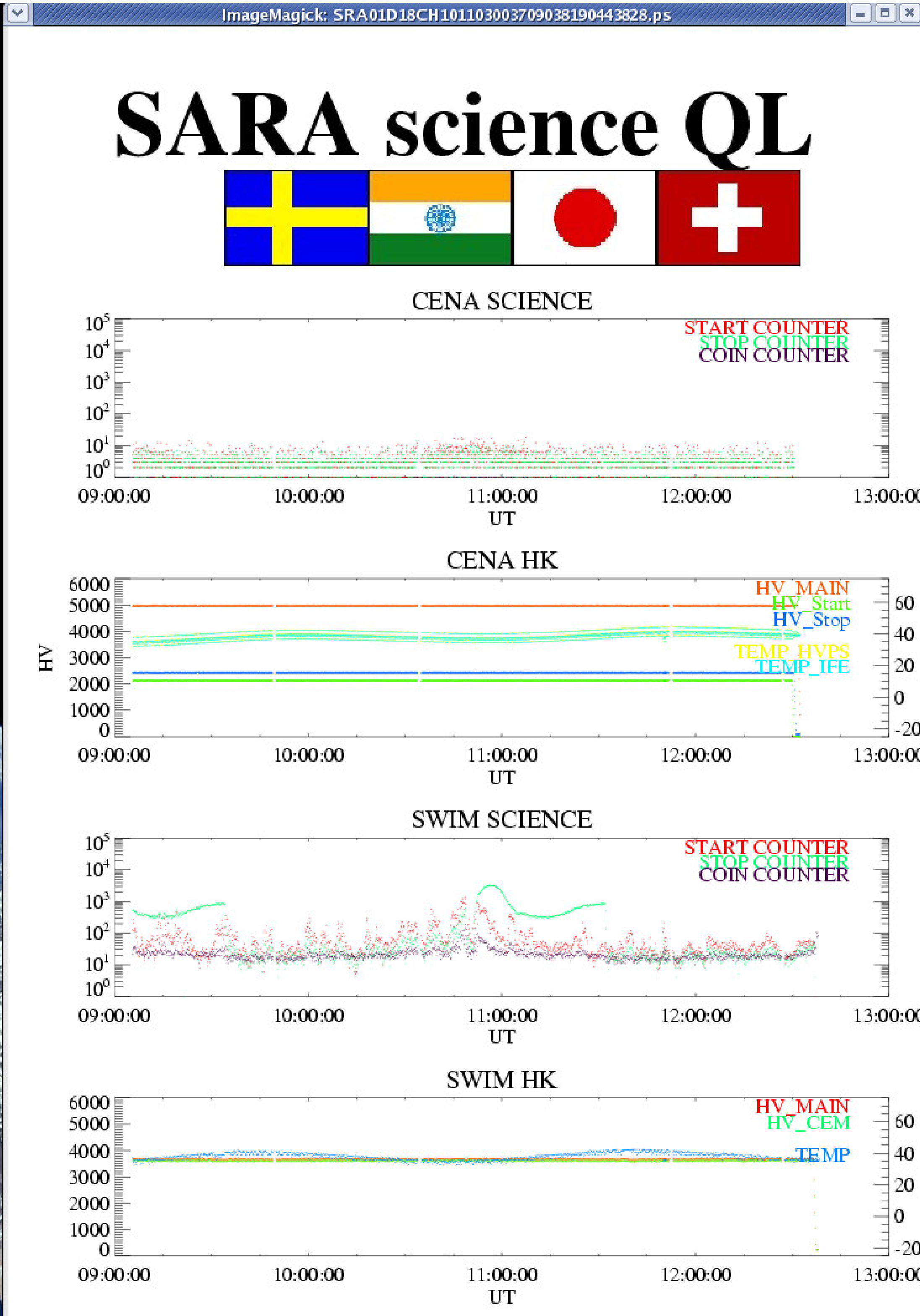
Perigee region. Doses fall down to minimal values of 1-2 μGy.h-1.
Chandrayan-1, RADOM
22 October 2008
Perigee= 255 km; Apogee=22800 km
Dose/Flux
Dose
Flux
Dose (uGy/h); Flux (cm^-2s^-1) D/F (nGy.cm^-2.p.^-1)
1E+6
1E+5
1E+4
1E+3
1E+2
1E+1
1E+0
1E-1
18:25
18:55
19:25
19:55
20:25
20:55
UTC
240
220
200
180
160
140
120
100
80
60
40
20
0
Channel number
Counts per channel (Log)
When D/F>1 nGy.cm2.part-1 mainly proton population.
When D/F<1 nGy.cm2.part-1 mainly electron population.
Apogee
Outer (electron) radiation belt (apogee). Doses reach 40000 μGy.h-1.
Slot region. Doses fall down to values of 450 μGy.h-1.
Inner (proton) radiation belt. Doses reached the maximum values of about 130000 μGy.h-1.



Subsequence data 1
October 22, 2008 at 06:22 IST
Perigee = 255 km
Apogee = 22860 km
Period = 6.5 hours
Inclination = 17.9° to the equator
October 23, 2008 at 09:00 IST
Perigee = 305 km
Apogee raised to 37900 km
Period = 11 hours
October 24, 2008 at 09:00 IST
Perigee = 305 km
Apogee raised to 37900 km
Period = 11 hours
October 25, 2008 at 05:48 IST
Perigee = 336 km
Apogee raised to 74715 km
Period = 25.5 hours
GCR Dose = 12.2687

SARA

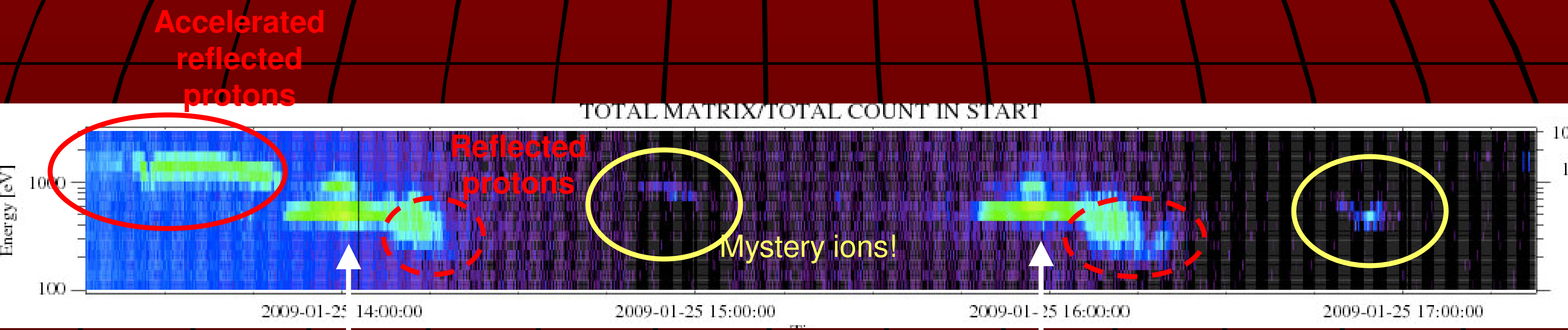
CENA	**Chandrayaan Energetic Neutral Analyzer**
SWIM	**Solar Wind Monitor**
DPU	**Digital Processing Unit**



SARA

Sub-kev Atom Reflecting Analyzer

Solar Wind Monitor : SWIM



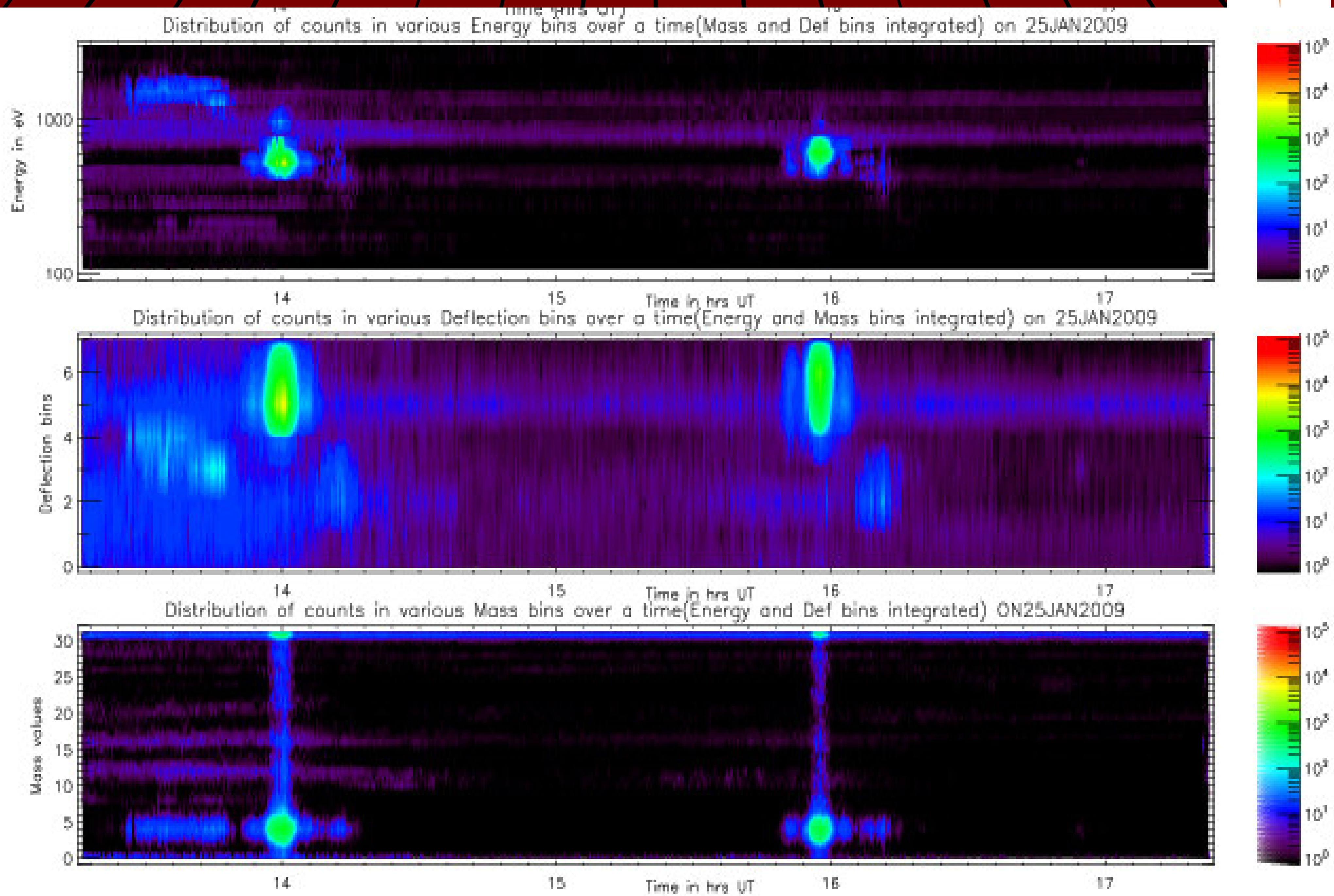
Solar wind

night side

Solar wind

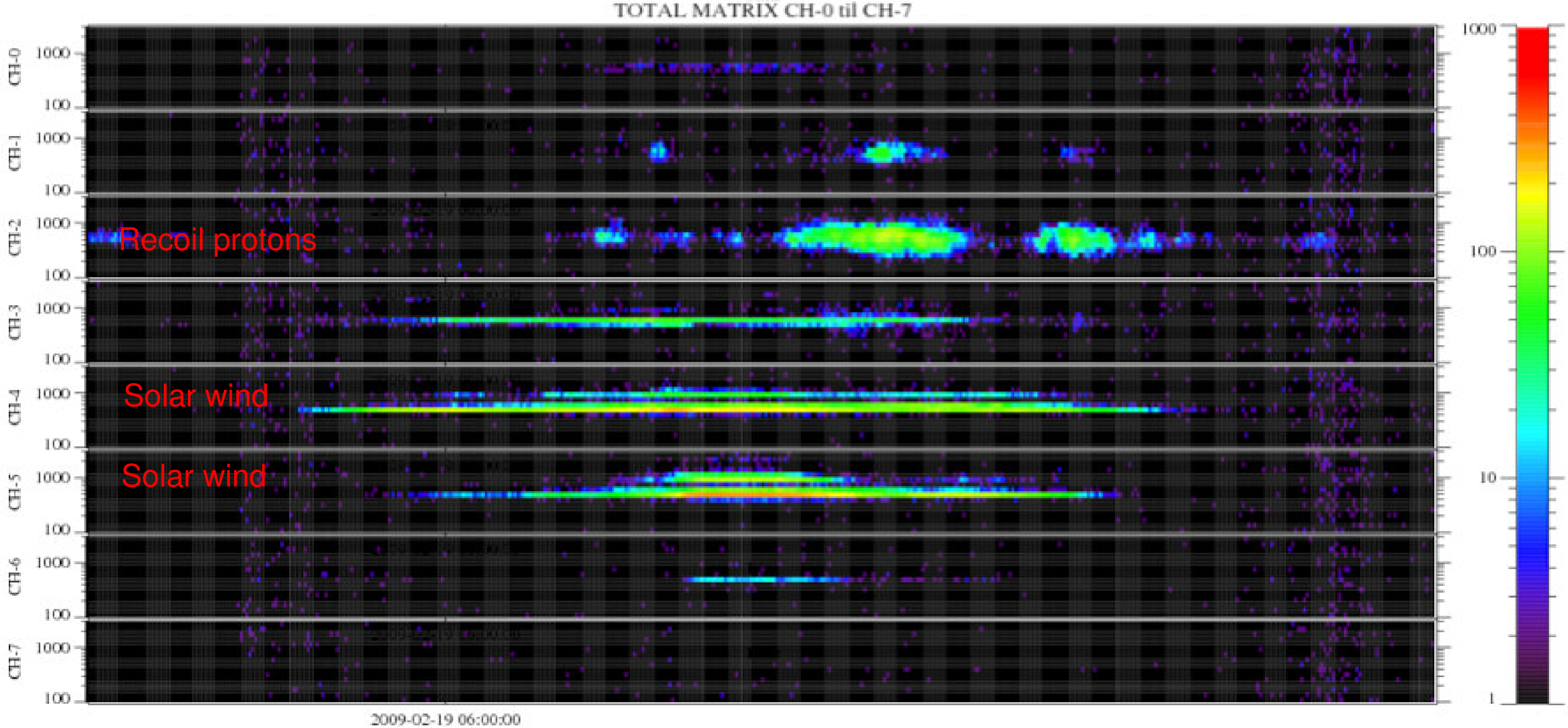
night side

SARA : Swim



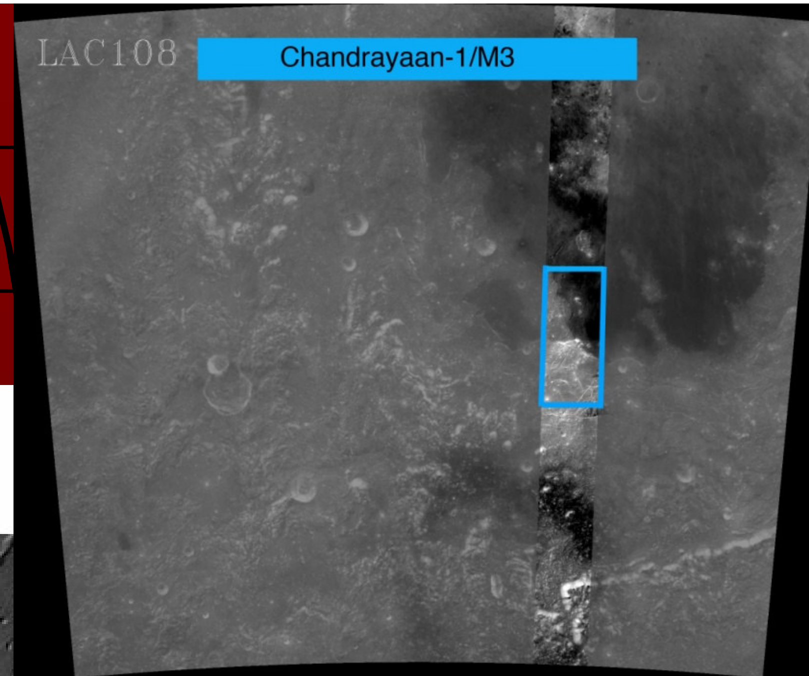
Distribution of counts in various Energy bins over a time(Mass and Def bins integrated) on 25JAN2009
Energy in eV
Time in hrs UT
Distribution of counts in various Deflection bins over a time(Energy and Mass bins integrated) on 25JAN2009
Deflection bins
Time in hrs UT
Distribution of counts in various Mass bins over a time(Energy and Def bins integrated) ON25JAN2009
Mass values
Time in hrs UT

SARA : Swim

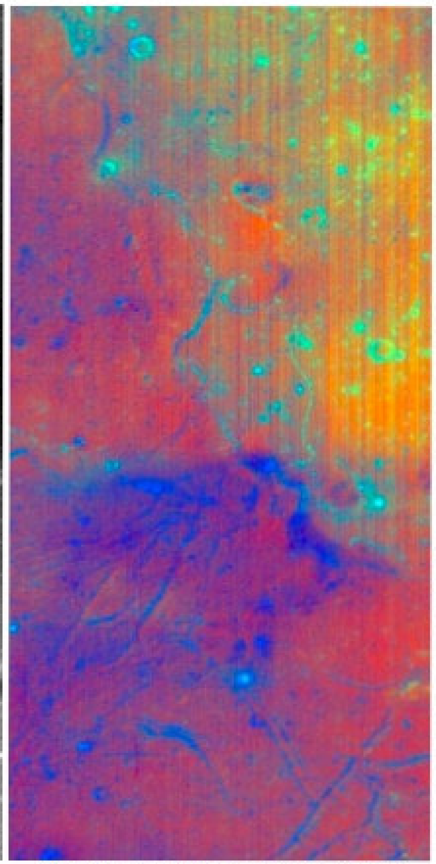


TOTAL MATRIX CH-0 til CH-7
CH-0
CH-1
CH-2
CH-3
CH-4
CH-5
CH-6
CH-7
1000
100
Recoil protons
Solar wind
Solar wind
2009-02-19 06:00:00
1000
100
10
1

Moon Mineralogy Mapper



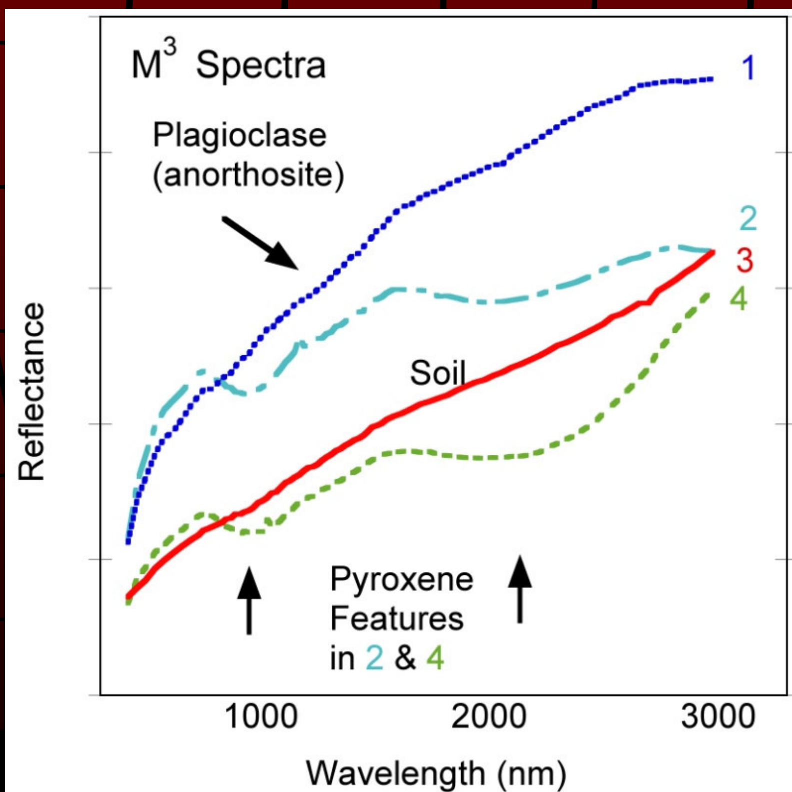

750 nm (reflected)


NIR Slope & Integrated band depth
[28 spectral channels used together]

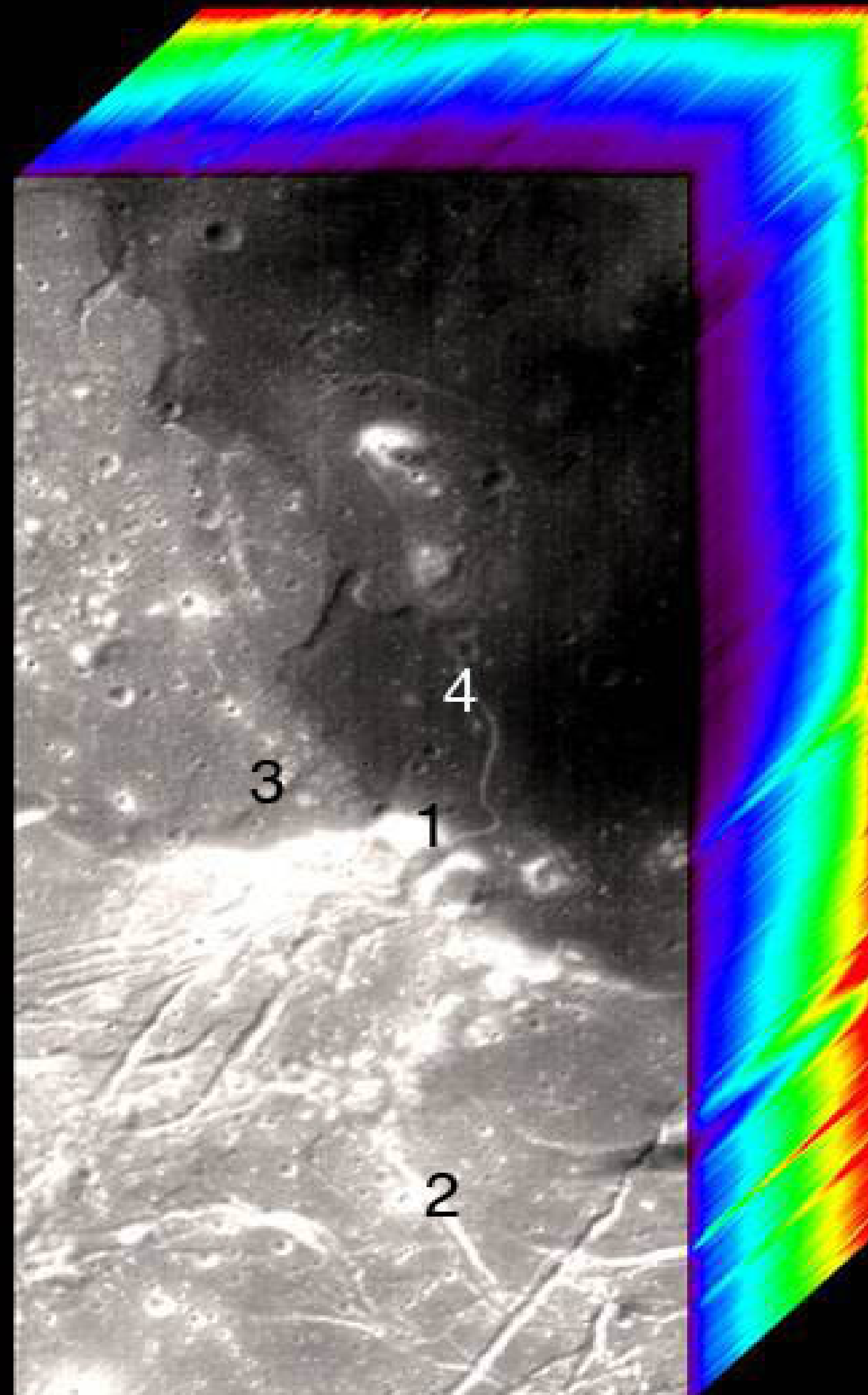

2940 nm (thermal)

Moon Mineralogy Mapper (MMM)

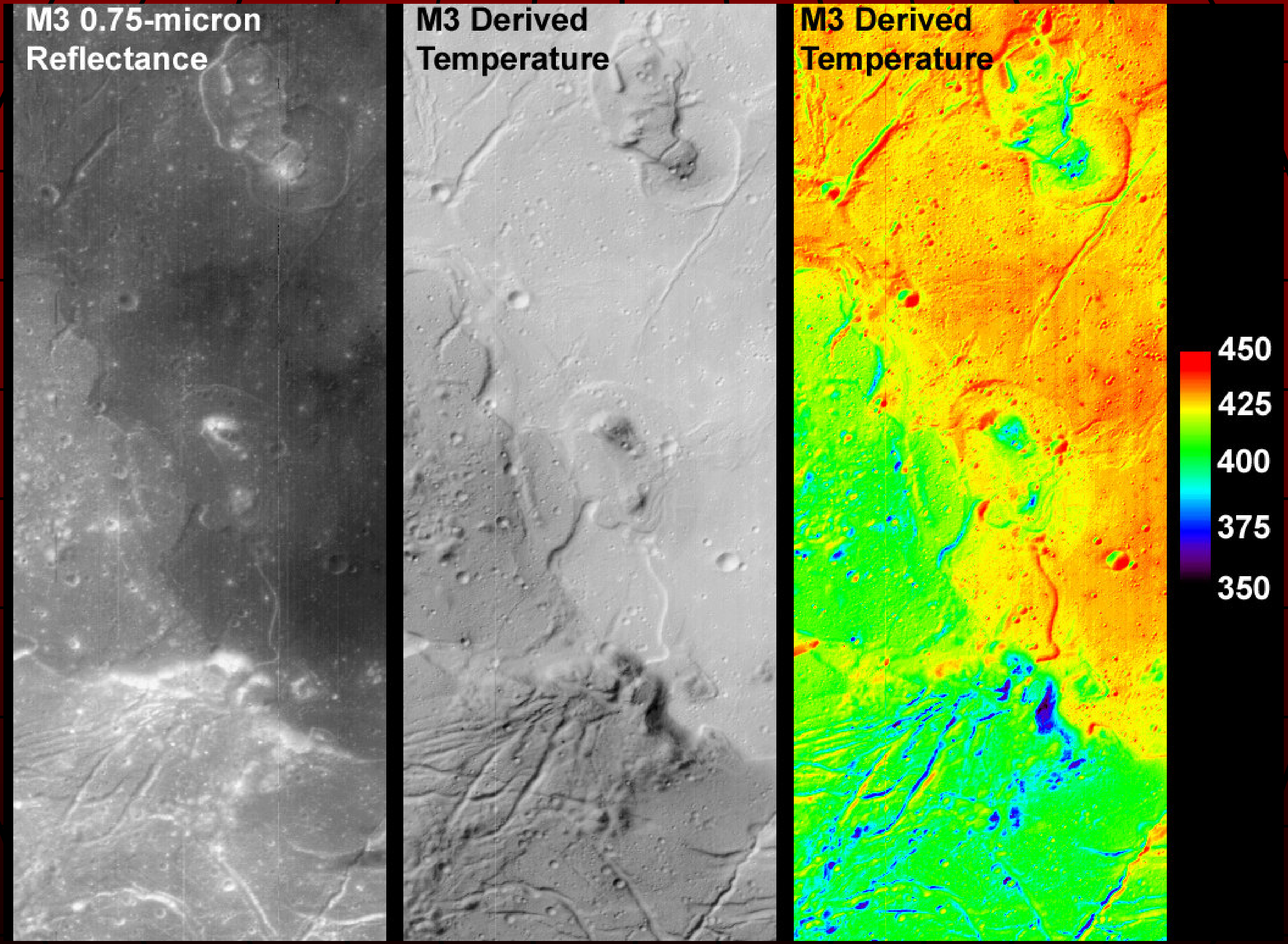
3D Moon Imaging



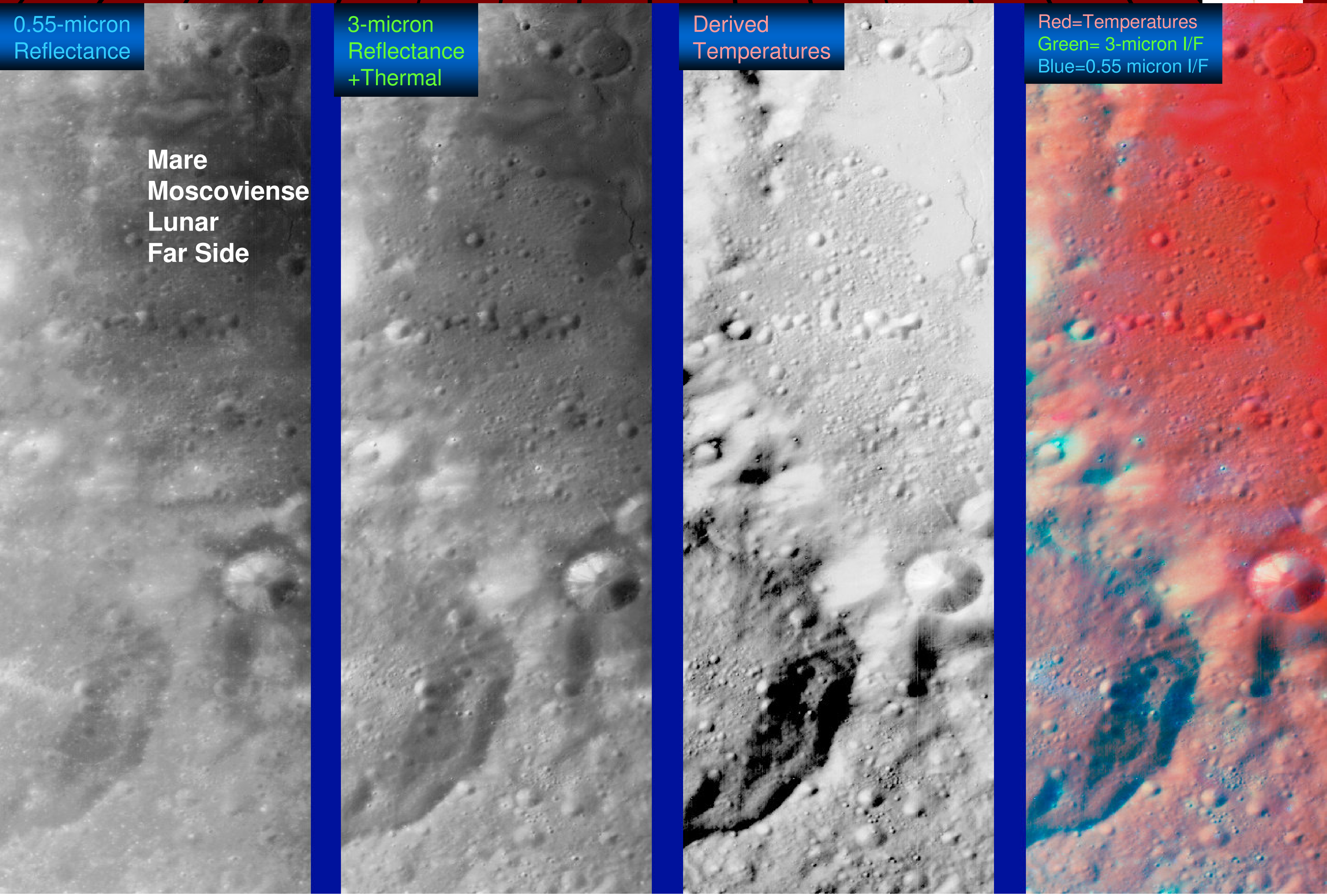
MMM/Chandrayaan-I



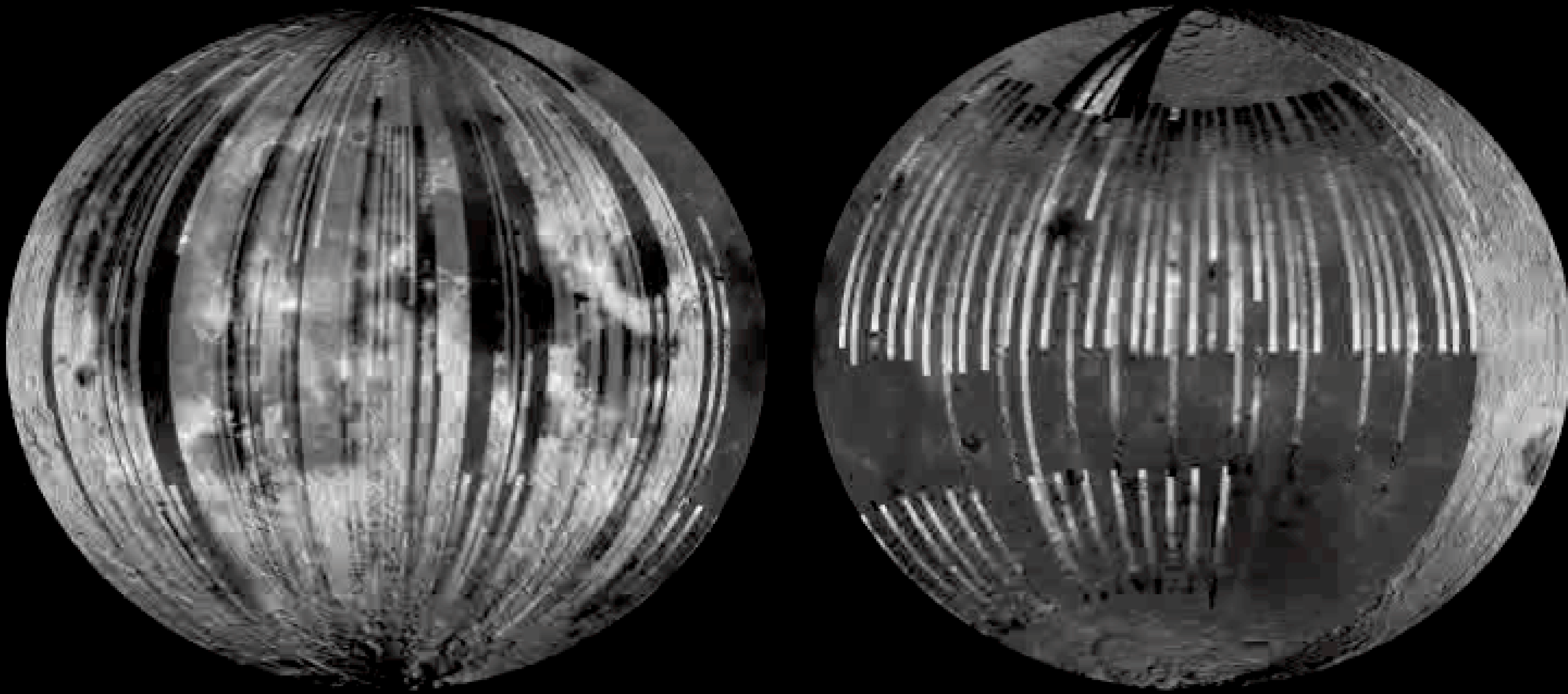
Moon Mineralogy Mapper

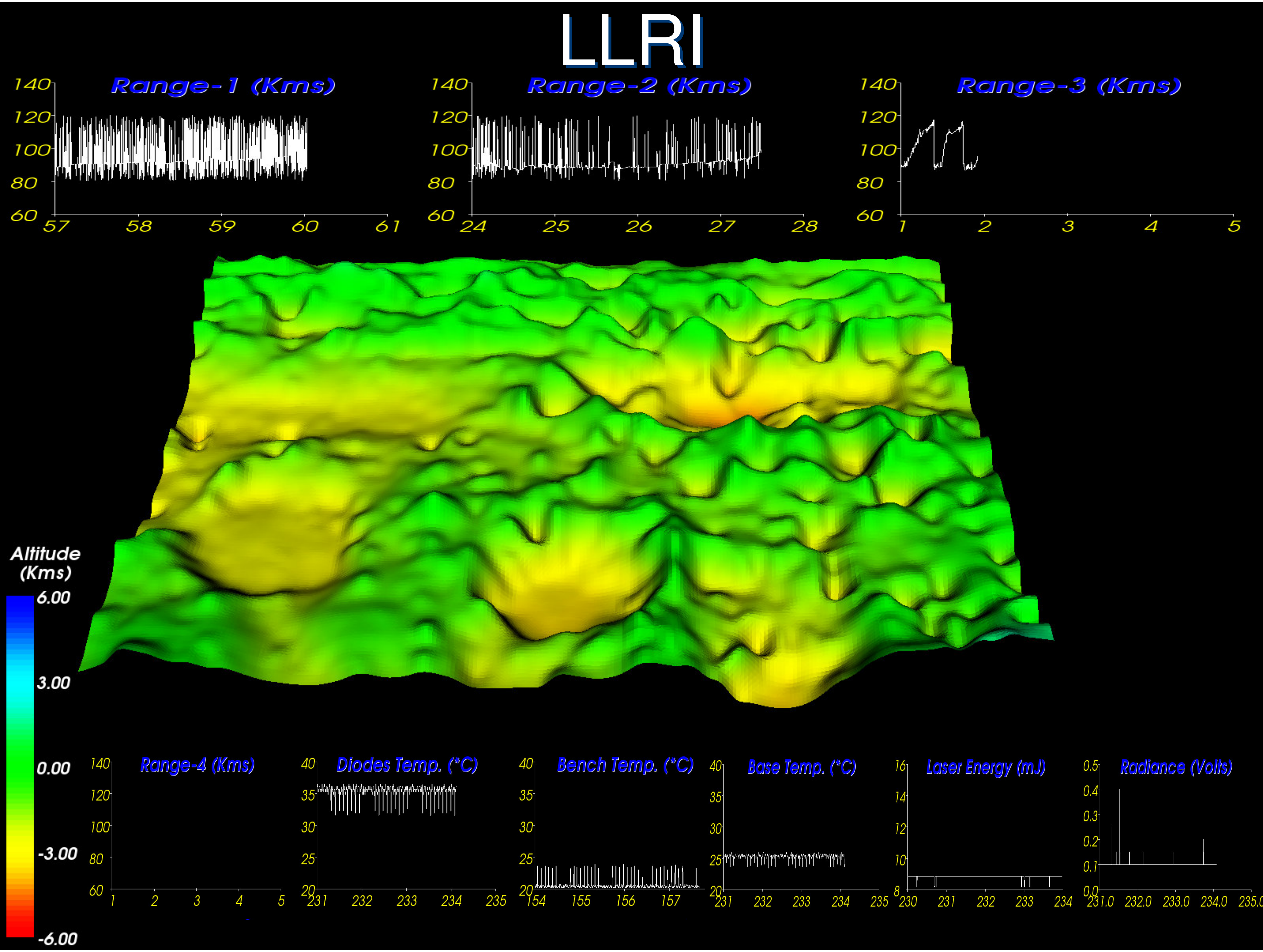


Moon Mineralogy Mapper

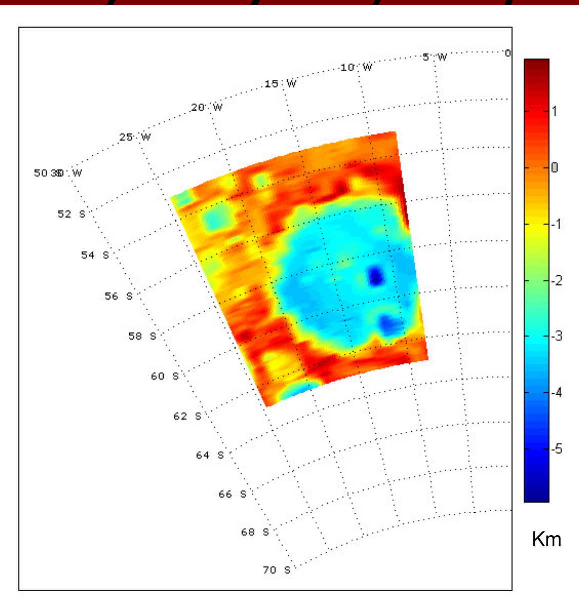


MMM Coverage

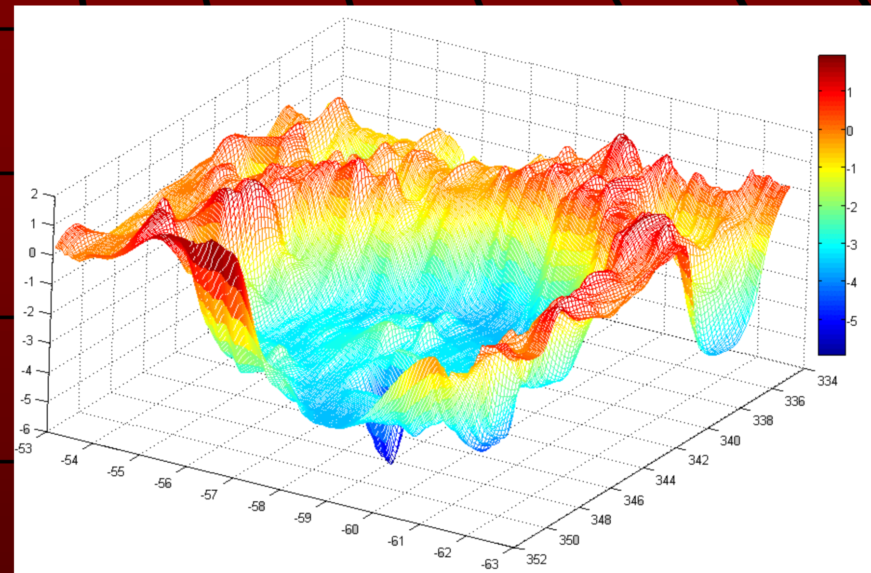


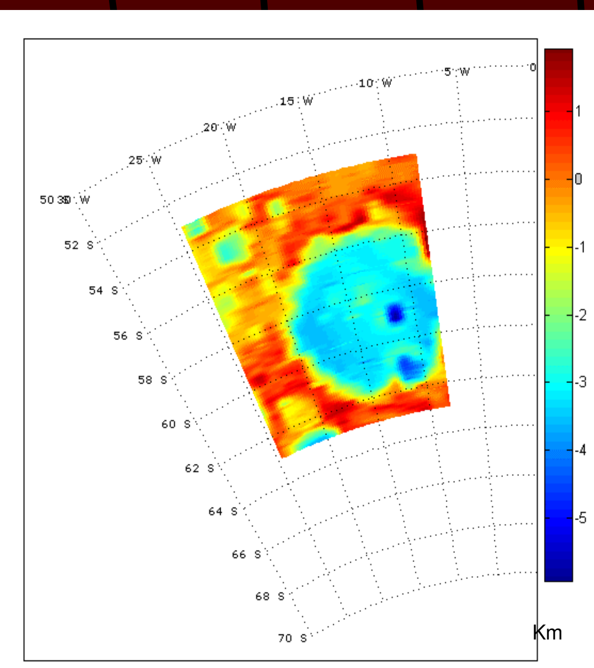

LLRI
Range-1 (Kms)
Range-2 (Kms)
Range-3 (Kms)
Altitude (Kms)
6.00
3.00
0.00
-3.00
-6.00
Range-4 (Kms)
Diodes Temp. (*C)
Bench Temp. (*C)
Base Temp. (*C)
Laser Energy (mJ)
Radiance (Volts)

LLRI

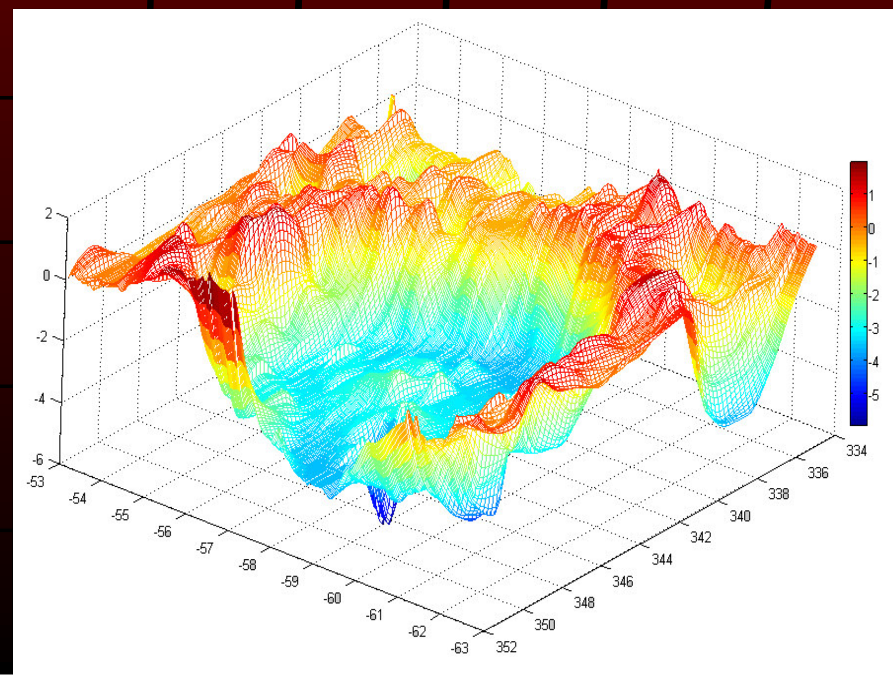


CLAVIUS Crater Topography from Range - 3 / 4 data

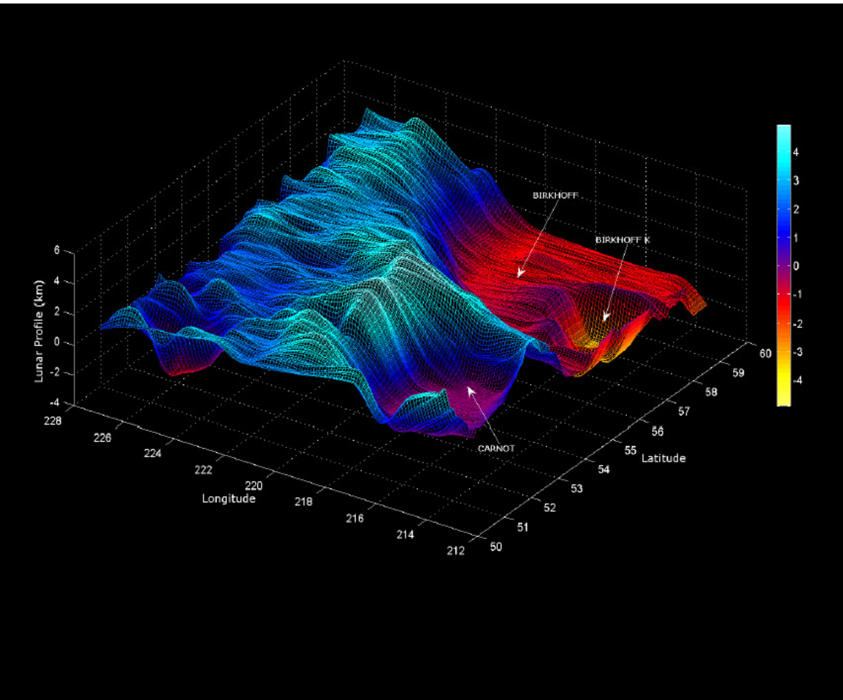


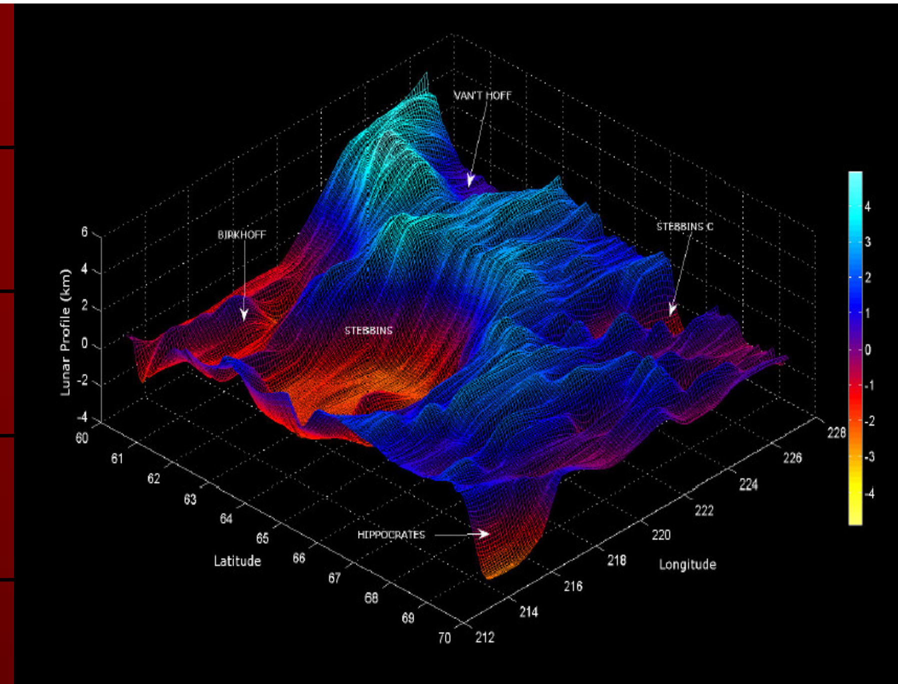


CLAVIUS Crater Topography from Range- 1 / 2 data



LLRI





BIRKOFF & CARNOT

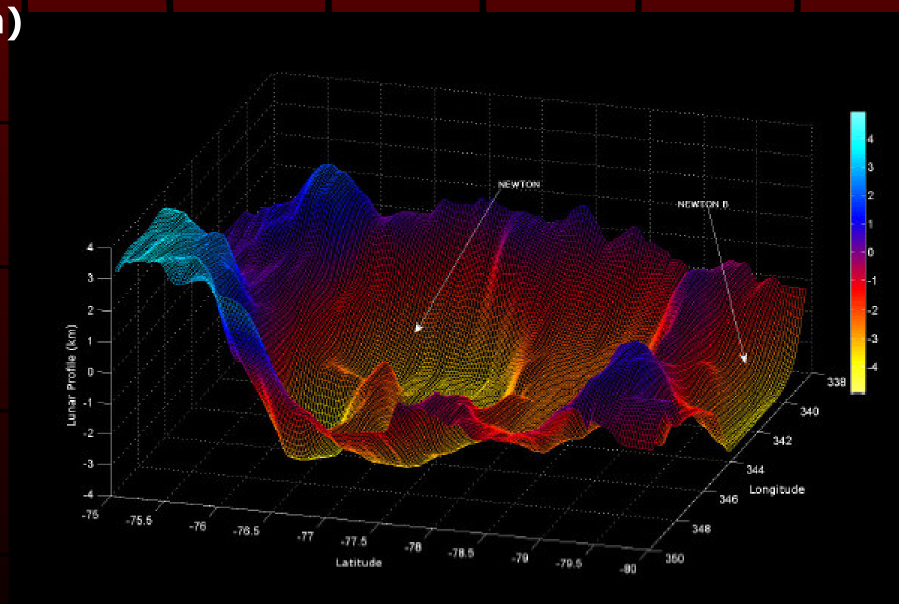
BIRKHOFF

Location : Farside (North)
Latitude : 58.7^0 N
Longitude : 146.1^0 W
Diameter : ~345 km
Depth : 4200m

STEBBINS & VAN'T HOFF

STEBBINS

Location : Farside (North)
Latitude : 64.8^0 N
Longitude : 141.8^0 W
Diameter : ~131 km
Depth : 4500m



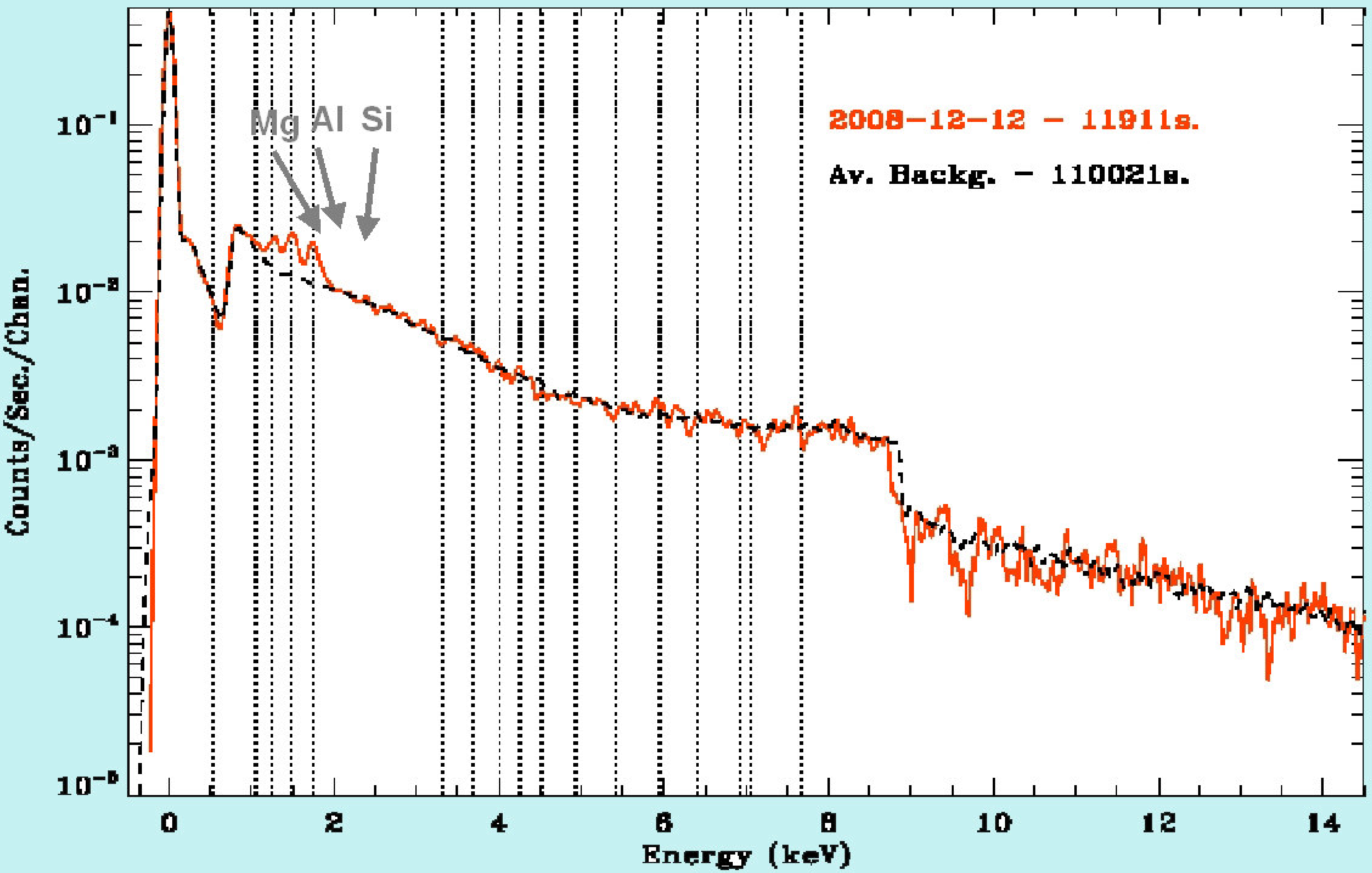
NEWTON

NEWTON

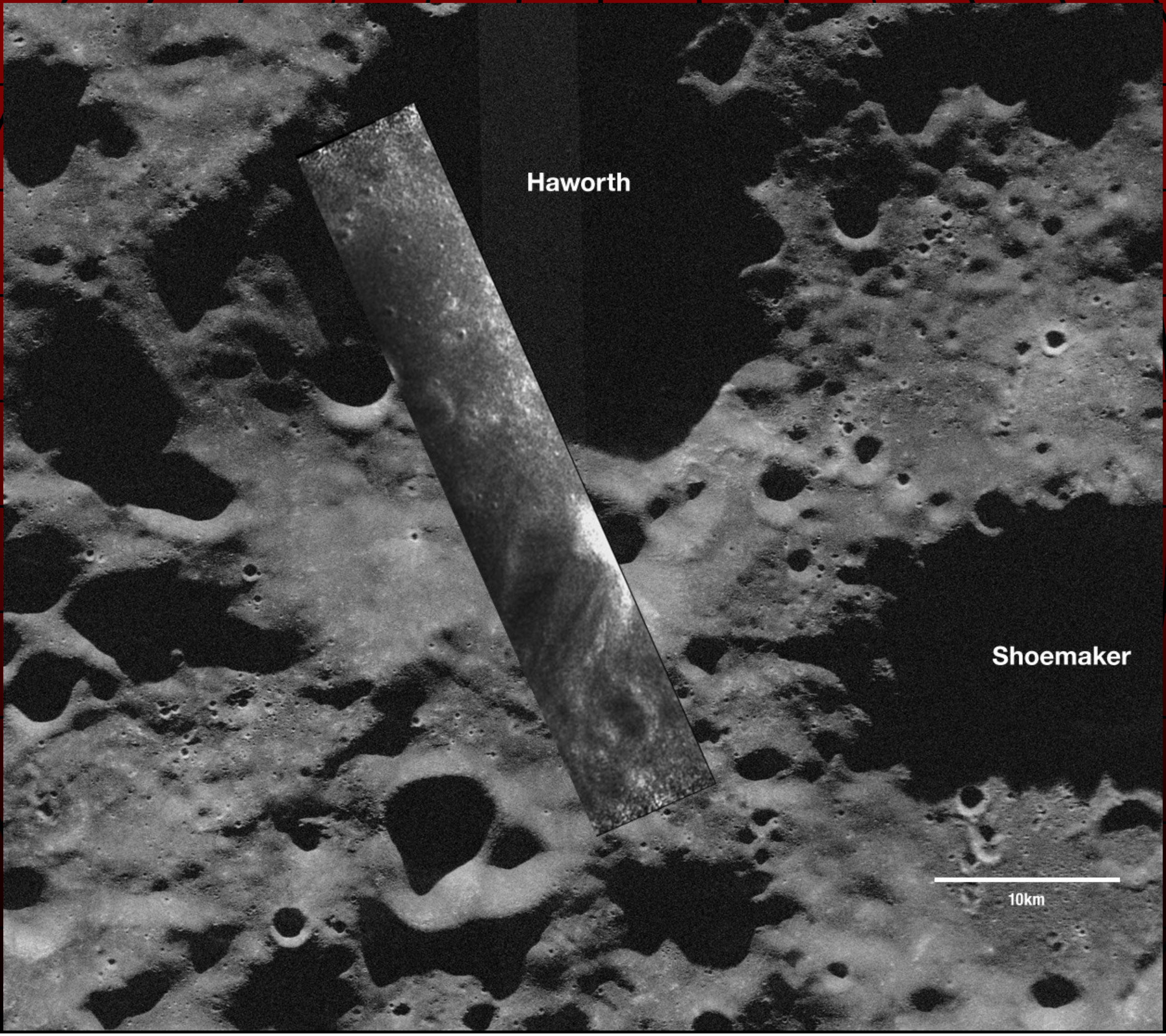
Location : Nearside (North)
Latitude : 76.7^0 N
Longitude : 16.9^0 W
Diameter : ~79 km
Depth : 4800m

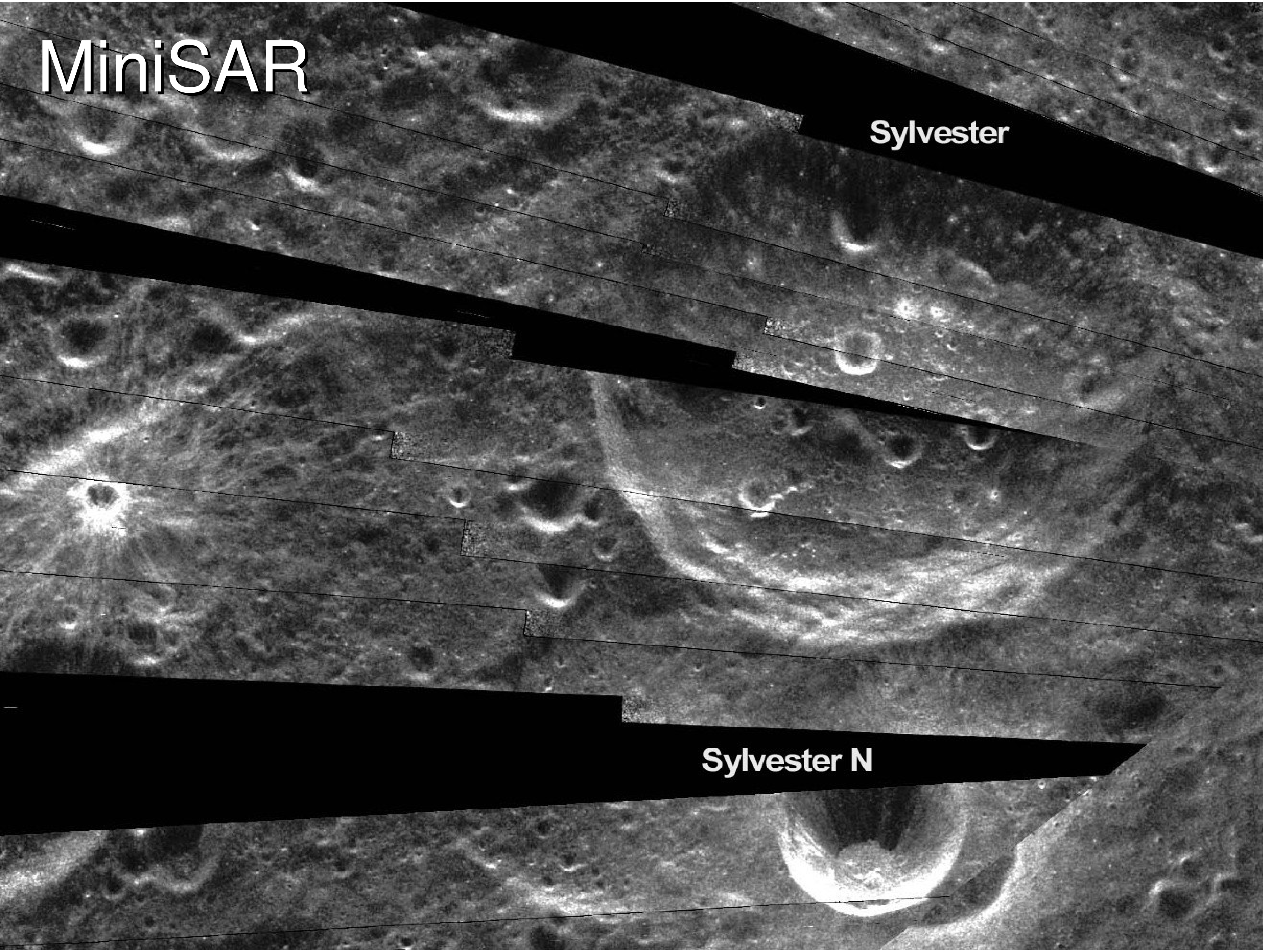
C1XS

First lunar spectrum under flare

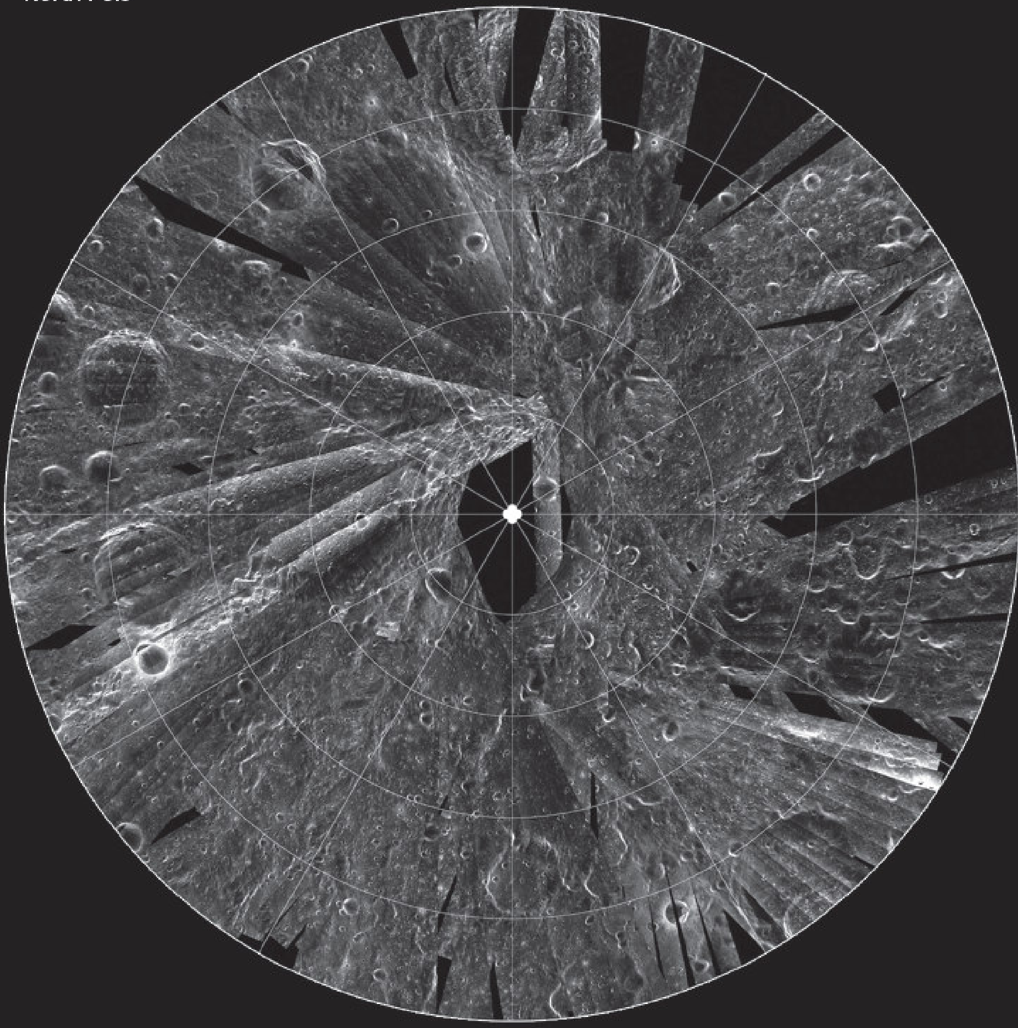


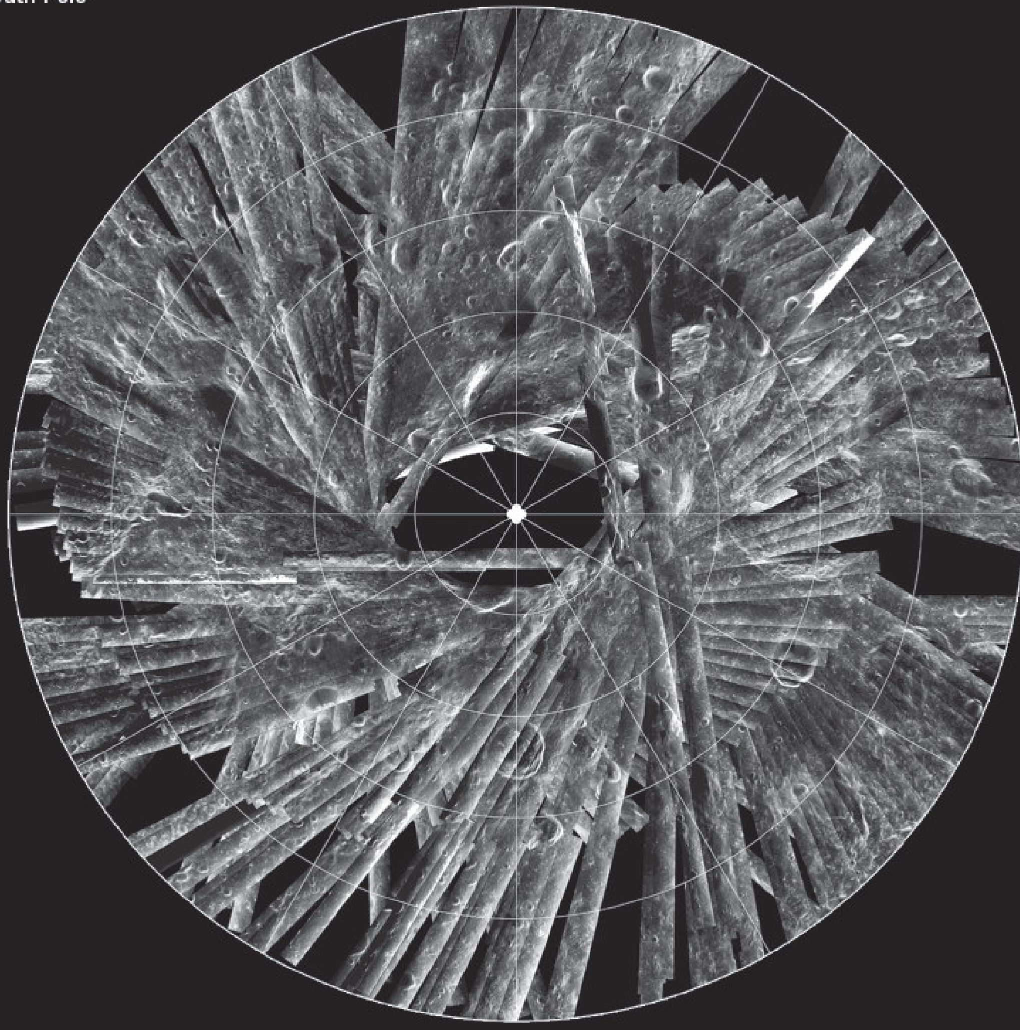
MiniSAR




MiniSAR
Sylvester
Sylvester N

MiniSAR Coverage





Lunar-polar mosaics showing data collected by Mini-RF on Chandrayaan-1 during its first imaging season. The mosaics cover within 10° latitude of each pole.

Chandrayaan-I

Thank you