The X Ray Spectrometers on SMART-1 and CHANDRAYAAN-1

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How D-CIXS works

1 The Sun shines on the Moon (in X rays)
2 The Moon fluoresces
3 Each X-ray energy indicates unambiguously the abundance of a particular element
4 D-CIXS detects these X-rays
5 Solar Monitor for Solar Input required for absolute abundances
D-CIXS uses Two New Technologies

- Swept Charge Device (SCD) Detectors
- Advanced Microstructure Collimator

To provide:
- High sensitivity to weak Lunar signal
- Compact, light design
- No need for active cooling
Solar Flare
15 Jan 2005
X-ray signatures of Chemical Elements

First ever remote sensing measurements of Ca at the Moon

![Graph showing X-ray signatures of Mg, Al, Si, Ca, and Fe]
Ground Tracks of Chemical Elements

Red facet sees Mare Crisium between dotted lines
Elsewhere both facets see Highlands

'SMART-1 – end of mission' press conference
04 September 2006
ESOC – Darmstadt, Germany
Detailed task of fitting Lunar composition to the data.

This is close to the Apollo 12 landing site.
Lunar observations

• The instrument observes Mg, Al, Si, Ca, Fe at the Moon
• Data match the underlying topography
• Soviet Luna samples give ground truth
• These are the first ever remote sensing measurements of Ca content at the Moon
• D-CIXS was still successfully returning data 2 seconds before impact
Unanswered questions about the Moon

What D-CIXS tells us

- How did the Earth-Moon system form?
  - Giant Impact?

- How has the Moon evolved since?
  - Magma ocean?

- Necessary data for the answer
  - Composition (Mg, Al...)
The Solar Cycle of X-ray Illumination

D-CIXS flew at the worst time

C1XS on Chandrayaan-1 will fly at the best!
INDIA’S FIRST MISSION TO MOON

CHANDRAYAAN-1

To achieve 100 x 100 km Lunar Polar Orbit.
PSLV to inject 1050 kg in GTO of 240 x 36000 km.
Lunar Orbital mass of 523 kg with 2 year life time.
Scientific payload 55 kg.

Expanding the scientific knowledge about the moon, upgrading India’s technological capability
and providing challenging opportunities for planetary research for the younger generation.
D-CIXS is a technology experiment

The proof of a technology experiment was to do great science!

Now we have proved the technique, we can use it all round the Solar System
D-CIXS is dead

Long Live C1XS!
C1XS/DCIXS - The Team

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