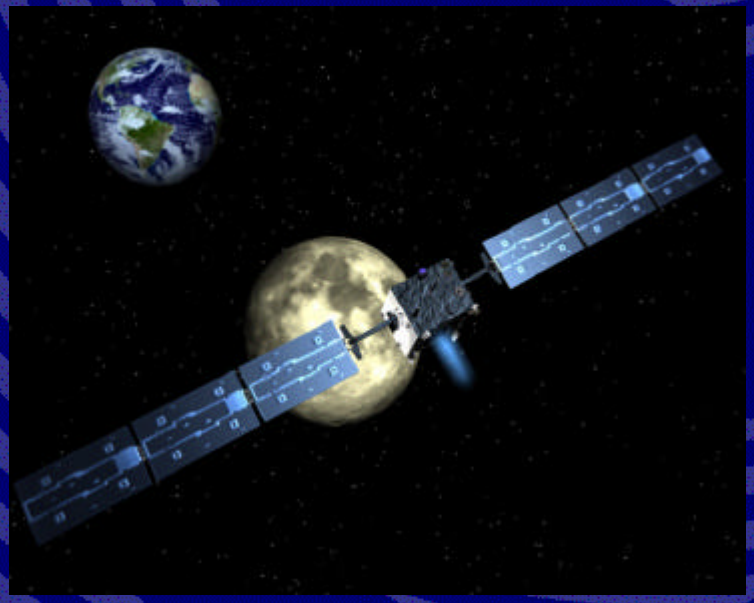
S M A R T - 1 e x p e r i m e n t s

W e l c o m e t o t h e M o o n



Bernard H. FOING

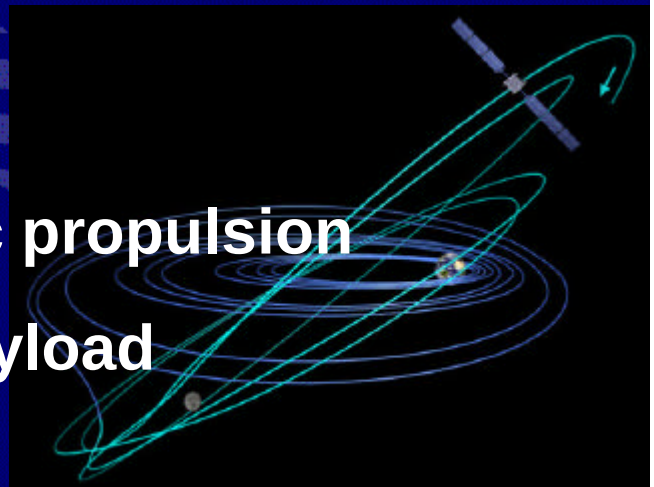
Chief Scientist & SMART-1 Project Scientist

ESA/ESTEC

SMART-1 Media Day
3 April 2003
ESTEC

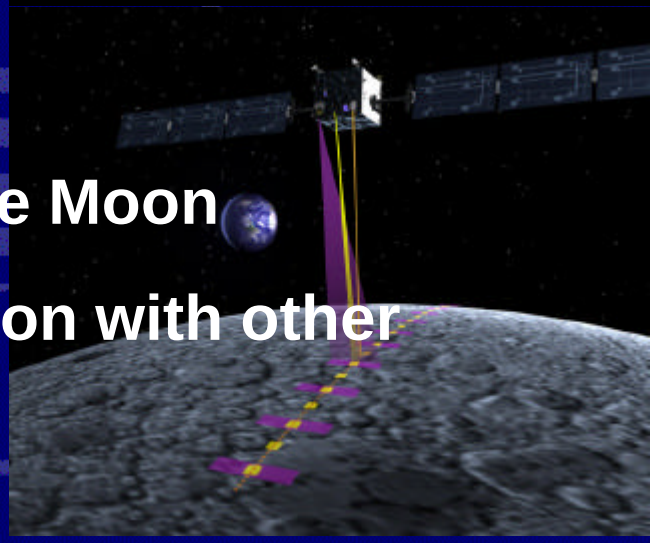
Smart-1 is not only

- ✓Getting to the Moon by solar electric propulsion
- ✓Testing challenging miniaturised payload



Smart-1 is also

- ✓Making new exciting science on the Moon
- ✓Working in international collaboration with other Lunar missions



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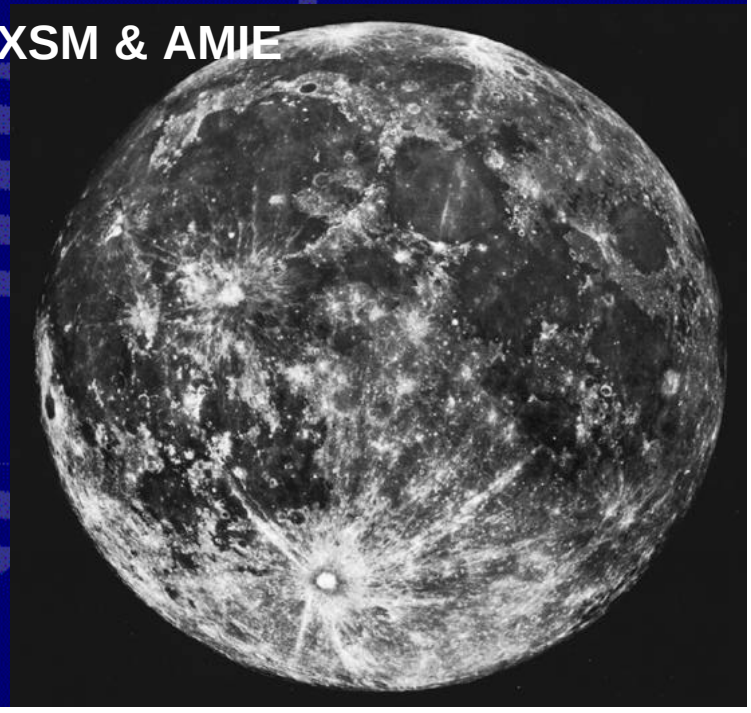
7 experiments and 10 investigations

1. **Testing new techniques on the way to the Moon**
   - EPDP and SPEDE
   - KATE and RSIS
   - Laser Link
   - OBAN
2. **Performing cruise science** D-CIXS, XSM & AMIE
3. **Observing the Moon**
   - AMIE
   - SIR
   - D-CIXS & XSM
   - SPEDE & RSIS



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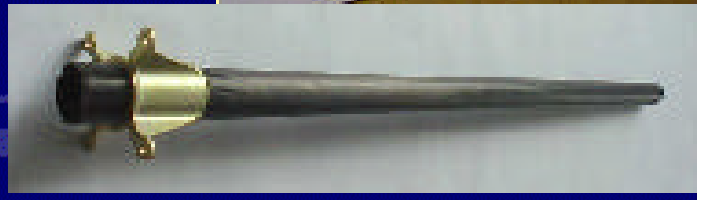
1. Testing new techniques on the way to the Moon

EPDP and SPEDE will monitor:

- how the ion engine performs
- what are the possible side effects on spacecraft and instruments
- how the spacecraft interacts with natural electromagnetic phenomena in the space around it



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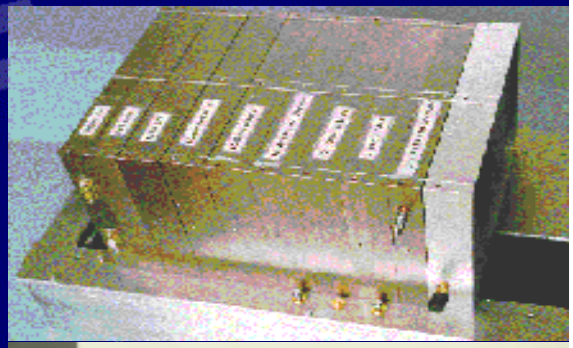
1. Testing new techniques on the way to the Moon

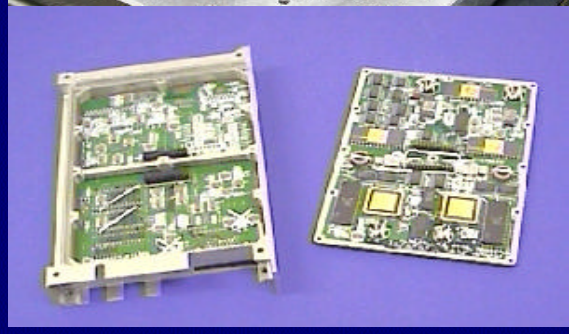
RSIS will:

- determine what is the precise thrust delivered by the ion engine

KATE will:

- demonstrate the next generation of high bandwidth radio links between the Earth and far-flung spacecraft (deep space communication)





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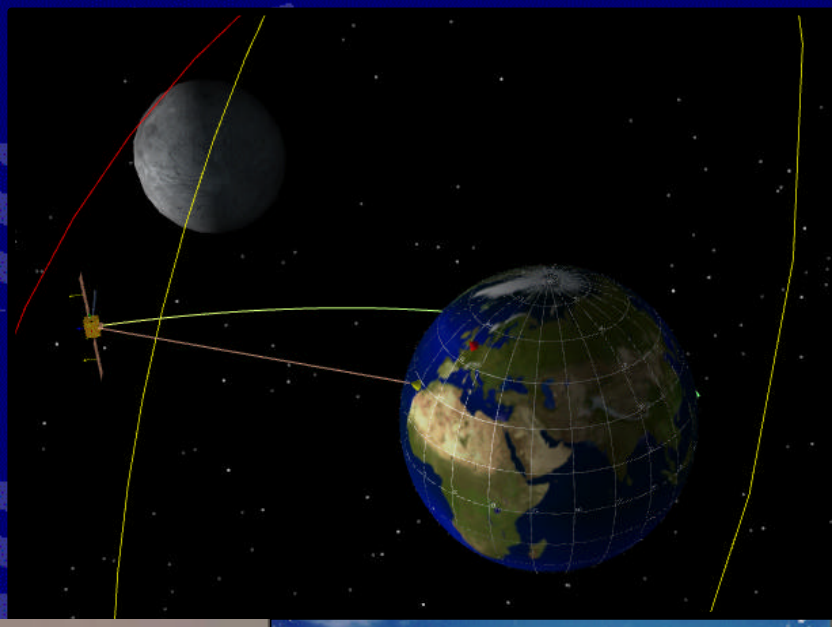
Smart-1

1. Testing new techniques on the way to the Moon

The Laser Link experiment will:

- test laser beaming from Earth to a camera on a fast moving spacecraft for communication purposes



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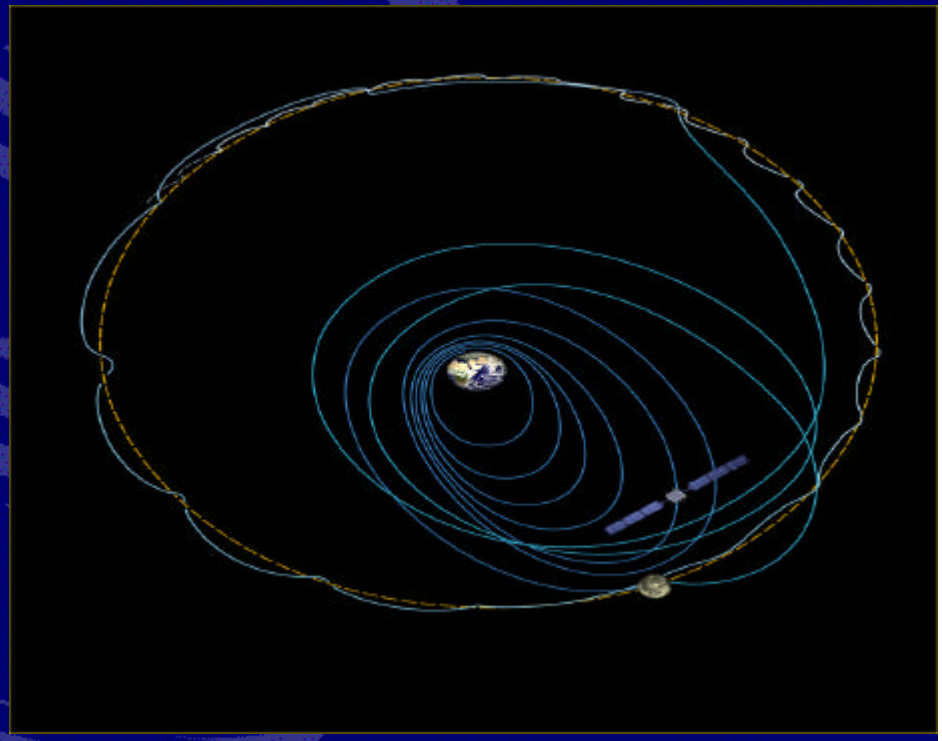
1. Testing new techniques on the way to the Moon

OBAN will:

- evaluate a computer technique for on-board autonomous navigation

  using images of the Moon, Earth, asteroids taken with AMIE referred to the stars seen by the star tracker



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S m a r t - 1

2 . P e r f o r m i n g c r u i s e s c i e n c e

to test in space the instruments performance

D-CIXS will:

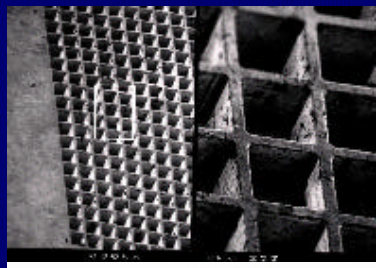
- monitor the X-ray variability of the Earth magnetosphere and bright X-ray sources

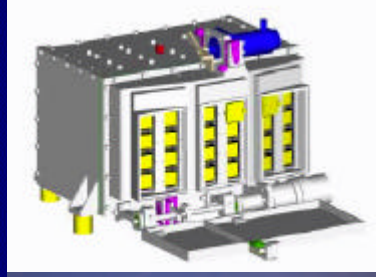
XSM will:

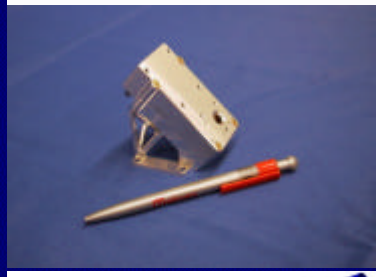
- monitor continuously the solar variation in X-ray due to active regions of the Sun and solar flares

AMIE will:

- deliver images of the Earth and the Moon, for calibration but also for public and education projects







S m a r t - 1

3 . O b s e r v i n g t h e M o o n . W h y ?

After Apollo/Luna (35 years ago) and more recent lunar missions the knowledge of the Moon is still surprisingly incomplete…

We still want to know about:

- **How the Earth-Moon system and rocky planets formed and evolved** (geochemistry and giant bombardment)

- **Geophysical processes** (volcanism, tectonics, cratering, erosion, deposition of ice and volatiles…)

- **How to prepare for future lunar and planetary exploration** (resources and landing sites)

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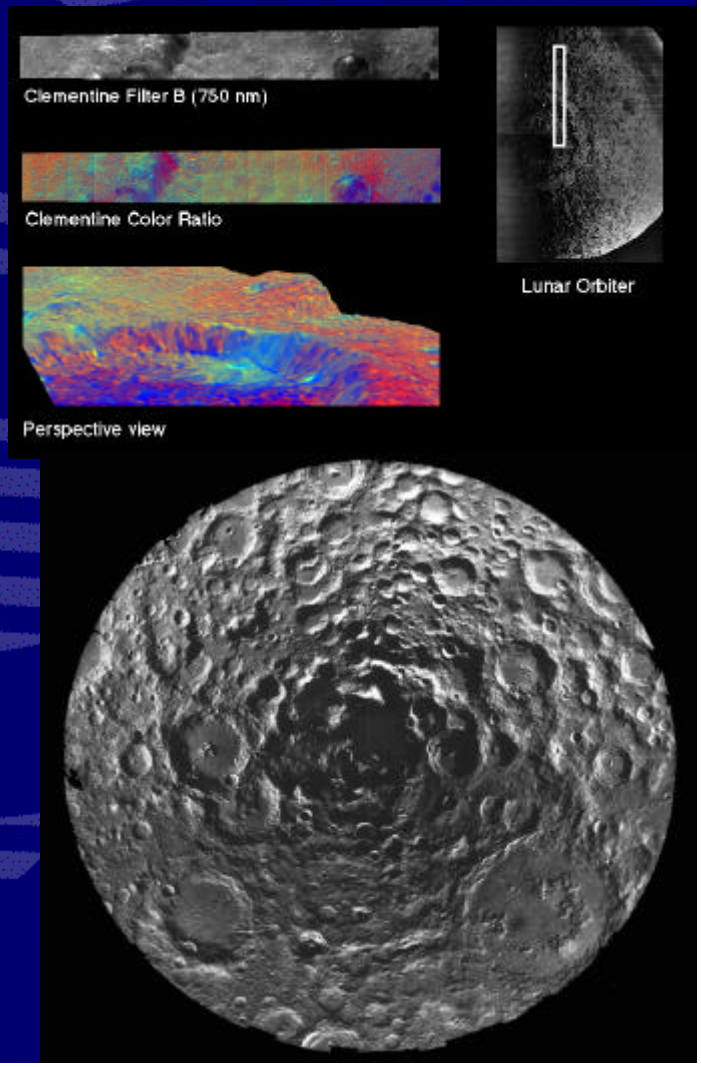
3. Observing the Moon

AMIE, the mini camera, will make multicolour imaging of the Moon for:

- High resolution geology
- Stereo, multi-angle imaging
- Survey landing sites for sample return
- Repeated deep imaging of south pole
- Mapping ‘eternal’ light and shadow
- Search for potential water ice traps
- Potential for lunar bases, power, resources
- Preparation for future lunar exploration



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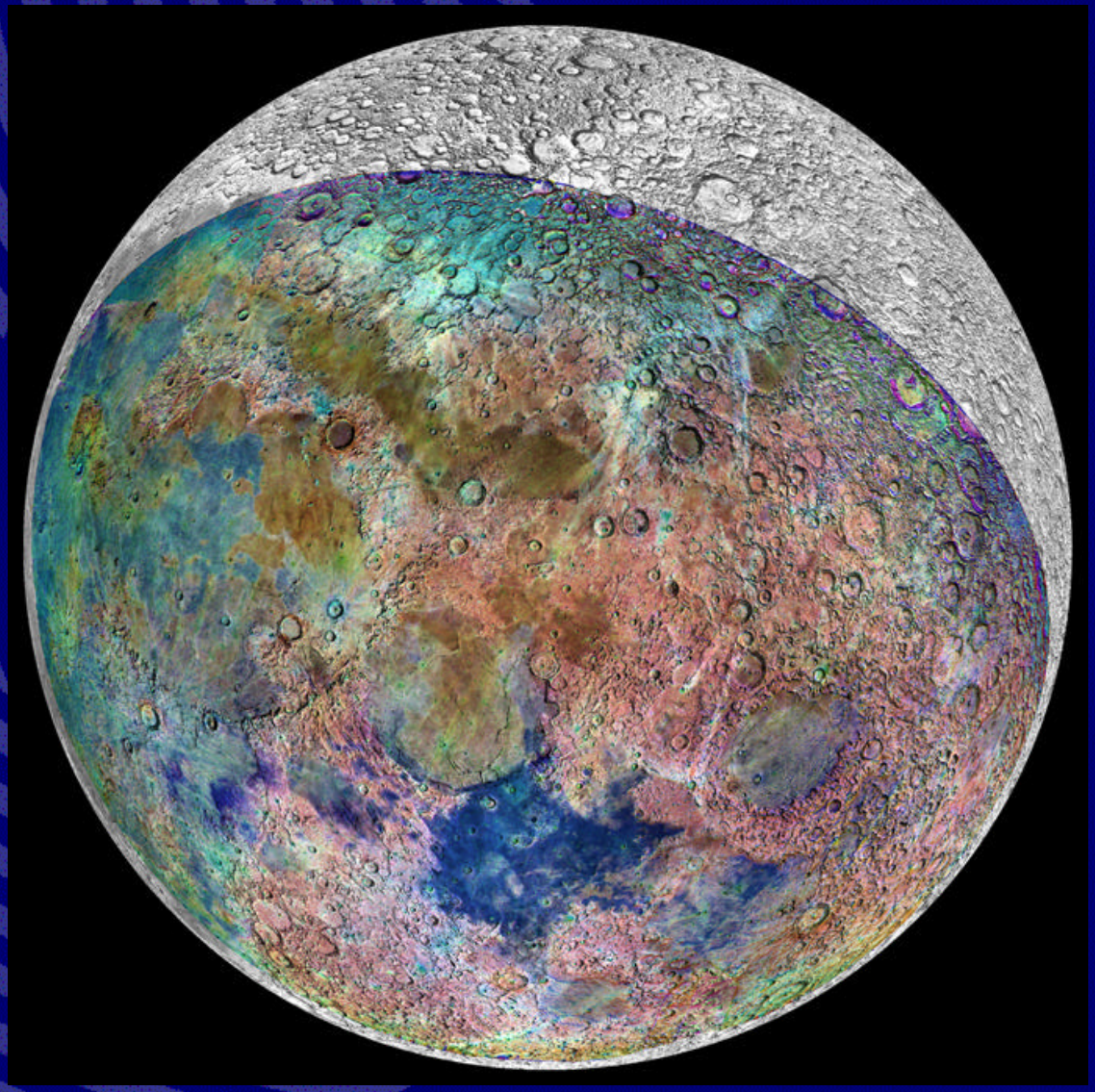
The colours of the Moon



Galileo lunar fly-by

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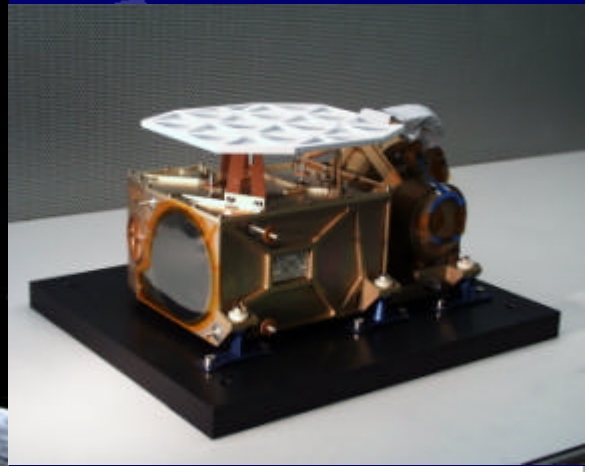
S m a r t - 1

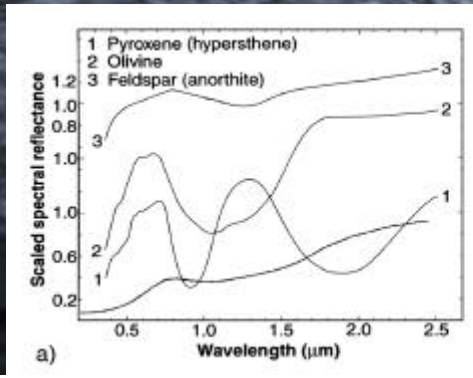
3 . O b s e r v i n g t h e M o o n

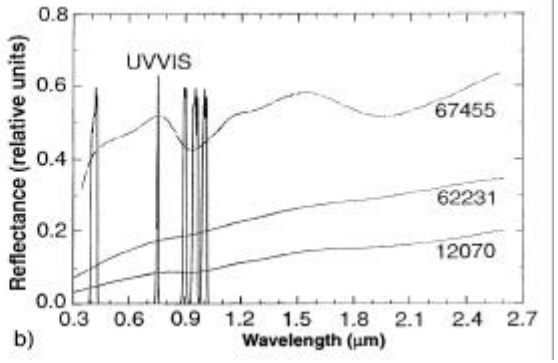
The SIR spectrometer will look at the "invisible" Moon in the infrared:

- to chart the Moon's minerals
- to find the signature of volcanism and impacts
- to search for the fingerprints of water-ice by peeking into dark craters

-





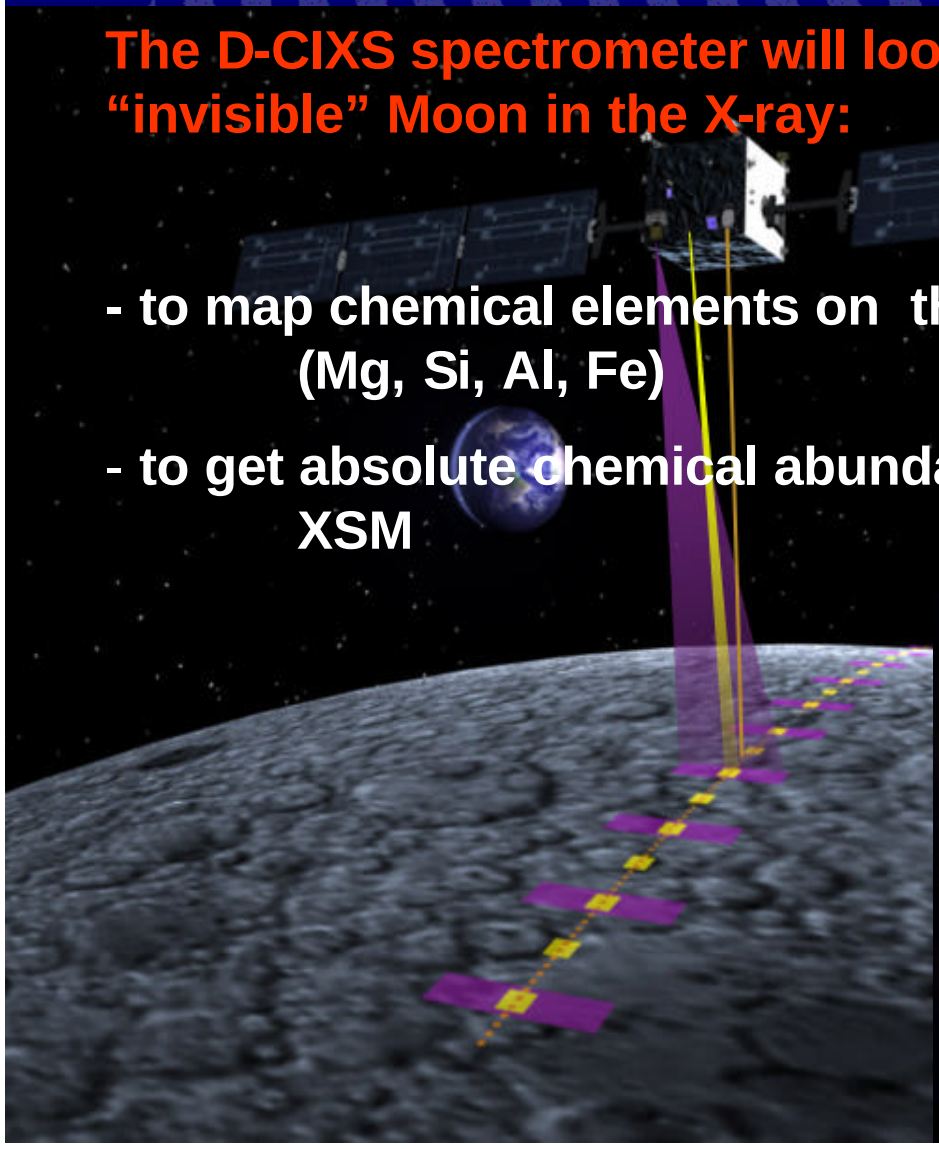


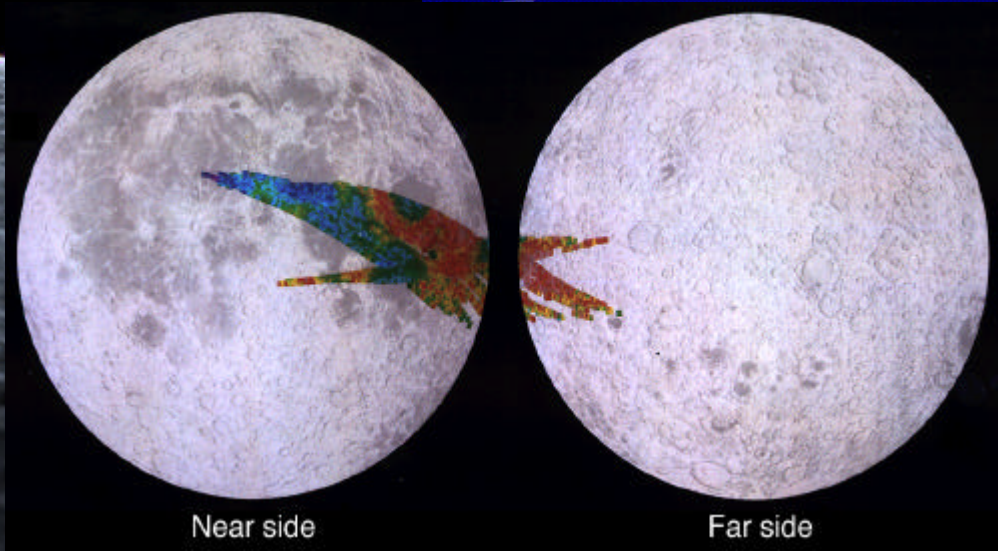
S m a r t - 1

3 . O b s e r v i n g t h e M o o n

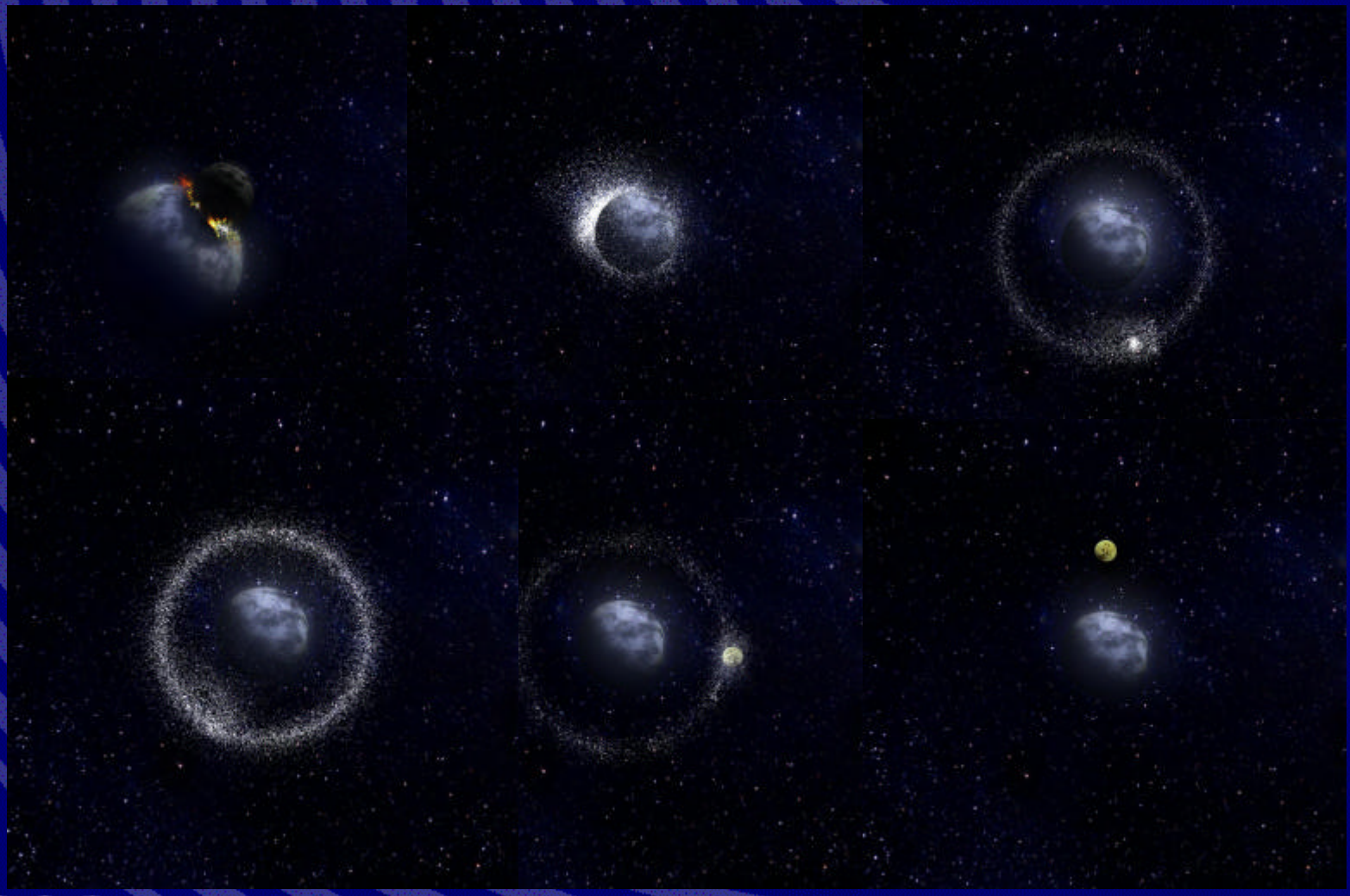
The D-CIXS spectrometer will look at the "invisible" Moon in the X-ray:

- to map chemical elements on the Moon (Mg, Si, Al, Fe)
- to get absolute chemical abundances thanks to XSM





…this will tell us more about the origin of the Moon (daughter of the Earth?), and its evolution



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3. Observing the Moon

SPEDE will:

- observe how the Moon leaves a wake in the solar wind

RSIS will:

- use radio waves positioning and AMIE images to demonstrate a new way of gauging the libration of planets and their moons

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International lunar exploration

- **Muses-A/Hiten** (ISAS) 1990
  - Circumlunar navigation
- **Clementine** (US, BMDO) 1994
  - Multi-band Imaging, technology demonstration
- **Lunar Prospector** (US, NASA Discovery) 1998
  - Neutron, gamma ray low resolution mapping
- **SMART-1** (ESA Technology Mission) 2003
  - Instrument technology, geochemistry, high resolution
- **Lunar A** (J, ISAS Science) 2004
  - 2 Penetrators with seismometers + equator cameras
- **SELENE** (J, ISAS/NASDA) 2005
  - Ambitious orbiter instruments for science
- **Somayana** (ISRO, India) 2007
  - Lunar Orbiter, launch PSLV
- **South Pole Aitken Basin Sample Return** 2009
  - NASA New Frontiers Mission

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International (ILEWG) phased approach for lunar exploration