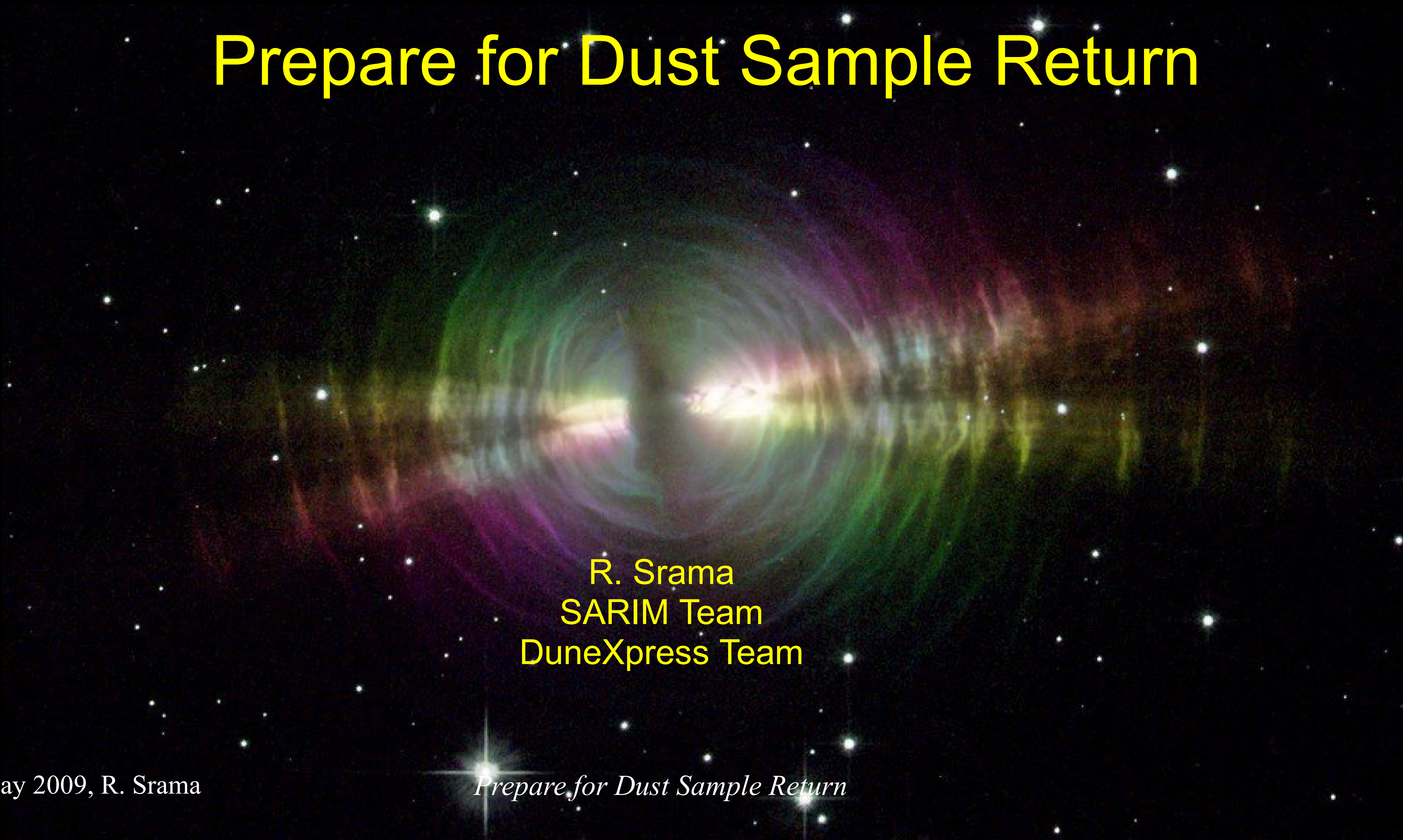
Prepare for Dust Sample Return



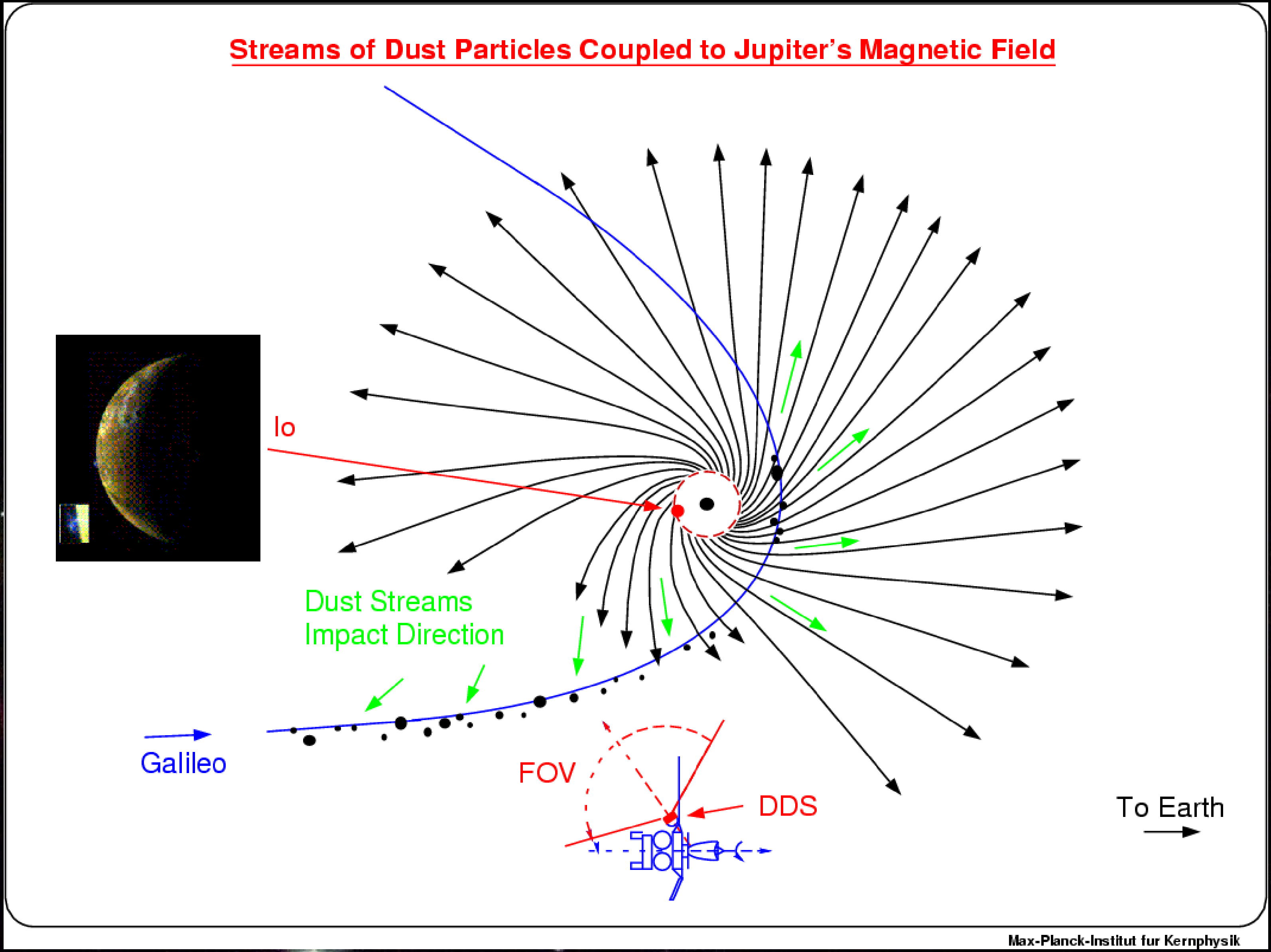
R. Srama
SARIM Team
DuneXpress Team

Where do we find dust?

- “Above” small bodies (moons, asteroids) – secondary ejecta of interplanetary dust impacts
- “Above” bodies with volcanoes/geysers (Enceladus, Europa? , Io, ..)
- Comets
- Interplanetary Dust
- Interstellar Dust

Dust : Messengers over time and space

H. Krüger

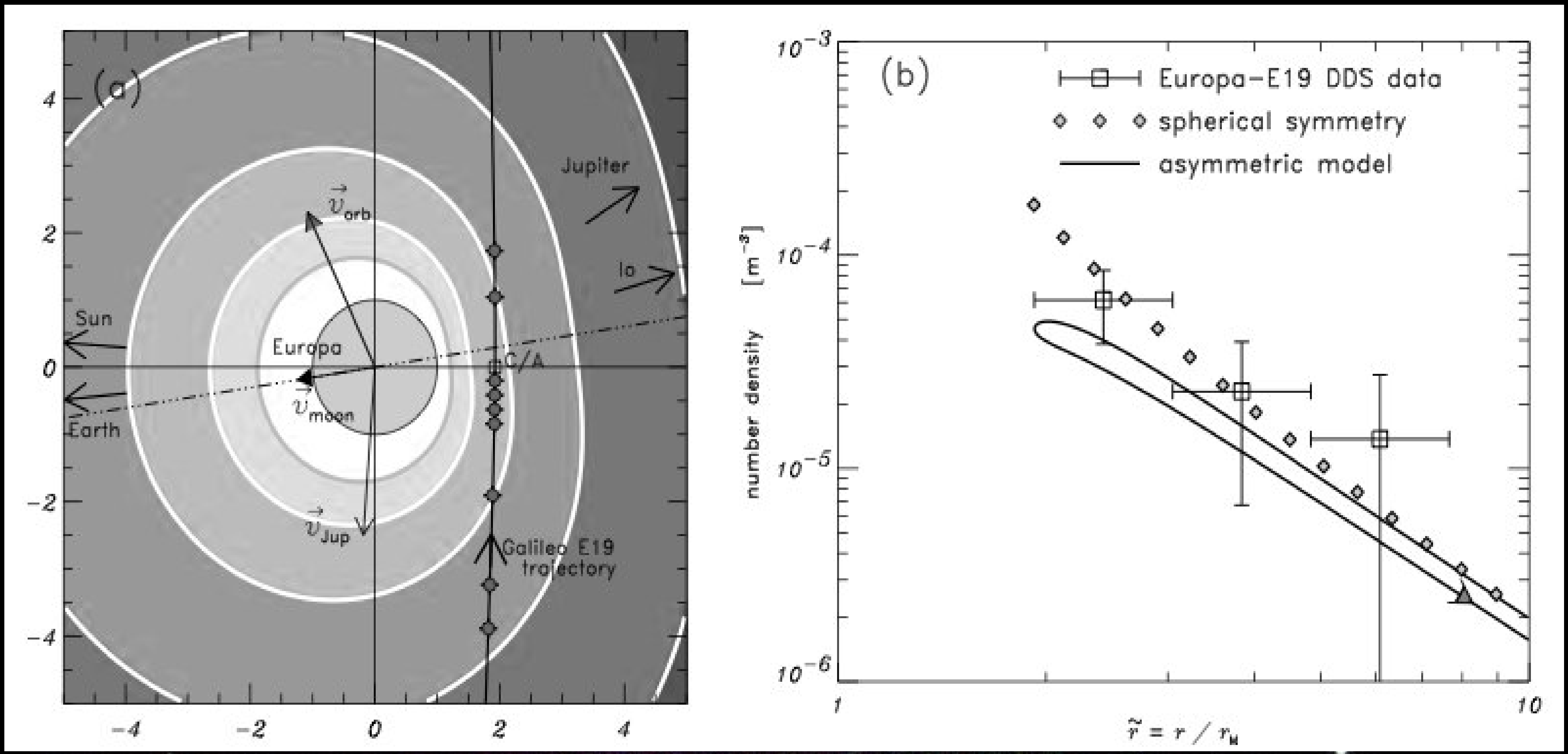


Dust Cloud around Ganymed : Moons as Dust Amplifiers

Link to surface and subsurface geology

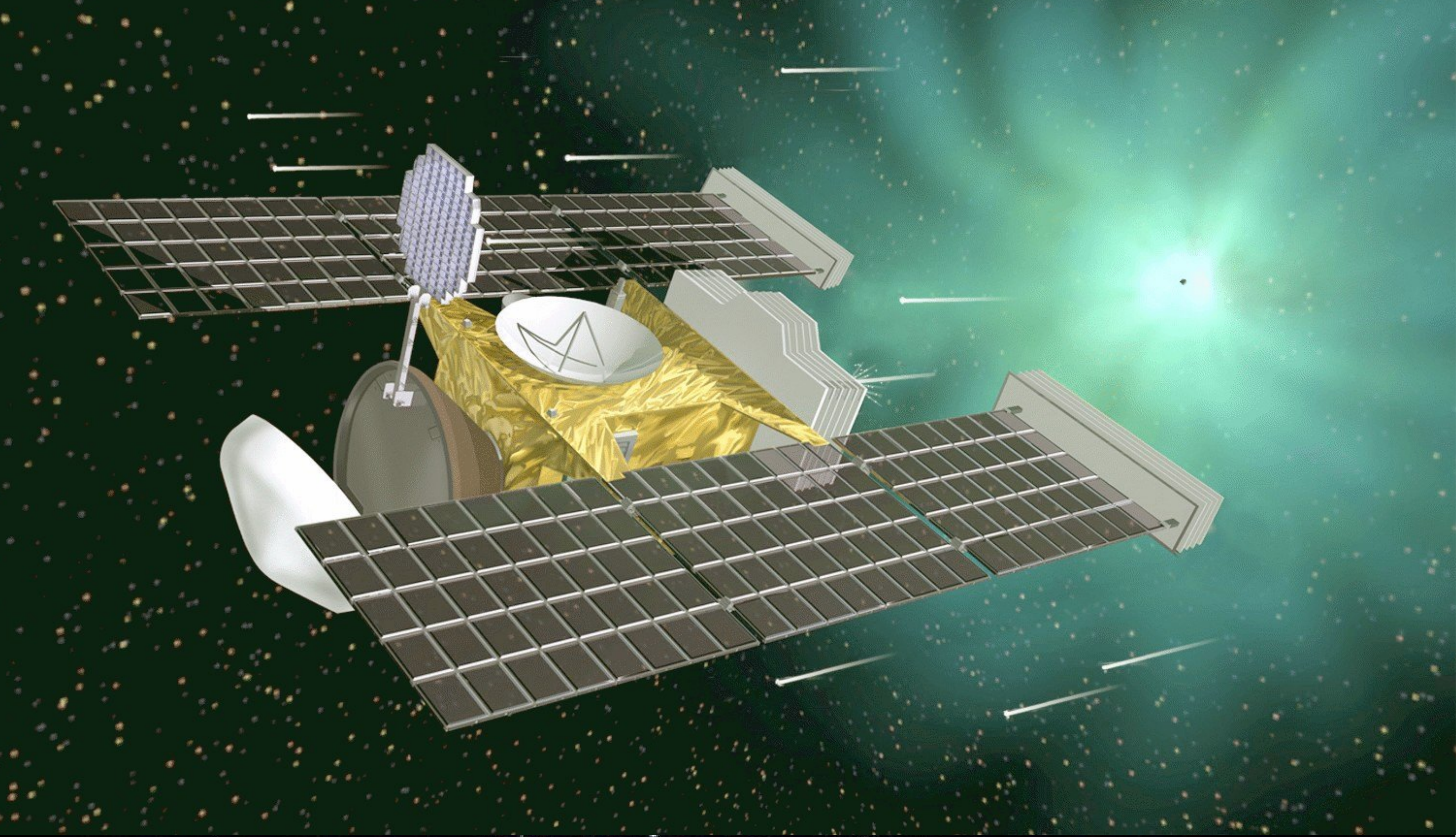
H. Krüger

GALILEO: Dust Cloud around Europa

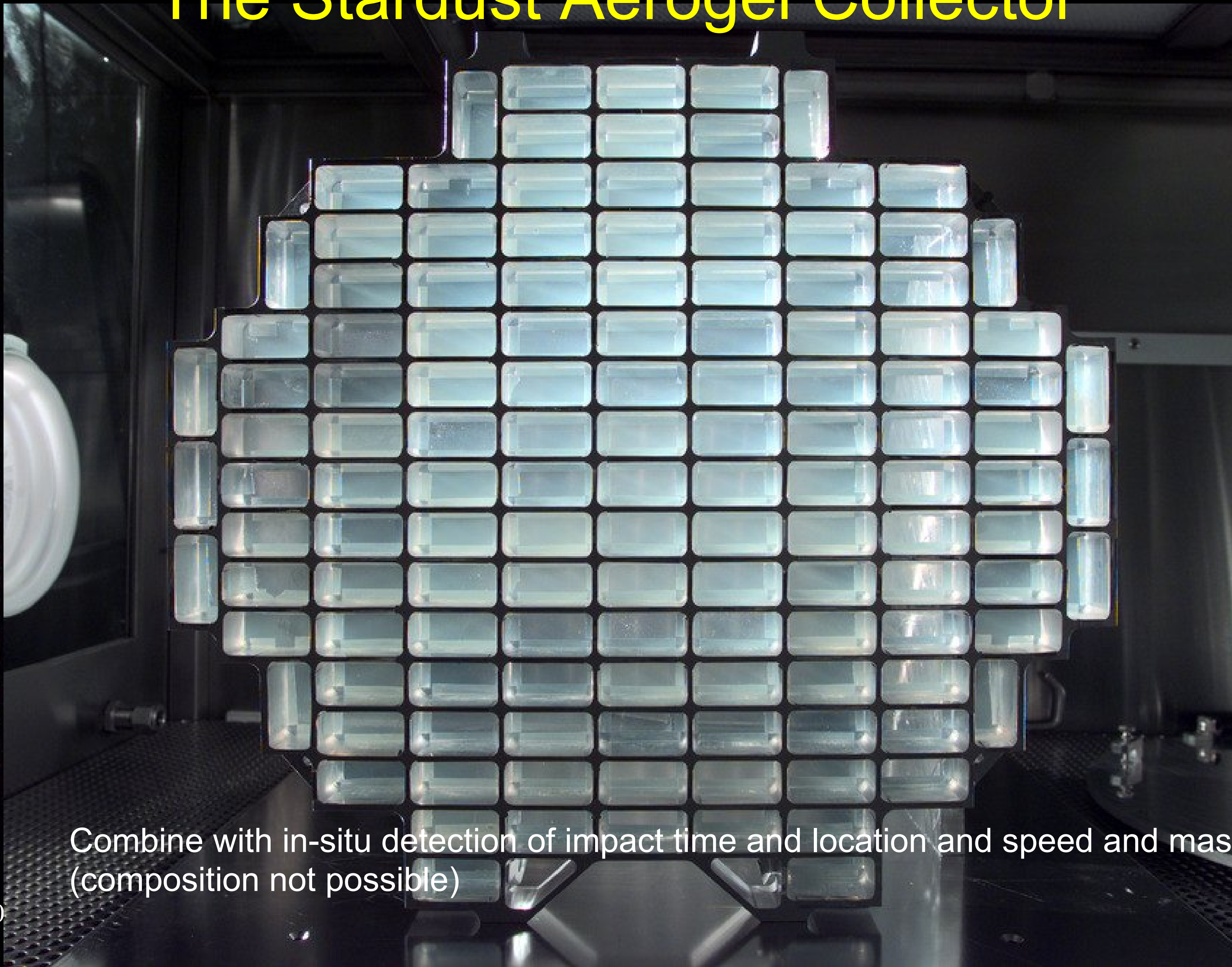


Europa-flyby Galileo, Sremcevicz 2004

Stardust : Successful Sample Return

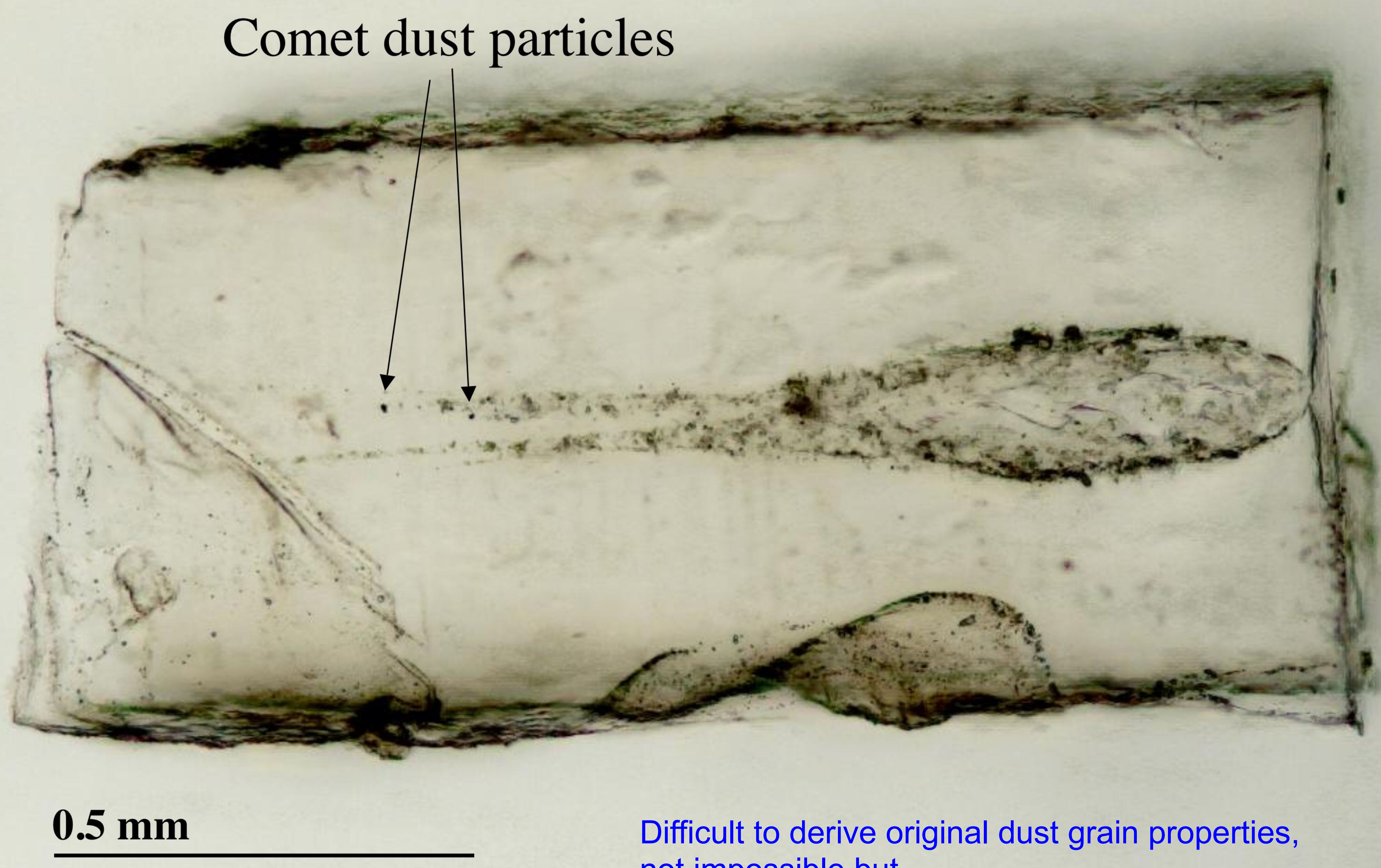


The Stardust Aerogel Collector

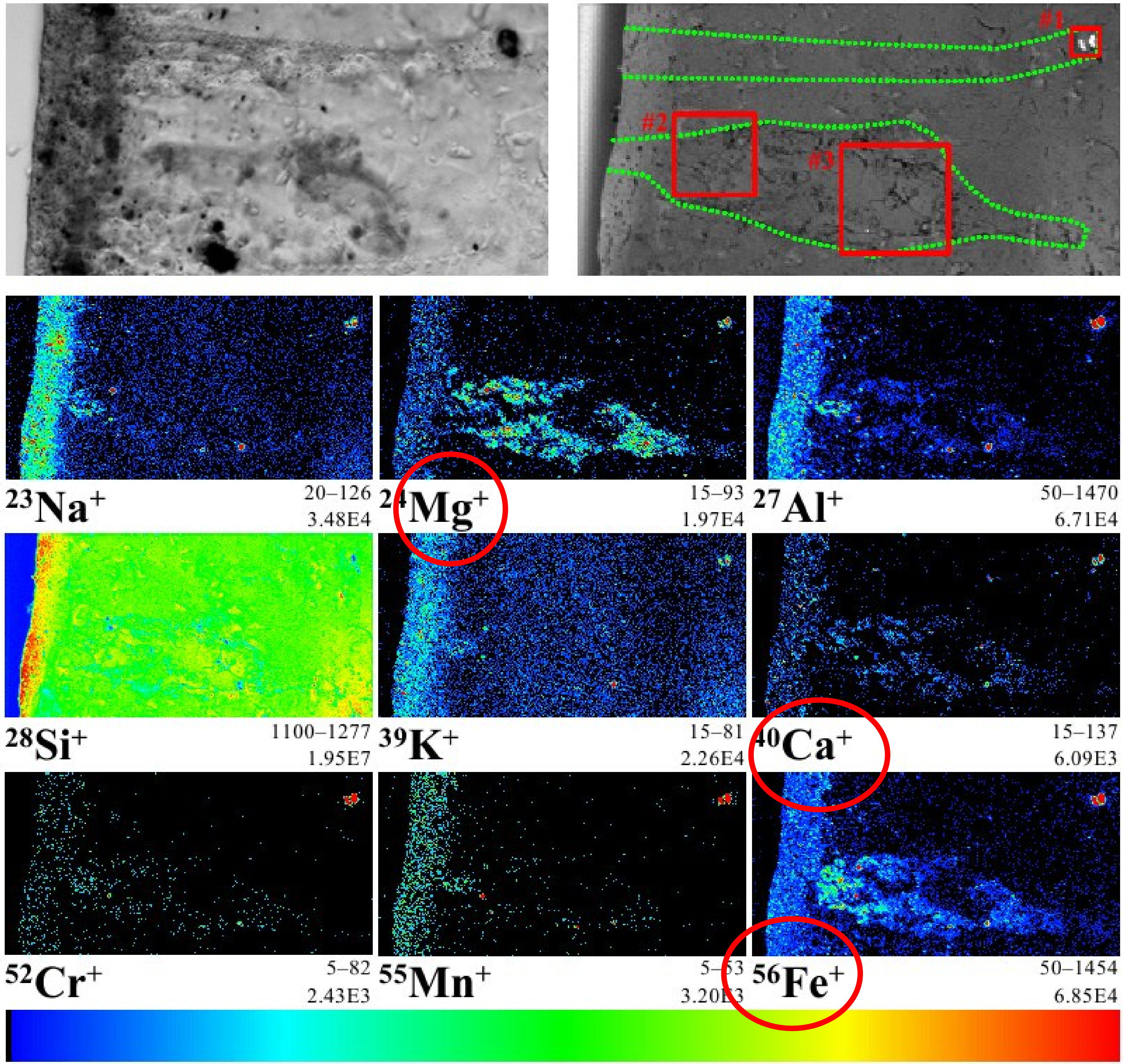


Combine with in-situ detection of impact time and location and speed and mass (composition not possible)

Example for collected dust particle (Stardust)



Difficult to derive original dust grain properties, not impossible but ...



TOF-SIMS Analyse
einer Allendespuren
in Aerogel
(T. Stephan,
Univ. Münster)

You do not need
the grain, you can
analyse the
track !

Where are we?

S A R I M

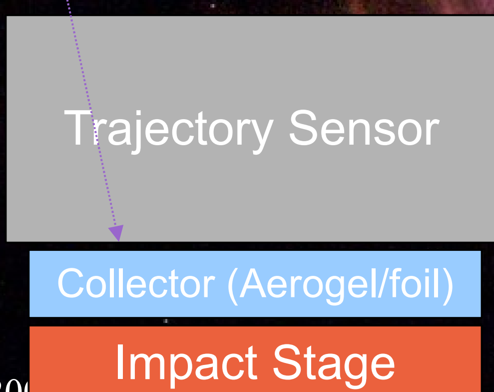
Sample Return of Interstellar Matter

Proposal for Cosmic Vision 2015-2025

May 2009, R. Srama

Preparation of Active Collector development

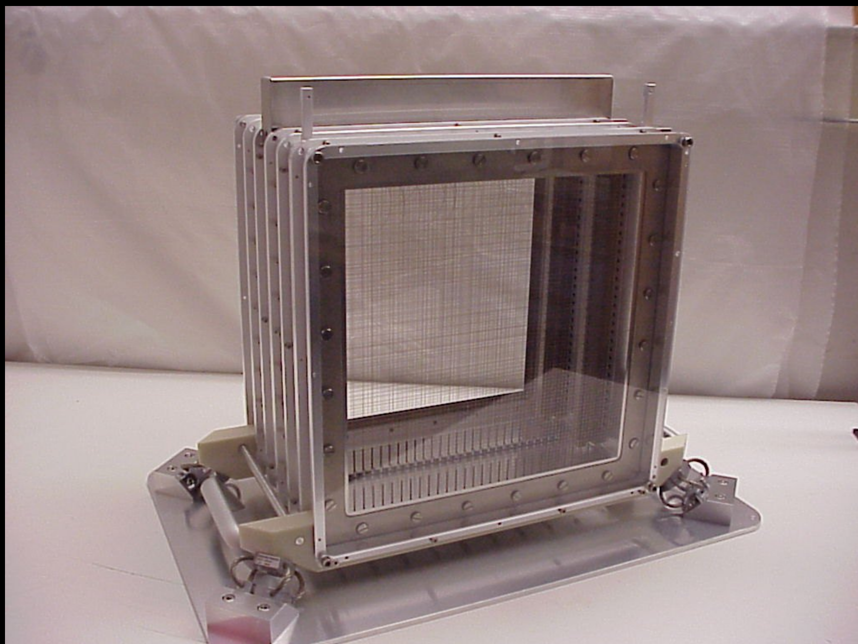
- Aerogel (10 times cleaner than Stardust)
  density gradient (2...20 mg/ml ?)
- Foils of „soft“ and „clean“ metals (aluminium)
- 7 Modules, each module is articulated individually to expose the collector during phases of interstellar dust detection.
- Each module has a collective area of 40 cm x 40 cm

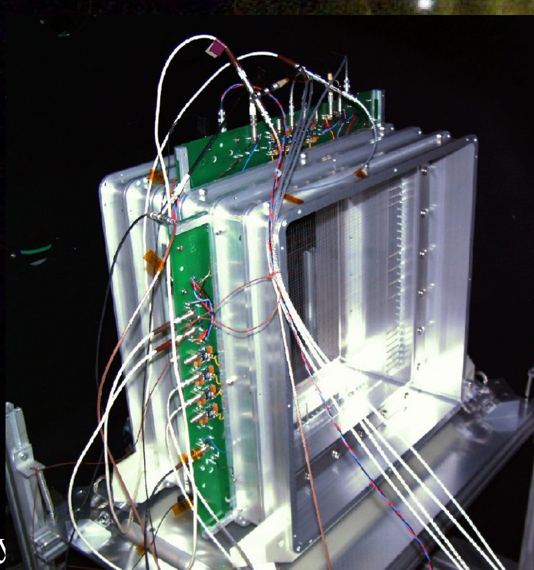


One of 7 active collector modules:

The collector will be removed during parts of the SARIM orbits

Trajectory Sensor developed

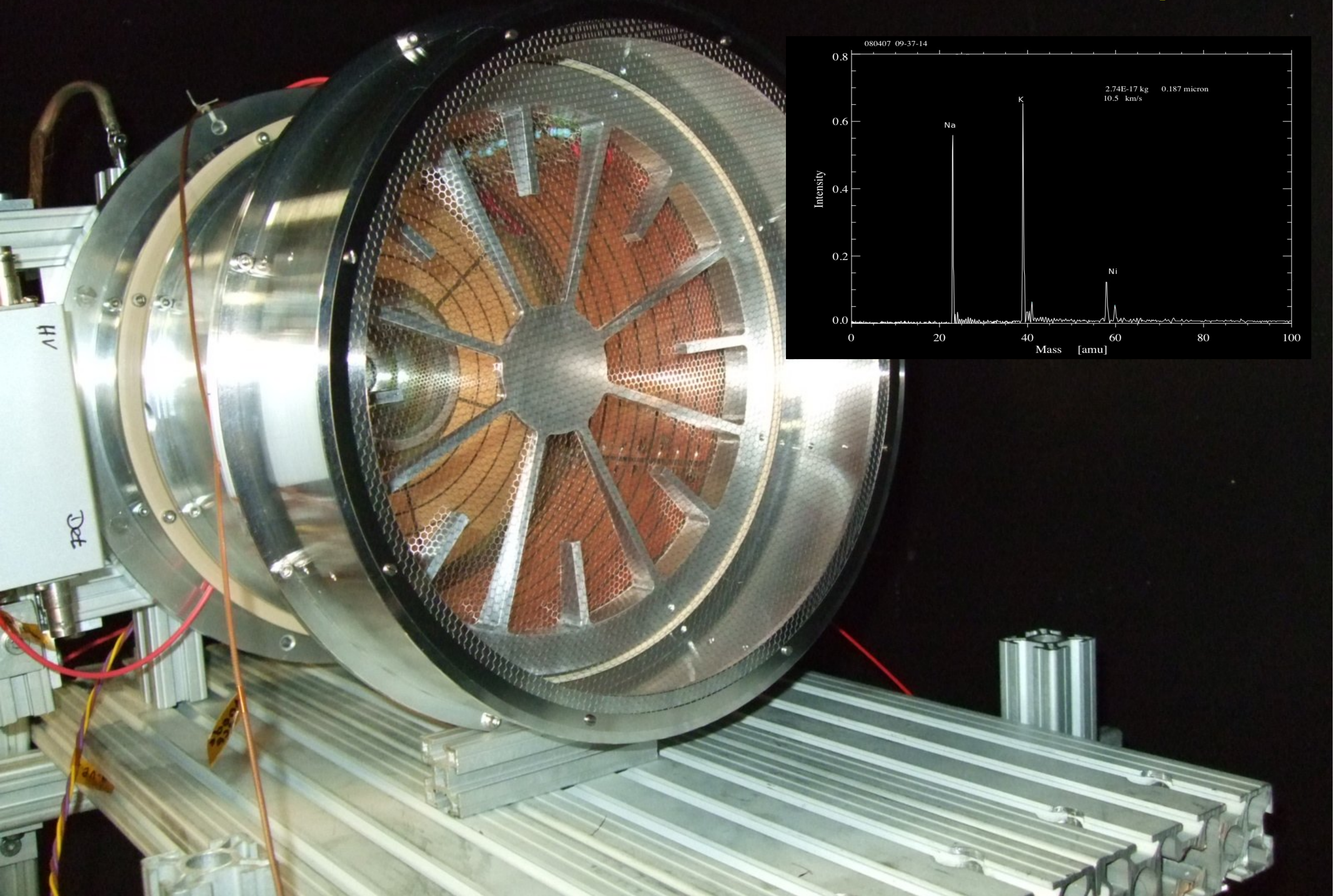




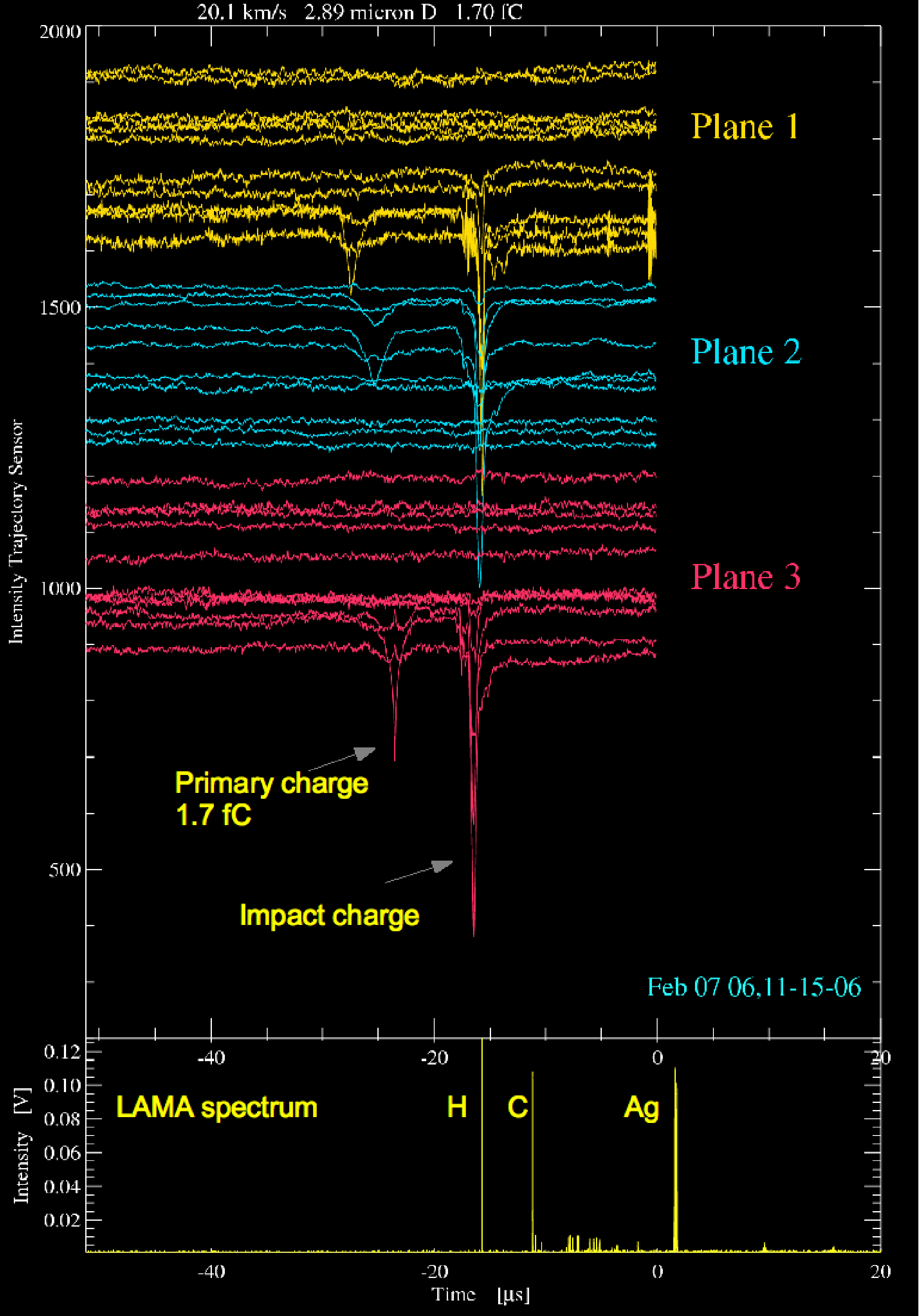
Measurement of induced charge of particle primary charge

Dimension	40 cm x 40 cm
Depth	20 cm
Sensitive area	0.14 m²
FoV half cone	45°
Data rate	1500 bps
Mass	< 5 kg
Power	8 W
Dust speed	1 .. 100 km/s
Dust charge	0.1 fC .. 100 fC
Dust mass	10e-15 .. 10e-8 g
Dust trajectory	1°
Dust composition	N/A

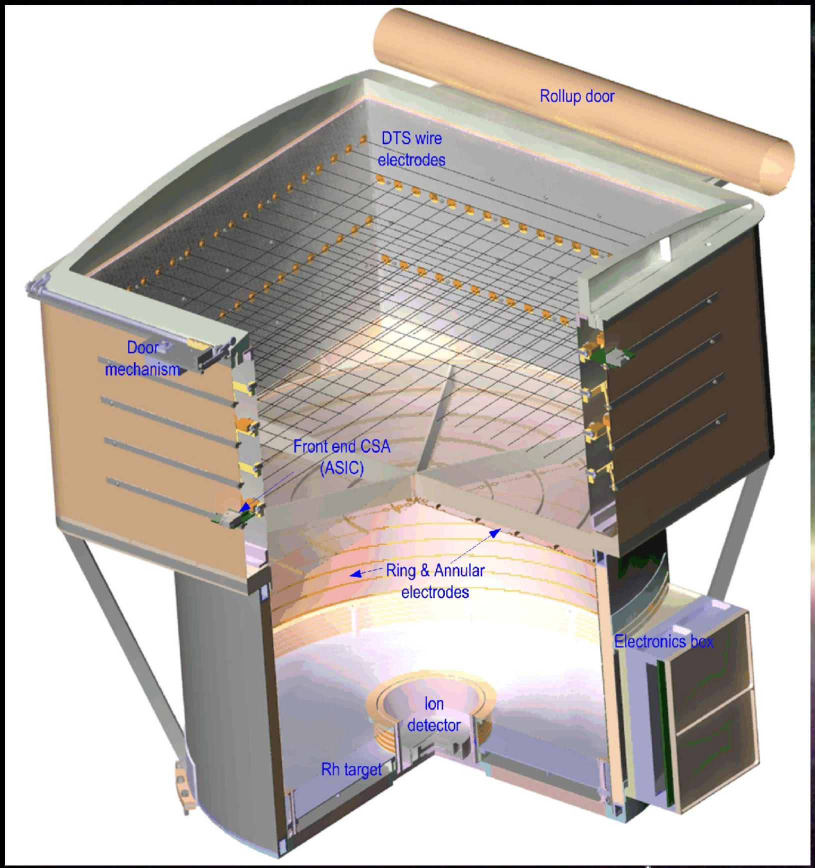
We have tested a Small Dust Telescope

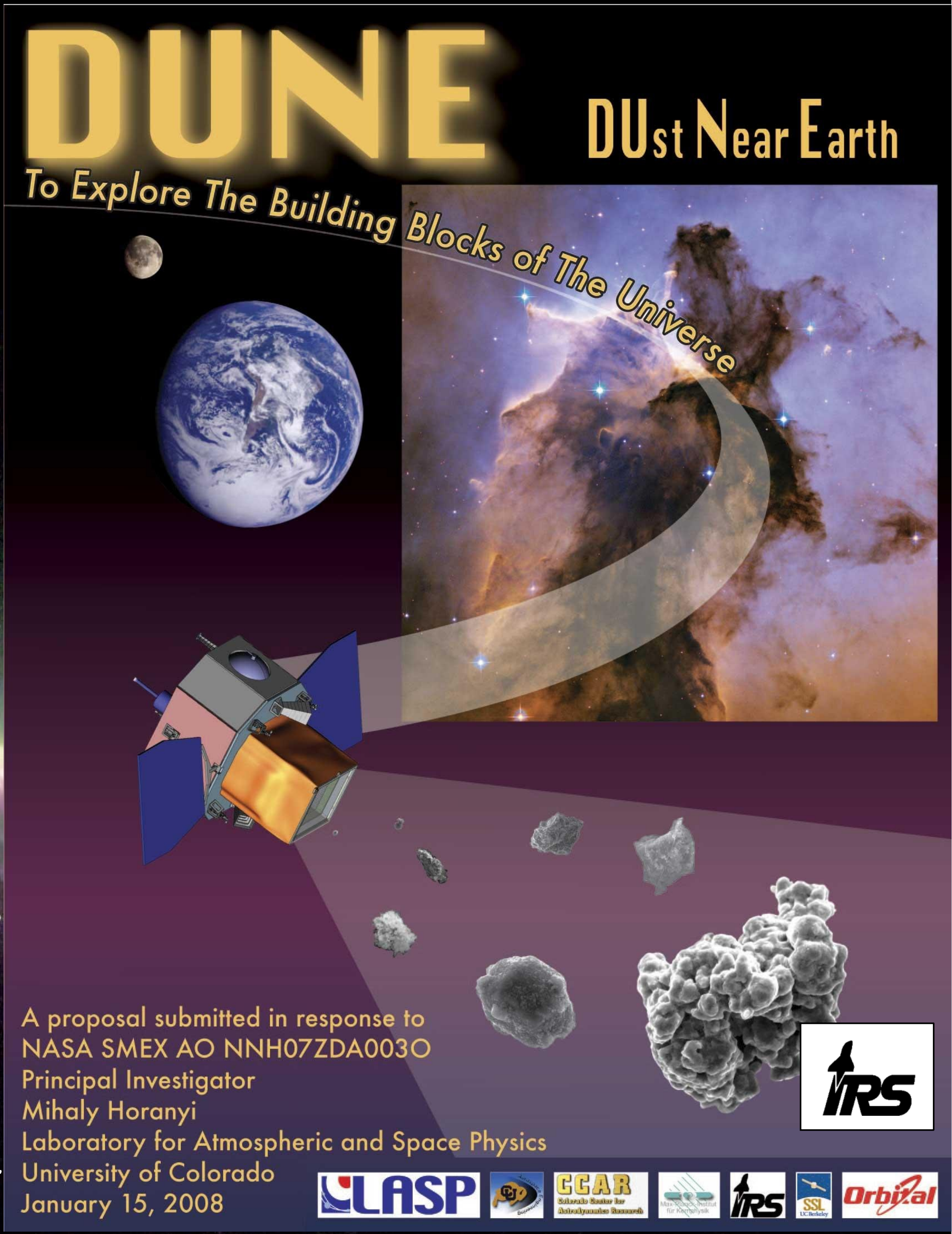


- Combine trajectory sensor and TOF spectrometer
- Dust origin AND dust properties (mass, composition, charge,...)



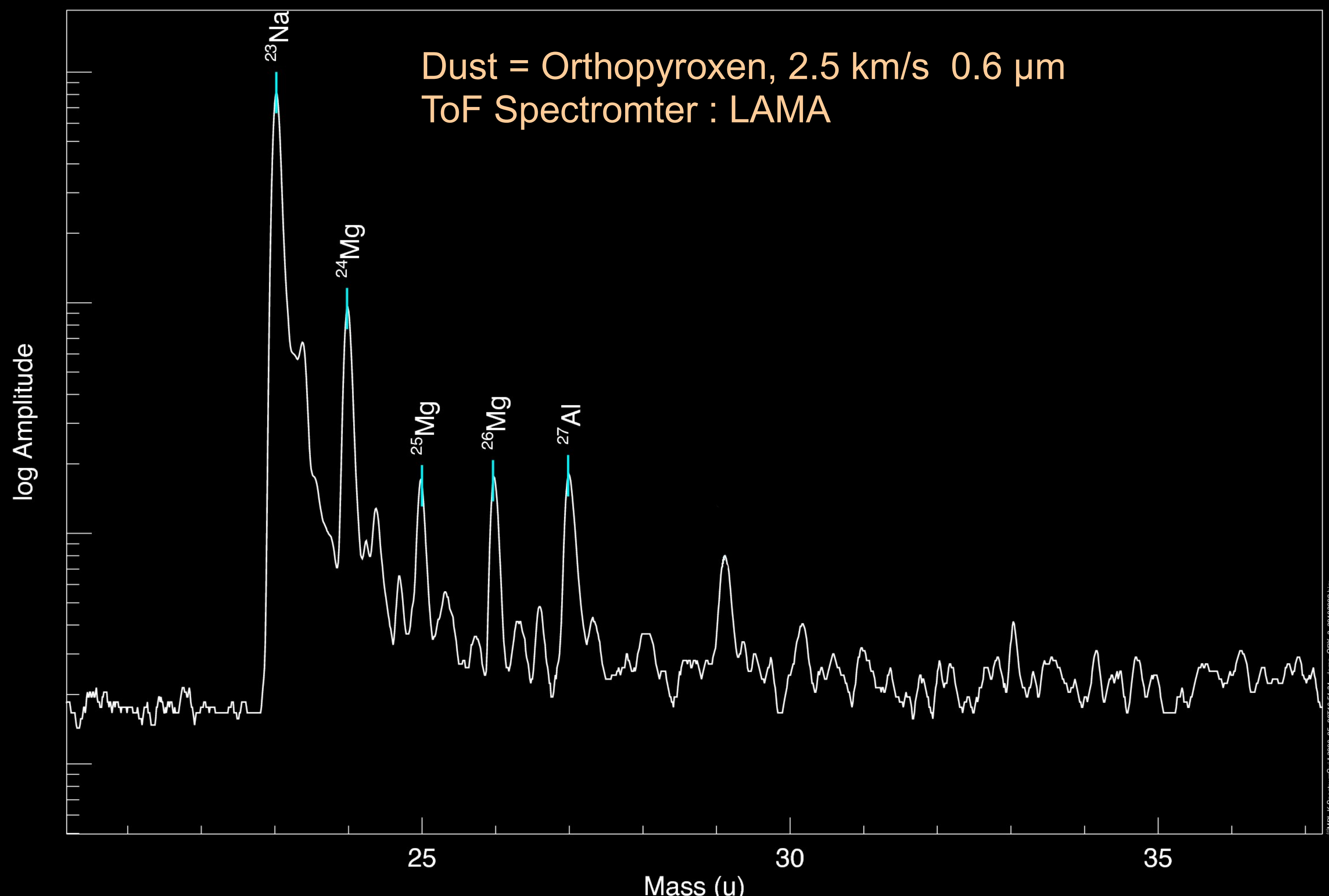
Univ. Colorado: Dune Mission Proposal (in-situ only)





Prepare for

New: Impact spectra of low-velocity impacts



New dust sample return mission - Increments on STARDUST

- 10 times sensitive area (collector 0.1 to 1 m^2)
- 10 times sensitive area (spectrometer 0.01 to 0.1 m^2)
- collection/detection of interstellar dust possible
- collection of dust grains in vicinity of small bodies (Hill sphere) – geyser or volcanoe activity provide a view below the surface
- Dust grains rich in alkali metals: proof of subsurface-ocean
- Determine impact time and location of individual impacts at the collector. Determine particle speed and mass of individual grains. We know where to look for particles in/at the collector.
- Combine with in-situ package (spectrometer/trajectory sensor)
- Separate interplanetary dust, interstellar dust, moon dust by trajectory analysis

Conclusion

- Targets: interstellar dust, interplanetary dust, dust from asteroid/moon surfaces, dust from moon interiors (detection of liquid water), cometary dust
- Combine dust collection with in-situ techniques, provides impact time and impact location (collector surface), grain mass, grain trajectory !
- Combine collector with in-situ compositional measurement (submicron or fast grains are problematic for collectors)

Small Body Session

Sample return and its laboratry analysis