

# Small Bodies and Dust Working Group

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# Science Cases



## Tasks for the First Meeting of the EUROPLANET Small bodies and Dust Working Group 2) define key questions

### PARTICIPANTS:

Any-Chantal Levasseur-Regourd: dust and comets (21/22)

Amara Graps: dust, charging, asteroids (21-23)

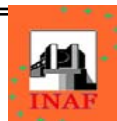
Elena Mazzotta Epifani: small bodies, Stardust samples (21-23)

Eduard Igenbergs: Instruments on Hiten, Nozomi, instruments derived from Giotto (21-23)

Teemu Maekkinen: cometary comas with SOHO, planetary atmospheres (21-23)

Harald Krüger: In-situ dust, dust dynamics, composition of cometary dust (21-23)

22 Nov afternoon: 3 more persons from other DWGs (M. Toplis, M. Küppers, M. Khodachenko)



## Tasks for the First Meeting of the EUROPLANET Small bodies and Dust Working Group

### 2) define science cases

1. How can we best optimise from observations, numerical experiments, laboratory simulations, further analysis of past mission data the science return of Rosetta? (Networking within EUROPLANET)
2. Which specific parameters of major interest to understand the history of the solar system should be addressed through a detailed space mission to a Near Earth object, and which instruments are required? (Networking within EUROPLANET)
3. What are the relative contributions of asteroidal dust, cometary dust, meteor streams, interstellar dust and circumplanetary dust to the structure of the zodiacal dust cloud as a function of heliocentric distance, latitude (and time)? (Ongoing activity, networking within EUROPLANET)
4. How representative are the comets that were intensively studied or that will be intensively studied, of the whole population of comets in space and time (i.e. everywhere in the solar system, now and in the past)? (Ongoing activity, networking within EUROPLANET)
5. How to better understand the physical processes taking place in dusty rings? How to extend the current physics of dusty rings of giant planets to the hypothetical martian dust rings? (Ongoing activity, networking within EUROPLANET)

## Tasks for the First Meeting of the EUROPLANET Small bodies and Dust Working Group 2) define science cases continued.

6. What are the connections between TNOs, centaurs, trojans, comets and icy satellites and what is the dynamical and morphological structure of the Kuiper belt?

7. What are the physical/chemical processes leading to distant activity, outbursts, splitting and disruption of cometary nuclei?

8. To which extent have the interstellar grains preserved their pristine properties and to which extent have they been processed in the cometary nucleus?

9. What are the values and ranges of key properties of a significant number of small bodies to constrain the formation environment and evolution of these bodies, e.g. density, bulk composition, mineral composition, isotopic, elemental, molecular composition, chemical and physical properties, dynamical evolution, etc.?

Targets/ Cases	1 Rosetta	2 NEO mission	3 Zody cloud	4 comets	5 dusty rings	6 connexns	7 comet phenom	8 IS in comets	9 form environ	SUM
Small Moons			X		X	X			X	4
KBO/TNO	X		X	X		X	X		X	5
Comets	X		X	X		X	X	X	X	7
Asteroids	X		X			X			X	4
NEOs		X				X			X	3
Rings	X				X					2
Dust	X		X		X	X	X	X		6
Sum	5	1	5	2	3	6	3	2	5	

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Method										
Ground-based	X		X	X	X	X	X		X	7
Space-based	X		X	X	X	X	X		X	7
In-situ	X	X	X	X	X		X	X	X	8
Database	X	X	X	X	X	X	X		X	8
Modeling	X	X	X		X	X	X	X		7
Lab	X		X		X	X		X	X	6
Sum		6	3	6	4	6	5	6	3	5

Results from systems analysis: (most broad coverage of topics and most involved expertise in Europe)

Methods	Targets etc.	
1-> 1,3,5	1->6	1. How can we best optimise from observations, numerical experiments, laboratory simulations, further analysis of past mission data the science return of Rosetta? (Networking within EUROPLANET)
2-> 6,7,9	2->3	
3-> 4	3->1	
4->2,8	4->5,7	3. What are the relative contributions of asteroidal dust, cometary dust, meteor streams, interstellar dust and circumplanetary dust to the structure of the zodiacal dust cloud as a function of heliocentric distance, latitude (and time)? (Ongoing activity, networking within EUROPLANET)
	5->4,8	
	6->2	6. What are the connections between TNOs, centaurs, trojans, comets and icy satellites and what is the dynamical and morphological structure of the Kuiper belt?
1,3,6,9 best ranked		
2,4,8 least involved		9. What are the values and ranges of key properties of a significant number of small bodies to constrain the formation environment and evolution, e.g. density, bulk composition, mineral composition, isotopic, elemental, molecular composition, chemical and physical properties, dynamical evolution, etc.?

**Multi-working group questions:**

- What drives the volcanism on Enceledus?
- How did Earth get its water?

**Caveats:**

- Haven't specified particular institutes
- Haven't drawn cross-links with other WGs yet



# Expertise in Building Instruments in Europe (for small bodies and dust)



SOME INSTITUTES WITH EXPERTISE IN BUILDING INSTRUMENTS WHICH ARE OF INTEREST FOR SMALL BODIES AND DUST IN EUROPE:

Near-UV, Visible, NIR imagers: Lindau; Marseilles; Orsay (IAS); DLR/Berlin

UV spectrometers: Aeronomie/France(IPSL-UPMC)

Visible spectrometry: IASF/Rome; IFSI/Rome; Observatoire de Paris-Meudon

Microwave spectrometry: Observatoire de Paris-Meudon

Dust spectrometry: Lindau

Gas spectrometry: CETP/France(IPSL); Lindau

Radar type instruments: Aeronomie/France(IPSL-UPMC); Grenoble; Lindau; Rome

Atomic force microscopy: Graz/Austria; ESTEC

Dust impact instruments: Univ. Naples; Capodimonte Obs. Naples; Heidelberg;  
TU Muenchen; Open Univ./UK

Plasma instruments: LPCE/Orléans

Gas chromatography: Open Univ./UK; Aeronomie/France(IPSL-UPMC); LISA/France;  
Lindau

Magnetometer: IC/London; Braunschweig; Orléans

Energetic particle instruments: Toulouse; Mainz; IRF/Kiruna; IFSI/Rome;  
CETP/France(IPSL); Lindau

Radio science: DLR/Germany; Univ. Rome





# Laboratory Experiments Expertise in Europe (for small bodies and dust)



## SOME INSTITUTES WITH LABORATORY EQUIPMENT:

Capodimonte Obs. Naples/Univ. of Parthenope: dust production, processing and analysis

MPIK Heidelberg, Open Univ./UK; Univ. of Kent/UK; TU Munich: Dust impact simulation

TU Braunschweig; TU Munich; Univ. Jena: Dust coagulation experiments

Aeronomie/France(IPSL-UPMC), LPCE/Orléans: light scattering exp. for dust and regoliths; dusty plasma exp.

MPE Garching: dusty plasma exp.

Leiden: interstellar dust analogues

