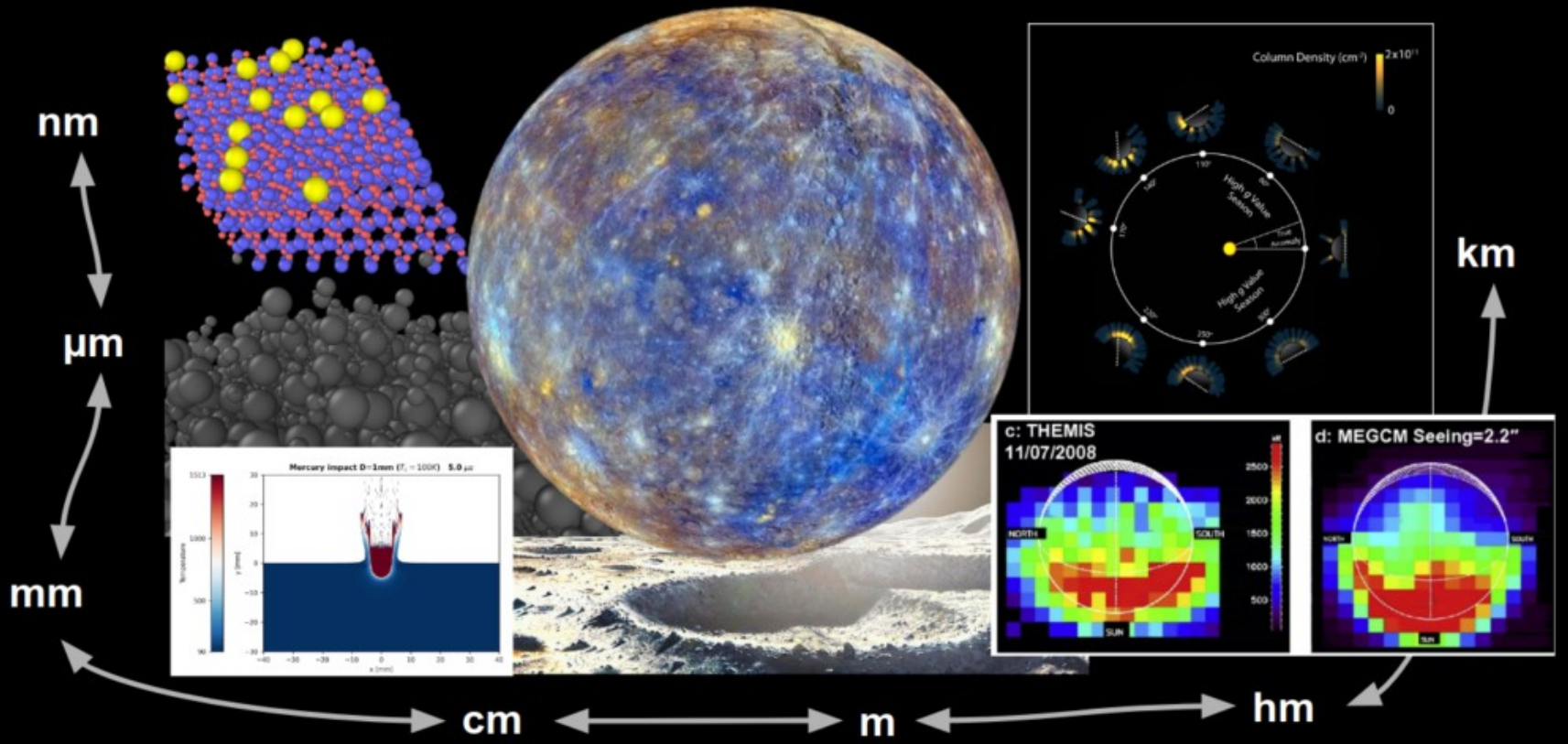
Multi-scale Understanding of Surface-Exosphere Connections (MUSEC)

INTERNATIONAL SPACE SCIENCE INSTITUTE

Agenda of the Second Meeting in Bern 11th – 15th of May 2026



The Team

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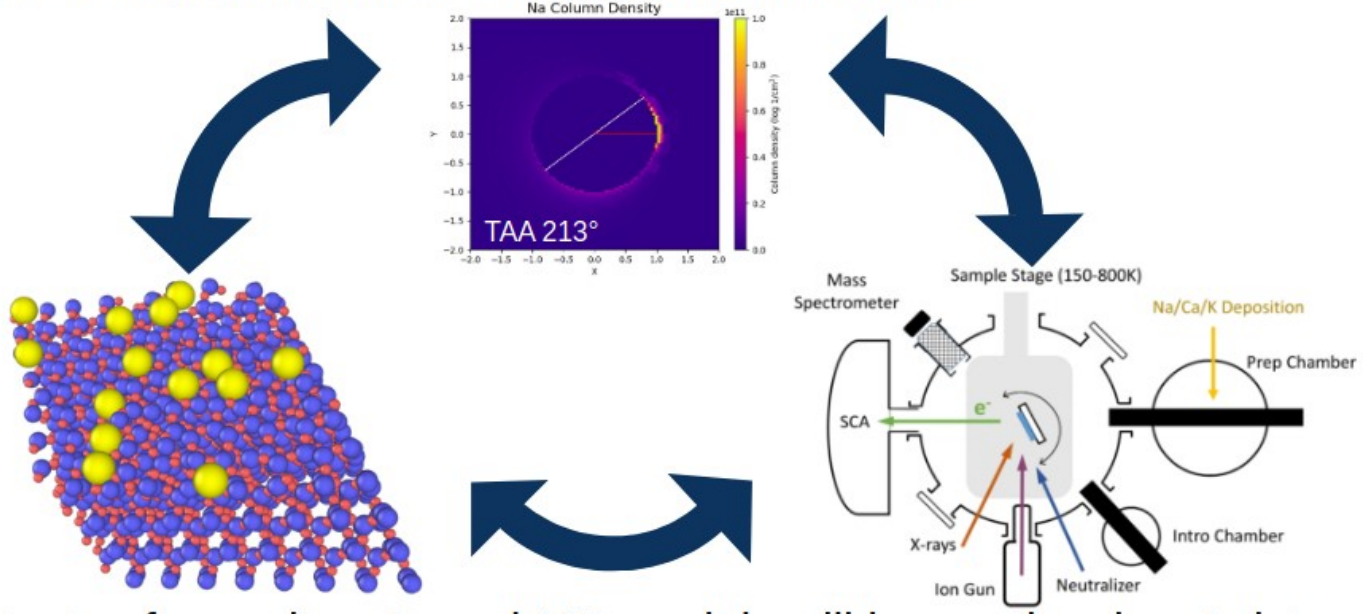
What is MUSEC ?

- Regroups theoretical experts on global exospheres and planetary surfaces to identify key gaps/assumptions in their models, providing focus to experimentalists and atomistic modelers



- Outputs of experiments and MD models will be used as inputs into preexisting global exospheric models

Agenda
11 – 15 May 2026

Topics :

1 – Surface Properties and their Variability – Effect on the Exosphere

- Global geological features and link to exosphere
- Local volatile concentration/coverage
- Multi-scale sputtering approaches (aging of surfaces)
- Temporal variability of the exosphere structure
- Key unknowns in exospheres models

2 – Observations and Experiments synergy with Numerical Models

- SBEs (adsorbed, amorphous) & coverage
- Reflection and energy accommodation of low energy atoms
- Direct comparison between lab experiments and numerical models (sputtering, micrometeoroids)
- Constraining the surface/exosphere using the current observations – Prediction for future observations
- Magnetosphere observations to constrain the surface-exosphere-magnetosphere interactions
- Icy surfaces – Effect on the exosphere, response to ions sputtering and radiolysis

3 – Linking the Different Scales and the Different Bodies

- Regolith structure / Porosity effects on the surface temperature, diffusion, sputtering, …
- Intragrain diffusion, implantation role on the surface composition
- Comparison between Mercury/Moon, or Icy bodies
- Applicability of the techniques developed to other airless bodies (or other fields)

Agenda
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	11/05	12/05	13/05	14/05	15/05
Morning 9:30 – 11:00	**Introduction** **Surface Properties and their Variability – Effect on the Exosphere** **Presentations**	**Observations and Experiments synergy with Numerical Models** **Presentations**	**Invited Talk : Micrometeroid impacts at airless bodies** **Group Photo**	**Linking the Different Scales and the Different Bodies** **Presentations**	**General Discussions** **Planning for collaborations** **Outcomes of the team** **New ISSI team ?**
Morning 11:30 – 12:30	**Surface Properties and their Variability – Effect on the Exosphere** **Presentations**	**Observations and Experiments synergy with Numerical Models** **Presentations**	**Linking the Different Scales and the Different Bodies** **Presentations**	**Linking the Different Scales and the Different Bodies** **Presentations**	**Conclusions**
Lunch					
Afternoon 14:00 – 15:30	**Splinter**	**Presentation/ Splinter**	Optional activity : Visit of MEFISTO at University of Bern	**General discussion: Identification of the relevant parameters for exosphere models**	
Afternoon 16:00 -17:30	**Summary & General Discussions**	**Summary & General Discussions**		**Summary & General Discussions**	
Evening		**Team Dinner**			

	11/05	12/05	13/05	14/05	15/05
9.30 -9.45	Introduction : S. Verkercke & L. Morrissey		Group Photo		
9:45-10:30	**A. Woodson** : Comparing numerical simulations to laboratory measurements of adsorbate sputter removal from granular regolith analogs	**E. Caminiti** : The Martian moons and their extreme environment in the context of the JAXA/MMX mission	Invited talk – **C. B. Senel** : Simulations of Micrometeoroid Impacts and Volatile Release: An Application to Europa	**A. Peschel** : Kinetic Modeling of Hydrogen Release from Lunar Regolith for Exosphere Simulations	**General Discussions** **-** **Planning for collaborations** **-** **Outcomes of the team**
10:30-11:15	**S. Verkercke** : Theoretical ion sputtering yields from loose powders using a multiscale Monte Carlo approach	**N. Brecher** : Developing an Experimental Setup to Study Lunar Water Migration Dynamics	**E. Lovett** : Modeling Europa's Stable Sodium Corona	**F. Leblanc** : On the origins of the CO2 exosphere of the Galilean satellites	
11:15-11:40	Coffee break	Coffee break	Coffee break	Coffee break	End of the meeting
11:40-12:25	**A. Georgiou** : Sputtering of minerals using Molecular Dynamics	**C. Dukes** : Measurement of Na/K Diffusion through Silicate Regolith Analogs	**M. Sarantos** : Identifying the key parameters for planetary exosphere models	**P. Lierle** : Ground-based observations of exospheric alkalis at Mercury, the Moon, and comets	
12:30-14:00	Lunch break	Lunch break	Lunch break	Lunch break	
14:00-14:45	**R. Robidel** : PHEBUS observations and BepiColombo operations during the orbital phase	**A. Ricketts:** Effect of volatile coverage using Molecular Dynamics simulations	**Optional activity** : Visit of MEFISTO at University of Bern	**L. Morrissey :** Expending the applications of numerical tools developed for planetary science	
14:45-15:45	Splinter	Splinter		General Discussions	
	Coffee break	Coffee break		Coffee break	
16:10-17:00	General Discussions – Debrief of the splinter	General Discussions – Debrief of the splinter	Free time		
Evening	Welcome drinks from ISSI (17:00)	Team Dinner		Eurovision Watch Party	

Splinter ideas

- Numerical models to assist experiments
- Rocky vs Icy worlds : how to adapt our methodology ?
- Effect of the manned exploration on the lunar environment
- Importance of water on rocky airless bodies
- Your idea ?

Optional Activity
13 May 2026
14h00 - ~15h00

Visit of the MEFISTO facility at the University of Bern with André Galli.

« MEFISTO is operating an electron-cyclotron-resonance ion source (ECRIS) for producing highly charged ions. The main goal of the MEFISTO source is to reproduce all the elements in their different charge states found in the solar wind. »

https://www.space.unibe.ch/research/infrastructure/mefisto/index_eng.html