

Laboratory for Rapid Space Missions

ORIGINS II Brainstorming



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Current LRSM Projects

What are we up to?

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2023 In-Orbit Verification Experiment 1 (IOV-1) on the International Space Station (ISS)

- Technology demonstration, prototype testing, and background measurements for
 - ComPol and AFIS sensors / detectors → Susanne Mertens, Stephan Paul
 - On-board data-handling systems for both missions → Stephan Paul, Ulrich Walter
 - Star tracker for ComPol → Stephan Paul, Ulrich Walter
 - Proof-of-principle test for MesoMag → Peter Fierlinger
 - tbc: in-orbit test of perovskite solar cells → Peter Müller-Buschbaum
- ORIGINS extra invest 2021
Seed Money 2022
Seed Money 2021

2024/5 Antiproton Flux in Space (AFIS) → Stephan Paul

- Measure antiproton flux in Earth's Van Allen radiation belts

2025/6 ComPol (Compton Polarimetry) → Susanne Mertens, Philippe Laurent (CEA), Carlo Fiorini (Polimi)

- Long-term X-ray observations of Cygnus X-1 to investigate its different emission states

Associated Projects:

- RadMap Telescope on the ISS (launch in Q2/2023)
- Instrument development for LUVMI-X lunar lander

Two preparatory Seed Money projects in 2020:

- Temperature-dependent light yield of scintillators
- Command and data handling for nanosatellites

LRSM & SML Facilities

Garching and Ottobrunn

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Garching

- ESD-controlled laboratory
 - 3 work benches with test & measurement equipment
 - Soldering station, incl. SMD placement and reflow oven
 - Optical work bench
- ISO 6 cleanroom
- Vacuum oven for test and degassing



Ottobrunn

- ESD-controlled laboratories, incl. electronics lab
 - Similar equipment as in Garching
- Shaker / vibration test stand for 80+ kg test load
- Thermal-vacuum test chamber (under construction)
- Sample-handling chambers and facilities (e.g., for regolith)
- EMI / test / calibration room



Our Plans

General Thoughts and Intentions

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- Our research has shown that there is large demand for **low-power, high-performance on-board data processing**
 - Significant synergies between current LRSM missions will likely extend to other activities
 - Possible involvement of additional partners interested in scientific data processing --- e.g., [Martin Werner](#) (TUM ASG)
 - Interest from ASG professors to contribute to and rely on our expertise for future missions / payloads
 - Cooperation with external partners: Leibniz Institute for High Performance Microelectronics (IHP), ESA, ...
- Our **expertise in (rapid) instrument / payload development** will allow us to **support new research ideas**
 - Suggestions from and cooperation with internal / external partners highly welcome
 - Could be **(small-)satellite missions, experiments on the ISS or aboard lunar orbiters, or instruments on other platforms** (e.g., planetary landers / probes)

Short-Term Goal: Apply for DFG Research Training Group (“Graduiertenkolleg”)

- Coordination:
 - [Chiara Manfletti](#) (TUM ASG, lead)
 - [Peter Fierlinger](#) (TUM Physics)
- Educational goal: bridge gap between engineering and natural sciences → based on LRSM core objectives
- Additional personnel for LRSM / SML missions & projects

Our Plans

Some Ideas for ORIGINS II

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“MesoMag” (Mesosphere Magnetometry, *working title*)

→ Peter Fierlinger

- Precisely measure Earth’s magnetic field at altitudes of 90 to 100 km
- Proof of principle in the lab and on the ISS as part of IOV-1

] Seed Money 2021

Measurements of Interplanetary Dust / Space Debris in Earth Orbit and Beyond (e.g., cislunar space)

- Currently: early prototype development of sensor based on Munich / Mars Dust Counter (HITEN, NOZOMI)
 - PhD position funded by [Roland Pail](#) (TUM ASG) and [DLR via LRSM](#)
- Interest by [Philipp Reiss](#) (science) and [Martin Werner](#) (data processing) to support flight mission in ORIGINS II
- Possible [links to IDSL, RU-D, and RU-E](#)

Extend LRSM / RU-D (?) to Include Planetary and ‘Deep-Space’ Science

- Strong interest by [Philipp Reiss](#) to contribute with his research on lunar / planetary science:
 - Water, ices, and volatiles in the Solar System
 - Atmosphere-less bodies as recorder of Solar System history
 - Planetary environments and interactions (solar wind etc.)
- Instrument and mission development for in-situ science (orbital and surface); possibility of interplanetary mission (with possible involvement of [Chiara Manfretti & Alessandro Golkar](#))

Continuation of ComPol and AFIS



Any other ideas?

Let us know!

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