

**ABSTRACT BOOK
PITCH AND POSTER
SESSIONS
AU SPACE DAY 2026**



AU Space Day 2026 - DISCO Submission

Title:

DISCO-2: A Student-Driven CubeSat Mission for Arctic Research

Presenter:

Cecilie Strømsnes, Aarhus University, Department of Physics and Astronomy

Co-authors:

DISCO-2 Team (Aarhus University, University of Southern Denmark, IT University of Copenhagen)

Abstract:

DISCO is the Danish Student CubeSat Program - a national, student-driven initiative that provides hands-on experience with the full lifecycle of a satellite mission. The program gives students the opportunity to work directly with space engineering, mission design, testing, and operations while contributing to real scientific and technological goals.

DISCO currently has three missions under development, and DISCO-2 is the most ambitious to date. Built by more than 130 students from three Danish universities, DISCO-2 is a 3U CubeSat scheduled for launch in March 2026. The mission combines educational impact with a clear scientific purpose: supporting Arctic research by collecting optical and thermal data of regions such as glaciers and fjords. A particular focus is monitoring small-scale temperature variations, which can contribute to improved understanding of environmental and climate-related changes in the Arctic.

Beyond its scientific objectives, DISCO-2 serves as a platform for student-led research and technology demonstrations, enabling the development and testing of new methods for onboard data handling, image analysis, and mission operations. The project highlights how student space missions can accelerate learning, foster interdisciplinary collaboration, and contribute to Denmark's broader space activities.

3 keywords:

CubeSat, Student Space Mission, Climate Research

Collaboration interests:

We seek collaborations with researchers, educators, and industry partners interested in satellite payload development, Arctic observation, onboard data processing, and student training initiatives. We also welcome new students to DISCO.

Contact information:

cecilie@phys.au.dk

Preferred presentation format:

Both poster and pitch

Title: Infrared Spectra of Interstellar Water Ice Analogues

Presenter: Lars Eric Borchert¹

Co Authors: Sergio Ioppolo¹, Emil Sloth Lundkvist¹, William Møller Johansen¹, Alfred Hopkinson¹

¹Department of Physics and Astronomy, Center for Interstellar Catalysis

Key Words: Interstellar Medium (ISM), Astrochemistry, Infrared Spectroscopy

Collaboration Interests: We are open to collaboration with anyone interested in ice spectroscopy, understanding of water ice structure, and/or the origins of life in space. We are also highly open to students interested in projects in laboratory astronomy

Preferred presentation format: Both poster and pitch

Contact information: larseric@phys.au.dk

Abstract:

The chemistry of the interstellar medium sets the stage for life's origins – on Earth and elsewhere in the universe. The ice-rich surfaces of dust grains in dense molecular clouds act as catalysts for the formation of complex organic molecules, which can then be delivered to the surfaces of newly formed planets via small meteor impacts. Robust understanding of the ice in space is therefore essential for a complete picture of the origins of life. Astrophysical ices and ice chemistry can be simulated in the laboratory with state of the art vacuum chambers such as The Center for Interstellar Catalysis (InterCat)'s Red Chamber. The chamber features ultrahigh vacuum and a variety of substrates which can be cryogenically cooled to act as interstellar grain analogues. With infrared spectroscopy, we are able to both identify the molecular species formed in the chemical reactions we wish to study, as well as provide high-quality ice reference data to theorists, observational astronomers, and other laboratories to help interpret observations of interstellar space. In this study, we present high quality set of infrared spectra and optical constants of water ices deposited onto a potassium-bromide substrate at a variety of temperatures and deposition rates. The comparison of these data with analogous results from other laboratories lets us evaluate laboratory techniques in simulating interstellar space, as well as interpret observations of water ice in space with the James Webb Space Telescope.

Title: Astronomy on Tap is back in Aarhus!

Presenter name and institute: Frederik Würtz Sørensen, IFA

Co-‘authors’: Mikkel Nørup Lund, Jakob Lysgaard Rørsted, Magnus Ingerslev Uggerhøj, Maria Prochal, Aleksandra Rabeda, Kristoffer Rosengreen Pedersen

Abstract:

During AU SpaCe Day 2025 in January, the ball started rolling again, and the first Astronomy on Tap event took place in April. Except for June, every month since has brought together 55–80 people at the Irish pub Tir na nÓg for an evening of astronomical merriment.

The event is open to everyone, with presenters challenged to explain their knowledge at a level accessible to a broad audience. While the front tables are often filled by non-IFA regulars and several IFA employees enjoy socializing over a beer, new faces join every month - many hearing about the event through friends or social media. As the event is open to everyone, so is the study of physics, which is why we strive to maintain a gender balance among our speakers.

We are a group of master’s students who plan, prepare, and execute the events, supported by a few IFA employees. As the current team will complete their master’s degrees in June 2026, we are recruiting new students to join. In addition, we are creating documentation on how we currently run Astronomy on Tap.

Our hope is that a student-run, IFA-backed setup will become a thriving constellation under the Aarhus SpaCe Center, spreading the joy and wonder of all things space for years to come.

3 Keywords: Outreach, Public presentations, Socialization

Collaboration Interests: We welcome professionals from all departments and companies working with space to join us as speakers and share their expertise with a broad audience.

Title	Gaia's Half-Time Show: Supercharging the Exoplanet Census
Presenter and Contact information	Silke Sofia Dainese, Department of Physics and Astronomy dainese@phys.au.dk
Co-author	Simon H. Albrech, Department of Physics and Astronomy
Preferred presentation format	Pitch

Abstract:

Gaia is about to shake up our exoplanet count. With its fourth data release (DR4) just around the corner, we expect to uncover about 7,500 new exoplanets, and by the end of the mission, maybe as many as 120,000. That's nearly 200 times more planets than we know today. Over the past decade, ESA's European Gaia mission has mapped more than 3 billion stars and other celestial objects. DR4, the "half-time show" of the mission, will deliver five years' worth of exquisite astrometry (where things are and how they move) and photometry (how bright they are and how that brightness changes). At Aarhus University, we're already using Gaia to track down and verify planets, and to model binary star orbits. The longer observation timescale and DR4's new time-series data will be a game-changer for our work. By combining this vast dataset with ground-based observations, simulations, and statistical analysis, we can dive deep into complex 3D multi-body systems, exoplanets tugging at their stars, and binary systems dancing through the Galaxy.

Keywords: Gaia, Exoplanets, binary stars

Abstract from James Scott

The Nordic Meteor Network is a collection of public citizens, astronomers and academics who share the goals of observing and learning about the night sky. We manage a suite of meteor cameras that each night record meteors and meteor showers above the southern Nordic countries and Greenland.

Quantifying Methane Emission Hotspots in Iran Using TROPOMI-Derived XCH₄ Observations

Presenter: Ali Rahimi — Department of Geoscience, Aarhus University, Aarhus, Denmark

Co-authors: Christoffer Karoff — Department of Geoscience, Aarhus University, Aarhus, Denmark

Abstract:

Methane (CH₄), the second most influential anthropogenic greenhouse gas, has been rising rapidly in recent decades, yet monitoring gaps remain substantial in regions such as Iran. This study provides a comprehensive assessment of the spatial and temporal distribution of column-averaged methane (XCH₄) across Iran using high-resolution TROPOMI observations from the Sentinel-5P satellite during 2019–2024, complemented by the bottom-up EDGAR v8.1 inventory. Results show that average methane concentrations increased from 1872.6 ± 11.9 ppb in 2019 to 1918.6 ± 11.2 ppb in 2024, representing a net rise of $+46.1 \pm 16.4$ ppb. Spatial analysis using Global Moran's I (0.914–0.982, $p < 0.01$), Local Moran's I, and Getis-Ord Gi* indicates that methane distributions form statistically significant clusters rather than being randomly distributed. Three dominant hotspot classes were identified: northern agricultural hotspots driven by rice cultivation, central metropolitan-industrial hotspots linked to dense urban activities, and southern fossil-fuel hotspots associated with oil and gas infrastructure. Western and eastern provinces exhibited sparse hotspot activity and lower baseline emissions. Seasonal analysis revealed peak XCH₄ concentrations in summer and autumn, with winter showing the highest variability. Comparison with EDGAR indicates notable discrepancies: although EDGAR provides consistent large-scale patterns, its spatial overlap with TROPOMI-identified hotspots remained below 5% in all months, suggesting underestimation of dispersed and high-intensity sources. Exclusive reliance on modeled inventories may therefore misrepresent methane emission magnitudes and locations. Integrating TROPOMI observations with EDGAR emissions, meteorological variables, and land-use information provides a robust framework for identifying high-confidence hotspots, improving source attribution, and guiding targeted methane mitigation strategies at the national scale. This study emphasizes the value of continuous, high-resolution satellite monitoring for accurately assessing methane dynamics in data-sparse regions such as Iran and informs evidence-based policy and mitigation planning.

Collaboration Interests:

We seek collaborations on satellite-based methane inversion, atmospheric transport modeling, cross-border hotspot verification, and integration of ground-based measurements with remote-sensing datasets.

Contact: ali.rahimi@geo.au.dk

Preferred Presentation Format: Both poster and pitch

Post-Launch Payload Capture via Cooperative Intercept: Concept and Feasibility (Preferred presentation format: Poster)

Mads Krogh Bänisch
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Keywords

Cooperative intercept, Concept development, Payload optimization

Abstract

This work explores a novel concept aimed at increasing the payload fraction of current launch vehicles, and potentially eliminating the need for multiple stages. The approach involves establishing a high-tensile, low density tether between the rocket's payload, and a massive "catching station" already in orbit. The connection is achieved with two small, maneuverable interceptor "hook" craft, after first-stage burnout.

One end of this tether is attached to a spool on the catching station. After the connection is established, this spool is allowed to unwind while applying a controlled breaking force. This gradual energy transfer allows us to draw the payload into orbit safely, without snapping the tether, while the catching station's lost momentum is later recovered using a highly efficient, low-thrust propulsion system like an ion engine.

Current work focuses on assessing the feasibility of the fast, cooperative intercept maneuver required to establish the payload/station connection. Additional analyses, including estimates of the tether's mass and length and a quantification of the associated performance benefits, will also be presented. Preliminary results indicate that the system could potentially eliminate the need for the second propulsion stage of a conventional two-stage launch vehicle—illustrated here using the Falcon 9 in its expendable configuration—by enabling orbital insertion without the upper-stage burn.

Future work will refine performance estimates, investigating the tether dynamics, and assess the feasibility of other aspects like how to apply the breaking force.

Collaboration interests

I would like to collaborate with fellow students and industrial experts who possess expertise in launch-vehicle design, spacecraft engineering, and other relevant areas. There is a substantial body of work to be undertaken across multiple aspects of the concept, and I do not have the capacity—neither in time nor in specialized knowledge—to address all of these components adequately on my own.

Strategic Skies: Denmark's Arctic Dilemma and the Danish–Swedish Bifrost Satellite as a Case of Security Science Diplomacy

Presenter name: Kristian Hvidtfelt Nielsen, Centre for Science Studies – Department of Mathematics, Aarhus University

Co-authors: Nina Holm Vohnsen, School of Culture and Society – Department of Anthropology, Aarhus University; Casper Andersen, Aarhus Institute of Advanced Studies (AIAS), Aarhus University

Abstract

The launch of the Danish–Swedish Bifrost satellite marks a defining moment in how Denmark is implicitly reshaping its Arctic strategy after five years of hesitation to replace the framework that expired in 2020. Throughout this period, the Danish government has continued to describe the Arctic as a “low-tension” region, as reiterated in the foreign minister’s Arctic statement of 11 October 2024, despite mounting geopolitical pressures following Russia’s invasion of Ukraine.

At the same time, Denmark faces growing external and internal tensions: international controversies over access to natural resources, increased Russian military mobilization in the Arctic, China’s expanding economic influence in the region, and renewed U.S. pressure over Greenland, alongside Greenland’s own push for greater autonomy and stronger North American ties. Together, these developments place Denmark in a strategic dilemma between sustaining commitments to peaceful and sustainable Arctic development and responding to an increasingly contested geopolitical environment.

The Bifrost satellite offers a valuable case for analysing how Denmark navigates its Arctic dilemma through emerging forms of security science diplomacy. Launched in 2025 as a technology demonstrator, Bifrost is a microsatellite equipped with optical and multispectral sensors, onboard artificial intelligence, and experimental inter-satellite communication capabilities. Rather than delivering operational reconnaissance, its primary purpose is to test AI-enabled data processing, enable near-real-time data selection, and build technical and organisational competence for future satellite constellations. Developed by a consortium linking Danish and Swedish industry, universities, and defence authorities, and supported by DALO and FMV, the project connects national capability building with international collaboration.

In the absence of a formal Arctic strategy and under growing geopolitical uncertainty, Bifrost actively shapes policy orientations by translating strategic concerns into technological infrastructure. Its dual framing as both research platform and security-relevant system enables Denmark to strengthen monitoring capacity, resilience, and autonomous data access while sustaining commitments to peaceful development and cooperation. Viewed through the lens of security science diplomacy, Bifrost illustrates how scientific collaboration, industrial innovation, and strategic signalling intertwine, allowing a small state to manage strategic ambiguity, negotiate sovereignty sensitivities,

and balance competing security, economic, and normative objectives in a contested Arctic environment.

Keywords: Arctic security; science diplomacy; space governance

Collaboration interests: Collaboration with researchers interested in techno-defence initiatives, Arctic governance, space policy, and science diplomacy, particularly those exploring the intersections of security, technology, and international cooperation.

Contact information: khn@css.au.dk

Abstract from Marcus Marcussen

Mu Herculis is a nearby quadruple star system where four stars interact on complex trajectories. To solve the puzzle that is their orbital motion, we tracked their positions across the sky, combining centuries of historical records with modern, high-precision space data from the Gaia and Hipparcos missions.

This combination of space- and ground-based tracking enables us to map the stars' full 3D paths which, crucially, allows us to determine their masses using gravity alone. These masses are the missing pieces of a larger puzzle.

At Aarhus University, we have monitored the brightest of the four stars for 12 years using the SONG network to characterize its solar-like oscillations. While such asteroseismic measurements promise accurate stellar ages and masses, they rely on evolutionary models that must be calibrated against independent mass measurements. We present a complete orbital solution that provides exactly this calibration, establishing Mu Herculis as a premier benchmark for stellar physics.

Abstract from Karsten Frank Brogaard

A small FUT-STEP for man - a giant leap in astronomy and space education at all levels!

Current and future educational activities and possibilities with FUT (det Fjernstyrede UndervisningsTeleskop), a remote controlled telescope in Australia, and the upcoming STEP (STars and ExoPlanets) space mission, are outlined.



INSTITUT FOR FYSIK OG ASTRONOMI
DET NATURVIDENSKABELIGE FAKULTET
AARHUS UNIVERSITET

Date: 9/12/2025

The Planetary Science Working Group (Aarhus Space Center)

Jonathan Merrison, Senior Researcher, Institute of Physics and Astronomy, Aarhus University
Christoffer Karoff, GEO, Aarhus University
Michal Kazimierz Budzik, MPE, Aarhus University
Keld Rasmussen, GEO, Aarhus University
Jens Jacob Iversen, IFA, Aarhus University

Abstract:

Planetary Science is the study of environments within our solar system, including Planets, Moons, Asteroids, Comets and even general aspects of our own planet. This working group aims to coordinate and encourage collaboration between groups at AU with common interests in such solar system environments/bodies. This could include educational/student activities, research projects or technology development. A useful focal point for such activities could be the Planetary Environment Facilities at AU which are already being utilized in cross disciplinary student research projects.

Keywords; Environmental simulation, Planetology, Space exploration

Collaboration Interests:

It is the hope that this working group will coordinate and support Planetary Science activities at Aarhus, this could include educational/student activities, research projects or technology development. These activities could be cross disciplinary and involve the Planetary Environment Facilities at IFA.

Contact: merrison@phys.au.dk

Preferred presentation: Pitch



INSTITUT FOR FYSIK OG ASTRONOMI
DET NATURVIDENSKABELIGE FAKULTET
AARHUS UNIVERSITET

Date: 30/11/2025

The Aarhus Planetary Environment Facility

Jonathan Merrison, Senior Researcher, Institute of Physics and Astronomy, Aarhus University
Keld Rasmussen, emeritus Geoscience, Aarhus University
Jens Jacob Iversen, IFA, Aarhus University

Abstract:

IFA operates a Planetary Environment Facility which for the past 15 years has been involved in collaborative experimental planetary science, that is to say the study of environments within our solar system, including Planets, Moons, Asteroids, Comets and even general aspects of our own planet for example atmospheric aerosols and wind driven processes. This has included the testing/calibration of sensor systems for the Space environment, in some cases for ESA/NASA missions, but also for several EU supported research networks. This has involved a broad range of (interdisciplinary) research areas ranging from extreme environments on Earth to extra-terrestrial environments such as those found on Mars, icy Moons and in Space/LEO. It is hoped that in the future this facility could provide a similar service to Aarhus University researchers and students. Homepage: [Planetology research and industrial testing in Mars environment \(au.dk\)](http://www.phys.au.dk/ifa).

Keywords; Environmental simulation, Planetology, Space exploration

Collaboration Interests:

It is the hope that the Planetary Environment Facility could become a useful focal point for Planetary Science activities at Aarhus, this could include educational/student activities, research projects or technology development. These activities could potentially be cross disciplinary and carried out through the support of the Aarhus Space Center.

Contact: merrison@phys.au.dk

Preferred presentation: Poster

POSTER ABSTRACT

Propagation Channel Modeling for LEO Satellite Missions Using Ray-Tracing Simulations

Wahab Khawaja, Ismail Guvenc, Rune Hylsberg Jacobsen¹⁾ (presenter)

¹⁾ Department of Electrical and Computer Engineering (ECE), Email (presenter): rhj@ece.au.dk

Key words: Satellite communications, channel model, ground station

This work presents a comprehensive high-resolution ray-tracing-based propagation channel model specifically designed for LEO satellite-to-ground links operating at X-band frequencies in urban environments. Existing satellite communication models predominantly focus on GEO and traditional LEO configurations for small satellites, leaving significant gaps in characterizing elevation-dependent fading, site-specific scattering effects, phased-array antenna misalignment, and weather-related attenuation.

Using ray tracing simulations conducted at Aarhus University's campus building at Katrinebjerg, we develop a parametric model that captures both large-scale and small-scale fading phenomena across varying satellite elevation angles. The model addresses critical propagation challenges including multipath clustering, temporal-spatial dispersion, and antenna gain filtering effects that are particularly pronounced in low-elevation scenarios where shadowing and ground reflection significantly impact link quality.

Our methodology employs comprehensive ray-tracing simulations for satellite passes at 400 km and 500 km altitudes, analyzing propagation characteristics under multiple visibility conditions including clear line-of-sight, non-line-of-sight scenarios, and various weather conditions such as rain and snow. Small-scale fading is characterized through shadowed and non-shadowed Rician distributions, with multipath component clustering detected and labeled using advanced DBSCAN algorithms. Large-scale fading incorporates path loss, hardware impairments, antenna misalignment, and atmospheric effects modeled as equivalent gain losses.

The model is validated against the established 3GPP NTN reference model, demonstrating its accuracy and practical applicability. We comprehensively assess link degradation arising from ground station antenna misalignment for both single-element and phased-array configurations, revealing significant impacts on received signal quality. Results show substantial multipath component variations, delay spreads, and angular dispersion as functions of satellite elevation angle. This research provides essential insights for link-budget design, phased-array beam steering optimization, and site-specific system planning, advancing beyond generic 3GPP/ITU models for next-generation LEO satellite communication systems.

Collaboration interest: Seeking collaboration with antenna and mechanical engineers to improve the ground station design and with photonics/optics experts for research in optical satellite communications.

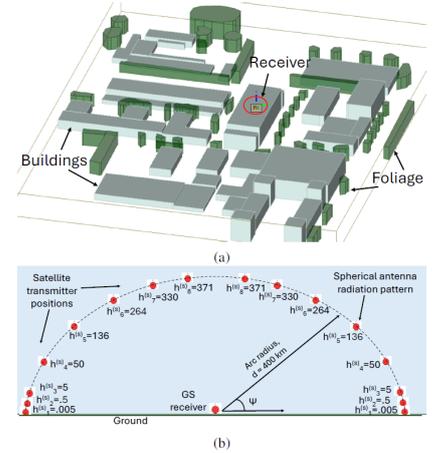


Figure 1: a) Ground station at Aarhus University's Edison Building; b) 400 km satellite pass with multiple elevation

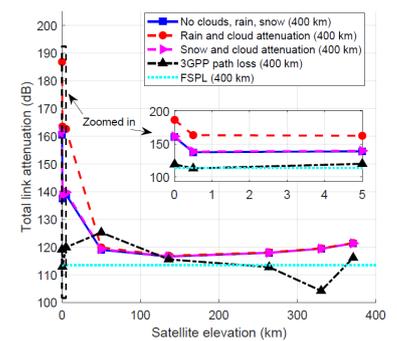


Figure 2: Total link attenuation for a 400 km satellite pass under varying weather conditions.

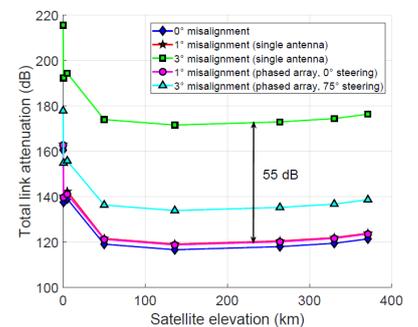


Figure 3: Total link attenuation for a 400 km satellite pass and antenna misalignment (0°, 1°, 3°).

ORDIS: Open Research Data Infrastructure for Space

Rune Hylsberg Jacobsen (rhj@ece.au.dk) - presenter

Denmark's framework for national space missions envisions data-driven virtual missions that leverage existing international satellites, archived datasets, and advanced digital tools. The ORDIS initiative establishes Denmark as a leader in Earth observation and space science by creating a flexible, AI-enabled ground segment that integrates heterogeneous data sources, supports multi-mission operations, and enables seamless access for research and commercial users.

Current infrastructure approaches are mission-specific, labor-intensive, and misaligned with the data-driven mission paradigm. ORDIS develops next-generation ground segment technologies that enable autonomous operations, multi-mission flexibility, and sophisticated data exploitation capabilities essential for virtual missions. This transforms ground segments from cost centers into strategic assets—accelerating innovation in climate monitoring, agriculture, maritime surveillance, and Arctic observation while unlocking opportunities in the downstream Earth observation economy.

Strategic Impact

ORDIS delivers scientific leadership through open, reproducible research frameworks; drives economic growth by enabling commercial Earth observation exploitation; positions Denmark as a sustainability leader through green computing expertise; and ensures international integration with ESA, NASA, and EU programs for global dataset access and co-funding opportunities.

Research Priorities

Autonomous and Intelligent Operations: AI-driven systems enabling autonomous ground segment operations with minimal human intervention, focusing on predictive maintenance, autonomous multi-mission scheduling, real-time anomaly detection, and explainable AI for critical situations.

Advanced Communication Architectures: Software-defined, reconfigurable ground stations supporting optical, RF, and future quantum links, with atmospheric compensation, hybrid protocols, and 5G/6G integration for resilient, adaptive infrastructure.

High-Performance Computing and Green Data Centers: Sustainable, scalable computing infrastructure optimized for Earth observation processing, advancing energy-efficient HPC architectures for AI/ML, innovative cooling solutions, renewable energy integration, and petabyte-scale storage systems—positioning Denmark as a leader in sustainable space data infrastructure.

Federated Data Infrastructure: Semantic frameworks enabling seamless integration with international programs while maintaining sovereignty, advancing distributed systems, privacy-preserving analytics, and multi-sensor calibration protocols.

Sustainable and Extreme Environment Operations: Ground station designs optimized for Arctic conditions, leveraging Denmark's Greenland geography to pioneer resilient space infrastructure in challenging environments.

ORDIS provides a replicable model for small-nation space investment, demonstrating how open infrastructure coexists with commercial viability, sustainability, and security—establishing Denmark as a destination for advanced space data processing.

Call to Action: Gather stakeholders to form a public-private partnership defining virtual space missions focused on excellence in space data procurement and utilization.