



# 2024 Earth-Space Symposium on 'Sustainability, Governance, Futures'

Utrecht, The Netherlands  
12-13 November, 2024

## Co-Hosts:

ERC Project PLANETSTEWARDS - Planetary Stewardship in view  
of Earth-Space Sustainability

Copernicus Institute of Sustainable Development, Utrecht  
University

Working Group on Earth-Space Governance, Earth System  
Governance Project



European Research Council

Established by the European Commission



Utrecht  
University



Earth  
System  
Governance

# Organizing Committee



**Xiao-Shan Yap**  
Utrecht University  
Chair



**Frank Biermann**  
Utrecht University



**Alice Gorman**  
Flinders University



**Marco Janssen**  
Arizona State University



**Rakhyun E. Kim**  
Utrecht University



**Tanja Masson-Zwaan**  
Leiden University



**Jean-Frederic Morin**  
Laval University



**Florian Rabitz**  
Kaunas University of  
Technology

# Support Team



**Blake Harvey**  
Utrecht University



**Ori Morales Hernández**  
Utrecht University



**Timothy Pape**  
Bowling Green State  
University



**Dimitra Stefoudi**  
Leiden University

# Program Overview

Day 1	November 12 (Tuesday)	Room
<b>Morning</b>		
8:30	Registration & welcome coffee	Johanna Westerdijkkamer
9:00	Opening: Planetary Stewardship in view of Earth-Space Sustainability	Belle van Zuylenzaal
10:00	PP 1: Sustainability Governance	Belle van Zuylenzaal
10:45	Coffee break	Johanna Westerdijkkamer
11:15	PP 2: Resource Governance	Belle van Zuylenzaal
12:00	Group photo & lunch	Johanna Westerdijkkamer
<b>Afternoon</b>		
13:15	Breaking Captured Futures: Co-Mapping Earth-Space Systems	Belle van Zuylenzaal
14:15	PP 3: Ethical & Philosophical Perspectives	Belle van Zuylenzaal
15:15	Coffee break*	Johanna Westerdijkkamer
15:45	PP 4: Space Governance Models	Belle van Zuylenzaal
16:30	Coffee break*	Johanna Westerdijkkamer
17:00	PP 5: Anticipatory Space Governance	Belle van Zuylenzaal
18:00	Evening reception	Johanna Westerdijkkamer
19:00	Walk to dinner place (optional)	
<b>Day 2</b>		
<b>November 13 (Wednesday)</b>		
<b>Morning</b>		
8:30	Welcome coffee	Johanna Westerdijkkamer
9:00	PP 6: Space in Future-Making	Belle van Zuylenzaal
10:00	PP 7: Global Equity	Belle van Zuylenzaal
10:45	Coffee break*	Johanna Westerdijkkamer
11:15	PP 8: Pluriversal & Cultural Perspectives	Belle van Zuylenzaal
12:15	Lunch*	Johanna Westerdijkkamer
<b>Afternoon</b>		
13:15	Transdisciplinary Approaches to Earth-Space Systems	Belle van Zuylenzaal
14:15	PP 9: Law & Institutions	Belle van Zuylenzaal
15:15	Coffee break*	Johanna Westerdijkkamer
15:45	PP 10: Power Dynamics	Belle van Zuylenzaal
16:30	Coffee break*	Johanna Westerdijkkamer
17:00	FutureSpace(s) & Strategic Foresight (Workshop I)	Belle van Zuylenzaal
	Constructing Nature in Space (Workshop II)	Kernkampkamer
17:45	Closing Remarks & Future Activities	Belle van Zuylenzaal
18:00	End	

\*Two creative contributions are presented at Kernkampkamer and Belle van Zuylenzaal.

# Program

## DAY 1, November 12, 2024 (Tuesday)

8:30 Registration & Welcome Coffee

9:00 **Opening:  
Planetary Stewardship in view of Earth-Space Sustainability**

The opening session will welcome the participants of the symposium and introduce the PLANETSTEWARDS project, including outlining a preliminary view of the key elements to be considered as constituting Earth-Space system(s). The session will invite leading experts to share their insights based on their respective fields, focusing on state-of-the-art development, the dynamics of the Earth-Space systems, and implications for sustainability and governance.

Xiao-Shan Yap (Chair, Earth-Space Symposium), Director & Principal Investigator, PlanetStewards Project, Utrecht University

Frank Biermann, Founder & Inaugural Chair, Earth System Governance Project; 2024 Volvo Environment Prize Winner; Utrecht University

Pascale Ehrenfreund, President, Committee on Space Research (COSPAR); Former President, International Astronautical Federation (IAF); Co-Chair, Global Future Council on Space of the World Economic Forum (WEF); George Washington University

Tanja Masson-Zwaan, President Emerita, International Institute of Space Law (IISL); Vice President, International Astronautical Federation (IAF); Leiden University

10:00 **Presentation Panel 1: Sustainability Governance**

*Session Chair: Marco Janssen*

**The Missing Ingredients for a Polycentric Governance System of Orbital Debris**  
Jean-Frédéric Morin – Laval University

**Sustainably Managing the Triple Planetary Crisis from Space: Disentangling the Astropolitical, (Geo) Ecological and Legal Conflicts on Earth**  
Feja Lesniewska – University of Surrey

**Earth-Space Sustainability Dynamics: Preliminary Findings**  
Loïs Miraux

10:45 Coffee Break

11:15

## **Presentation Panel 2: Resource Governance**

*Session Chair: Tanja Masson-Zwaan*

### **Synthesizing Frameworks of Sustainability for Futures on the Moon**

Marco Janssen – Arizona State University

### **Protecting Extra-Terrestrial Biodiversity: What Space Law Can Learn from Protecting Biodiversity on Earth**

Marjan Ajevski – Open University

### **Space Resources and the Capitalocene**

Thomas Cheney – Northumbria University, Newcastle

12:00

**Group Photo & Lunch**

13:15

## **Breaking Captured Futures: Co-Mapping Earth-Space Systems**

This session will dive deeper into the transition from ‘outer space’ to ‘Earth-Space’. The session will begin with an introductory talk on futuring by Jeroen Oomen, followed by interactive activities for participants to share their diverse perspectives. We will jointly discuss how outer space became a governance object in global space history, in what ways Earth-Space system(s) may be thought of as a new governance object, and the differences between the two.

Jeroen Oomen & Xiao-Shan Yap – Utrecht University

14:15

## **Presentation Panel 3: Ethical & Philosophical Perspectives**

*Session Chair: Jean-Frédéric Morin*

### **Resonant (off)worlds. Place-Making and ‘Geoconstructivism’ in Cosmic Imaginations**

Paloma Puente-Lozano – University of Madrid

### **Uncovering a Bridge from Earth-Space to and with Outer-Space**

Brit Kolditz – Memorial University of Newfoundland

### **Considerations of Justice for the New Space Age**

Santiago Vrech – Utrecht University

### **Politics of Space-Making: The Role of Responsibility and Ethics in the Multi-Planetary Paradigm**

Claudiu Martin – Complutense university of Madrid

15:15

**Coffee Break\***

15:45

**Presentation Panel 4: Space Governance Models**

*Session Chair: Florian Rabitz*

**A Green Toolkit for Space: Enabling Sustainable Choices for the UK & Global Space Industry**

Rachael Craufurd Smith – University of Edinburgh

**Enhancing the Role of Games in Space Governance**

Anna Hurova – University of La Rochelle

**Space for Earth and Earth for Space: Towards a Future Research Agenda for the 18th Sustainable Development Goal**

Ioana Bratu – Vrije Universiteit Amsterdam

16:30

**Coffee Break\***

17:00

**Presentation Panel 5: Anticipatory Space Governance**

*Session Chair: Rakhyun E. Kim*

**The Crimes of Outer Space**

Julia Muraszkievicz – University of Amsterdam

**Living Amongst the Stars: Conceptualising Freedom of Movement to and from Future Extraterrestrial Human Settlements**

Anna Marie Brennan – University of Waikato, New Zealand

**Ecocide in Outer Space: Countering Irreversible Harms to the Space Environment**

Fiona Naysmith – Open University

**Situating Astrobiology in a Future-Oriented Earth-Space Governance Model**

George Profitiliotis – Blue Marble Space Institute of Science

18:00

**Evening Reception**

19:00

**Walk to Dinner Place (Optional)**

We will have dinner (self-paid) at Chillz. Address: Oudergracht Aan De Werf 211, Utrecht.

\*Visit Kernkampkamer during these breaks to view the artwork 'Space Shadows' by Sebastian Leva Spivey from the University of Twente.

## **DAY 2, November 13, 2024 (Wednesday)**

8:30 Welcome Coffee

9:00 **Presentation Panel 6: Space in Future-Making**

*Session Chair: Rakhyun E. Kim*

**From Globalization to Planetization: How Changing the Historical Narrative Can Draw Attention to Earth-Space Sustainability**

Brad Tabas – ENSTA Bretagne

**From craft to debris: A narrative analysis on how space objects become waste**

Renne Vantola – National Land Survey of Finland / University of Lapland

**No time for the future? Futuring Practices and Conflicting Temporalities in European Space Policy-Making**

Nina Klimburg-Witjes & Philipp Kürten – University of Vienna

**Socio-technical imaginaries of space utilization in the Anthropocene**

Margaux D'Hont – CNES, France; Lois Miraux

10:00 **Presentation Panel 7: Global Equity**

*Session Chair: Marco Janssen*

**The North-South Structure of the Global Satellite Industry**

Florian Rabitz – Kaunas University of Technology

**Earth Observation as a Tool to Advance Neocolonial Regimes: The Case of Africa**

Smit Rajshekhar Patel

**North-South Dynamics in Global Environmental Governance: Comparing Outer Space with Other Areas Beyond National Jurisdiction**

Philippe Evoy – Université Laval and VU Amsterdam

10:45 Coffee Break\*

11:15 **Presentation Panel 8: Pluriversal & Cultural Perspectives**

*Session Chair: Jean-Frédéric Morin*

**Kinship and living in Treaty with outer space**

Hilding Neilson – Memorial University of Newfoundland & Labrador, Canada

**Integrating Indigenous outlooks in international space law: a relational approach to the environment**

Giuliana Rotola - Scuola Superiore Sant'Anna, Italy

**Star-Spangled Speeches: Spaceflight's Agendas in Asia**

Valentin Hoffmann – University of Vienna



**How to stop Captain Kirk becoming the next Cortez, Coen or Cook**  
Adrian Young – Inspectie Leefomgeving en Transport (ILT), Ministerie  
Infrastructuur en Waterstaat (Min IenW); Leiden University Graduate

12:15

Lunch\*

13:15

### **Transdisciplinary Approaches to Earth-Space Systems**

This panel invites experts from different fields to offer a transdisciplinary view on addressing challenges in the Earth-Space systems. Each speaker will present their work in their respective research or policy fields, including space debris mitigation, the protection of dark and quiet skies, Astronomy from the Moon, and advocacies for space cultures. The discussion will focus on the emergent issues, the different methodological approaches (e.g. engineering modeling, risk assessments, and art sciences), and what might be some potential synergies to better address the challenges of the Earth-Space systems.

Xiao-Shan Yap (moderator) – PlanetStewards Project, Utrecht University

#### **ESA's Zero Debris Approach**

Francesca Letizia – European Space Agency (ESA), ESTEC

#### **Protecting Lunar Sites of Extraordinary Scientific Importance (SESIs)**

Martin Elvis – Harvard & Smithsonian; International Astronomical Union (IAU)

#### **Planetary Public Stack: 'More-than-Planet'**

Miha Turšič – Waag Futurelab

14:15

### **Presentation Panel 9: Law & Institutions**

*Session Chair: Tanja Masson-Zwaan*

#### **Integrating Outer Space into the Regulatory Regime for Environmental Protection to Promote Earth-Space System Governance**

Merve Burger – University of Neuchatel & Aylin Yildiz Noorda –University of Lisbon and University of Bern

#### **Protecting Ocean Ecosystems from Outer Space Activities: Reflections on regime interaction after the Recent Advisory Opinions of the International Tribunal for the Law of the Sea**

Vito De Lucia – Norwegian Centre for the Law of the Sea

#### **Legal Issues of Space Resource Activities: The path towards a new international legal framework?**

João Marques de Azevedo – NOVA School of Law

**The international legal framework on the utilization of remote sensing satellites in the event of a disaster: analysis of the Copernicus emergency**



management service and its contribution in the response to the wildfire in Chile

Elisa Leoni – Centre for Higher Defence Studies (Casd) - School Of Advanced Defence Studies (Ssuos) – University of Turin

15:15 Coffee Break\*

15:45 **Presentation Panel 10: Power Dynamics**

*Session Chair: Florian Rabitz*

**Cosmolocal production for sustainable space technology**

Lucas Lemos – Tallinn University of Technology

**Technological Borders in Space: Taiwan's Pursuit of High-Resolution Satellite Capabilities Amidst Geopolitical Tensions**

Yi-Ting Chang – University of Oxford

**Towards Effective Governance: Drawing Lessons to Prevent a Hiroshima in Space**

Justine Dousset – Institute of Space and Telecommunications Law (IDEST)

16:30 Coffee Break\*

17:00 **Future Space(s): Strategic Foresight (Workshop I)**

Philipp Kürten & Nina Klimburg-Witjes – University of Vienna

In our workshop, we will begin by shortly introducing our research into the futuring practices of outer space. Participants will then work in four groups to explore distinct future scenarios designed to inform European space policy, examining how Earth-Space Governance perspectives can contribute novel insights into each scenario. Together, we will then critically examine how futuring practices such as strategic foresight can inform, influence and reshape our current approaches, policies and priorities in Earth-Space Governance.

**Constructing Nature in Space (Workshop II)**

Timothy Pape – Bowling Green State University

In this workshop we will discuss how (social) constructivist theories may assist in Earth-Space sustainability challenges, governance issues, and future-making endeavors. Participants will share experiences and viewpoints regarding how nature is framed beyond Earth. After a short brainstorming session, interested participants will initiate a multi-authored perspective paper which will propose broad theoretical conceptualizations of how novel extraterrestrial ecosystem governance schemes may be constructed.

17:45 **Closing Remarks & Future Activities**

Xiao-Shan Yap – PlanetStewards Project, Utrecht University

18:00 End (see next page for information on creative contributions)

\* Stay at Belle van Zuylenzaal during these breaks for the creative contribution by Athanasios Tsarouchas from Maastricht University on 'Immersive Virtual Reality Experience: Exploring Space on the Moon and in Earth's orbit'; Visit Kernkampkamer to view the artwork 'Space Shadows' by Sebastian Leva Spivey from the University of Twente.

# Abstracts

## Creative Contributions

### **Space Shadows**

Sebastian Leva Spivey – University of Twente

Space Shadows is an practice of capturing extraterrestrial travelers in cyanotype prints, solidifying their shadows in chemically hardened sunlight. It began with the series Untitled (Moon Trees #1-7) in 2022, and continues now with Untitled (Rocket Parts) in 2024. For each iteration of Space Shadows, I make a series of cyanotype prints by using objects that have traveled through the atmosphere as the image matrix, and then exposing the image using sunlight. In this way, I am able to capture the “shadow” of extraterrestrial travelers. Such a collaboration between earthling, solar energy, and space-artifact materializes a relationship of wonderment, finitude, and release that opposes the extractive national and corporate imaginations that dominate the current space age. It also enacts an immediate relationship of earthlings as creatures already engaged in cosmic encounters, without the mediation of industry. Moon Trees used leaves, twigs, and other detritus collected from the Moon Tree in Sewanee, TN, USA. This is one of several Moon Trees scattered across the USA, all of whom are grown from seeds sent into orbit around the moon on Apollo 14 in 1971 and planted on their return. Rocket Parts was created by capturing impressions of small rockets and cubesats built and launched by Space Society Twente, a student organization at the University of Twente, NL, that seeks to find ways to make space a space for all. This project was also presented at the EASST-4S 2024 meeting.

### **Immersive Virtual Reality Experience: Exploring Space on the Moon and in Earth's orbit**

Athanasios Tsarouchas – Maastricht University

This VR creative session is designed to transport participants into the vast expanse of space, providing a series of unforgettable, immersive experiences that highlight key milestones in human space exploration. The session begins with a walk on the moon, where participants will feel the surreal sensation of lunar gravity and traverse the rugged, alien terrain. This segment offers a rare opportunity to appreciate the moon's desolate beauty and understand the challenges faced by astronauts. Next, participants will witness the historic Apollo 11 landing. Through VR technology, they will experience the tension and triumph as Neil Armstrong and Buzz Aldrin make their legendary descent to the lunar surface. This reenactment provides a profound appreciation of one of humanity's greatest achievements and the intricate details of the mission. The journey continues with a visit to the International Space Station (ISS). Here, participants will explore the cutting-edge research facility that orbits Earth, gaining insights into the daily lives and groundbreaking work of astronauts aboard the ISS. The interactive tour includes viewing various modules, observing scientific experiments in progress, and understanding the unique challenges of living in microgravity. The session concludes with a breathtaking view of Earth from orbit. Participants will experience the awe-inspiring sight of our planet from space, observing its beauty and fragility from a perspective few have witnessed. This segment emphasizes the interconnectedness of life on Earth and underscores the importance of space exploration for understanding and preserving our home planet. Through these immersive VR experiences, participants will gain a deeper appreciation for space exploration, the remarkable achievements of astronauts, and the future potential of human endeavors in space. This session not only educates but also inspires a sense of wonder and curiosity about the universe, fostering a deeper connection to the ongoing story of space exploration.

## **Presentation Panel 1: Sustainability Governance**

### **The Missing Ingredients for a Polycentric Governance System of Orbital Debris**

Jean-Frédéric Morin – Laval University

The pollution of Earth's orbits by debris represents a pressing environmental problem. Recognizing that geopolitical factors hinder the adoption of a multilateral solution, several experts advocate for a polycentric governance system, inspired by Elinor Ostrom's work. This paper assesses the viability of such a proposal. It finds that the global network of space organizations exhibits the structural characteristics of a polycentric system. However, arrangements concluded among these organizations fail to promote sustainability norms and interviews with key stakeholders reveal the absence of several institutional conditions for a sustainable polycentric governance system. The paper concludes that a polycentric structure alone does not guarantee the emergence of sustainable governance. As orbital space is a relatively easy case for applying polycentricity theory to the global commons, this research serves as a reminder about the limitations of polycentric approaches in global environmental politics.

### **Sustainably Managing the Triple Planetary Crisis from Space: Disentangling the Astropolitical, (Geo)ecological and Legal Conflicts on Earth**

Feja Lesniewska, Joshua Andersen, and Rosalind Malcom – University of Surrey

The triple ecological crisis of climate change, ecological degradation and toxic waste pollution are global commons problems requiring collective action by states to transform the international legal order. To varying degrees states have cooperated to resolve the crisis through numerous multilateral environmental agreements (MEAs). MEA parties increasingly rely on Earth observation technologies situated in orbital space to gather data for monitoring and reporting on anthropogenic activities, including their impact on ecosystem functions such as forest, waters and oceans. Information and communication technologies supported by satellite systems are becoming increasingly embedded in net zero transition infrastructures and devices to decouple economic activity from environmental impacts. The growing reliance on space to provide the essential services, especially data, to transition out of a triple planetary crisis has led to calls to rethink space sustainability, such as the Astra Carta (2023), using a systems approach underpinned by life cycle analysis. International space law urgently needs updating within an underpinning theoretical framework protecting the commons, to ensure that access to orbital space and its services remain available to be used in the multipronged approaches to tackle the triple planetary crisis, but also that space activities themselves are also sustainable throughout their full life cycle. Reaching such consensus faces daunting challenges due to antagonistic relations in a multipolar astropolitical world in which militarised space activity is a central focus of states' (China, Russia and US). The paper is a cartographic exercise that will map the interconnected nature of space sustainability issue. This paper uses a transdisciplinary systems approach to unravel the interconnections across, between and within the astropolitical, (geo)ecological and legal domains on Earth to identify strengths, weaknesses, opportunities and threats to the sustainability of space services necessary to address the triple planetary crisis.

### **Earth-Space sustainability dynamics: Preliminary findings**

Loïs Miraux

In the context of rapid growth of the space sector, the environmental consequences of space activities are drawing increasing attention from academia, policymakers, and the general public. Concerns include the accelerating accumulation of debris, light pollution from artificial space objects, atmospheric effects of launches and reentries, and pressures on the biosphere over the lifecycle of space systems. Recent research has acknowledged that the development of space activities has multiple consequences on the Earth environment, highlighting the interconnected nature of Earth and space sustainability leading to the concept of 'Earth-Space sustainability'. However, existing studies and policies addressing the aforementioned environmental impacts of space activities tend to focus on isolated issues without considering the entire picture. This is due to the inherently complex nature of these impacts requiring highly specialized knowledge but also because the study of these impacts as distinct fields of research is still relatively new, with the exception of space debris. As a result, not only are these issues still poorly understood individually, but

importantly, their collective interactions and the resulting intertwined dynamics have been largely overlooked. Yet, it is well known from research on socio-ecological systems that environmental problems are often deeply interconnected. Studying how different components evolve and influence each other with time through systems thinking to identify relationships and feedback loops is critical to avoid ineffective or even counterproductive mitigation measures, as well as unintended consequences like burden shifting. Therefore, this paper brings together multidisciplinary research on the environmental impacts of space activities to describe the Earth-Space sustainability problem through causal loop diagrams and a simplified and stylized system dynamics model. This approach provides a new understanding of this problem by highlighting the existence of unexpected influences, harmful reinforcing loops, and conflicting mitigation measures, which have profound implications for space policy-making and space systems design.

## **Presentation Panel 2: Resource Governance**

### **Synthesizing Frameworks of Sustainability for Futures on the Moon**

Marco Janssen – Arizona State University; Afreen Siddiqi and Olivier de Weck – MIT; Parvathy Prem – John Hopkins

Over a dozen nations have expressed plans to engage in robotic and human missions to the Moon. The Artemis campaign explicitly aims for sustainable exploration, and its current plans include crewed and robotic operations on the lunar surface. With growing interest in lunar surface exploration and sustainability goals, it is important and timely to explore what lunar surface sustainability means. We present initial work on research to develop a novel framework for evaluating lunar surface sustainability. Frameworks for sustainability on Earth offer useful guidance for future exploration. What does "sustainability" mean for space exploration? Some of the definitions in published literature are conflicting or incomplete. Building on the work on the governance of coupled infrastructure systems, we will develop a framework of governance for the lunar surface. Social and political factors will be integrated with technical and scientific considerations through inclusion of the concepts of emissions and natural capital accounting. For lunar surface presence, quantitative estimates of gaseous, liquid, and solid emissions from humans, robots, and infrastructure to the lunar environment (including its exosphere and surface) can be used as metrics relevant for sustainability. Currently planned space exploration activities have the potential to change the character of these assets, raising the question of what it means to sustainably interact with the lunar environment. Later in the project, we aim to demonstrate how the framework developed in this work may be applied to the lunar south polar region, a location of interest for multiple governmental, commercial, and other actors.

### **Protecting extra-terrestrial biodiversity: what space law can learn from protecting biodiversity on Earth** Marjan Ajevski – Open University

When we eventually find extra-terrestrial life in the solar system it will most likely not be a single form of life but a bio-diverse ecosystem. Moreover, there is a possibility that these ecosystems will be fragile. So how do we protect them from damage? COSPAR has issued its planetary protection guidelines, which covers mission planning and execution of missions to celestial bodies that either have life or have had life in the past. However, COSPAR is a committee within a private body, the International Science Council, and its regulatory reach is limited. While most scientist interested in finding extra-terrestrial life would follow the COSPAR planetary protection guidelines, not all activities in space are carried out by scientists. For example, SpaceX is planning to extend the capabilities of its Starship platform to eventually be able to land on Mars, with several planned failures before a landing is successful. Is SpaceX going to follow COSPAR's planetary protection guidelines in those planned failures and eventual landings? Who is going to make them? In this paper we are going to explore the experiences of trying to protect biodiversity on Earth, especially in areas beyond national jurisdiction, such as the High Seas or the sea-bed. Much like space, these areas are seen as an international commons, or a common heritage of humanity. This means that international law governs those areas, and there have been concerted efforts over the last three decades to protect biodiversity through international law. This means that they have had to confront issues such as lack of norms, as well as lack of monitoring and enforcement once those norms were created. These are useful experiences from which space law and governance can use to stave off the worst of humanity's instincts exploit nature as a resource.

## Space Resources and the Capitalocene

Thomas Cheney – Northumbria University, Newcastle

The prospect of space mining necessitates a critical analysis of space resources within the context of the climate crisis and humanity's (and/or capital's) relationship with natural resources and the broader environment. This analysis requires situating space resources and space expansionism within the context of the history of European colonialism and imperialism, capitalism and industrial development. To that end this paper will draw on the works of Julie Klinger, Corey Ross, Jairus Victor Grove, Martín Arboleda, Elizabeth Carolyn Miller, Jason Moore and others. This paper seeks to build on my recent work calling for a 'cosmic turn' in environmental thinking (Cheney 2024) and an 'environmental turn' in space governance (Marino and Cheney 2023) particularly relating to the discussion of space resources and governance. This paper will develop the argument that space mining needs to be understood as continuation of the process of commodification and extraction that has wrought unprecedented ecological transformation and created the Anthropocene (and why that is perhaps better conceived of as the Capitalocene). Space mining needs to be seen as an extension of the 'Cheap Nature' project and part of capital's continuing search for new resource frontiers. The prevailing space expansionist paradigm driving interest in space resource exploitation rather than auguring the development of a 'new future' benefiting 'all of humanity' will extend the extractivist paradigm responsible for the climate crisis and inextricably intertwined with the colonialism and ecological imperialism encapsulated by the term 'capitalocene.' Any Earth-Space Sustainability governance initiative needs to centre a critical analysis grounded in legal geography and the environmental humanities, especially if space resource activities have any hope of being 'in the interest and for the benefit of' all humans as the Outer Space Treaty calls for. A non-extractivist approach to space resources may be possible but not without challenging the existing paradigm.

### **Presentation Panel 3: Ethical & Philosophical Perspectives**

#### Resonant (off) worlds. Place-making and 'geoconstructivism' in cosmic imaginations

Paloma Puente-Lozano – University of Madrid

This paper seeks to analyse ongoing attempts to put forth critical/alternative cosmic imaginations that problematize the terrestrial egocentrism integral to hegemonic discourses about outer space in many space-faring states' astrocultures. It will explore a paradox that runs deep in the project of putting forth critical cosmic imaginations, in which geocentrism, resonance, and place-making are presented as problematic and inescapable at the same time. On the one hand, place-making practices are essential to the way scientists and lay people alike cope with extra-terrestrial and cosmic objects and environments. Worlding and place-making have been claimed by anthropologists to be firmly anchored in resonance as a mechanism to cope with the 'distant', 'alien', "unearthly" (Messeri, 2016). On the other hand, the entanglement between territorial logics or territoriality and place-making of outer space has facilitated, legitimated and perpetuated expansionist policies reaching out new planetary domains, since Earth-based outlooks tend to make outer space activities very prone to be codified in terms of a territorial logic and territoriality, and thus to conceive outer space as part of an ever-expanding process of volumetric territorilisation that potentially encompasses the whole cosmos. This process can be considered as part of an ongoing extra-terrestrial expansion of geopower and the outcome of geoconstructivism (Neyrat, 2019). Yet to retain the 'radical alterity' of both Earth and/or off-worlds (as these new political ontologies call for; Luisetti, 2023) seems to run counter to the very idea of place-making. In that sense, alternative cosmic imaginaries need to work out a delicate balance, for both an Earth-bound perspective and a sense of place/sense of planet are to play a central role in any critical (i.e decolonised, deterritorialised) imagination on outer space. Thus, the problem is not in itself the geocentric nature of outer space imaginaries and their ensuing terrestrial bias, but frontierism, settler/colonial mentality and space expansionist ideologies that are embedded in well-established geocentric astrocultures and the negative and dangerous outcomes that stem from the territorial gaze: one that makes the cosmos amenable to Westphalian logic that these ideologies cast upon outer space (Billé, 2020: 10).

## Uncovering a Bridge from Earth-Space to and with Outer-Space Brit Kolditz – Memorial University of Newfoundland

Space on earth is under various pressures, including land use change, urbanization and different forms of densification, e.g. building and population densities. Besides intensified air traffic, an increase in the use of unmanned aerial vehicles is to be expected, posing further challenges for air traffic management as part of space management. The growing occupation of space by human activities and technologies is not limited to Earth, but increasingly extending to outer space. In addition to internationally unregulated expansion and use of Earth's orbital environment, the accumulation of space debris poses a related grand challenge that parallels the human-made waste problem on Earth. Apart from the pressing need for international organization and legal regulation in terms of the use of outer space, I offer an alternative approach to a grounded understanding of space by uncovering a bridge between earth and outer space. In contrast to abstract and thus detached understandings of rules and laws, it is about the more fundamental relationality of humans to "free space" itself. In this presentation I introduce the "Phenomenology of Space," which differs critically from common phenomenology and sense of "place" while it offers a spatial analysis and conceptualization of "free space". Both as theory and as practice, phenomenology of "space" can make the relational structure between earth space and outer space comprehensible and extends the human understanding of earth-space to and with outer-space. The approach enables awareness of free space as well as the loss of it as result of increasing crowding and densification. Space becomes apparent as finite resource, where its absence affects the interconnected health of humans and earth's terrestrial and extraterrestrial environment. Based on understandable spatial relationality, sustainable responsibilities and political decisions can be made with earth space and outer space and addressing the problem of "free riders" in the "tragedy of the commons."

## Considerations of Justice for the New Space Age Santiago Vrech – Utrecht University

To the best of our knowledge, space is deemed to be lifeless [1], [2]. From this claim (I), two further claims can be defended. First, (II) that celestial bodies are not intrinsically valuable objects. These bodies are instrumentally valuable. Hence, we can unboundedly advance our own means without much further problem. Second, (III) it is misplaced to undertake policies of environmental protection for celestial bodies. Earth pollution should be moved to space, and this should not be a reason for alarm. As a matter of fact, this would be preferable. Many authors have argued that the move from (I) to (II) is reductionistic or, simply put, wrong. [3], [4], [5], [6]. Other writers, however, have overlooked this issue and argued for the step from (II) to (III) [7], [8]. In this talk I will argue against those who have objected from the move to (I) to (II). I will maintain that the lifeless condition of celestial bodies is a central truth that has an important consequence: celestial bodies are not intrinsically valuable. However, I will argue against those who move from (II) to (III) by showing that we have moral reasons to seriously consider applying a theory of environmental justice for celestial bodies.

## Politics of space-making: The role of responsibility and ethics in the multi-planetary paradigm Claudiu Martin – Complutense university of Madrid

Is it not paradoxical that outer space, which appears limitless, can only be accessed from this narrow territory on which humans, among other species, depend for their survival, and what Bruno Latour (2020) has called critical zones? One of the principal objectives of this paper is to inquire into the responsibility of private companies and public institutions with the capability to colonise other planets, and thereby position themselves as a new elite with agency and primacy over the new multi-planetary paradigm. Specifically, it aims to analyse whether they bear a special responsibility to ensure the habitability conditions of Earth, particularly concerning what Rockström et al. (2024) call the "planetary commons," and what legal or economic reforms are necessary for their effective implementation. However, this new regulation cannot solely focus on the economic benefits it may generate; its foundation must be primarily the strengthening of ethics. In recent years, feminist theory and queer futures have demonstrated that in contrast to the modern paradigm of unlimited growth, a new paradigm grounded in an ethics of care must be established, creating new forms of life that consider the agency of more-than-human actors in the complex system that is Earth. If the above is successful, the consequences will be the alignment of outer space governance interests while simultaneously repairing terrestrial injustices committed against both humans and the more-than-human. Ultimately, Earth-space



governance is relevant because it plays a crucial role in reconfiguring a new form of enlightenment and understanding of what it means to inhabit space, which is one of the main political objectives of the contemporary context. In this sense, the paper seeks to make two main contributions: first, to define the responsibility of the actors who have the most agency over the Earth-Space governance process, and second, how such accountability helps to generate an awareness of multi-planetary that facilitates the eco-social transition.

## **Presentation Panel 4: Space Governance Models**

### **A Green Toolkit for Space: Enabling Sustainable Choices for the UK & Global Space Industry**

Rachael Craufurd Smith – University of Edinburgh

The space sector may have lagged behind Earth-based terrestrial and marine comparators in environmental awareness, but, with increasing commercial development and competition for limited resources, it is rapidly catching up. This has led to the production of multiple sustainability guidelines, standards, and regulations at international, regional, and national levels; a situation further complicated by the interaction between space-specific and other laws and regulations, such as planning and atmospheric pollution laws. Understanding the practical implications of these overlapping regulatory domains and diverse concerns is immensely challenging, yet also essential if we are to prevent long-term, cumulative negative consequences for both the Earth and space. With this in mind the paper considers: 1) how current knowledge about sustainable practices flows to, from, and between actors operating within the space sector; 2) the extent to which companies, notably SMEs, working at different points in the satellite life cycle, are able to access, and provide, information on the significant environmental impacts of their material use, procurement, and space operations; and 3) the potential barriers to, and incentives for, such knowledge transfer and behaviour change. Building on this, the paper explores how the complex web of principles, standards, rules, and guidelines could be translated into a user-friendly, online information platform: a 'Green Toolkit for Space'. In particular, we illustrate with reference to batteries and solar panels how such a platform could enable concerns, new information, and good practice to be shared amongst industry and other interested parties, including the public. Consideration is also given to how such a platform could relate to other information and evaluation systems, such as business environmental, social and governance reporting, and the key challenges posed by its operation.

### **Enhancing the Role of Games in Space Governance**

Anna Hurova – University of La Rochelle

Adaptive governance as a concept came from institutional theory evolution of institutions for the management of shared assets and has been suggested to apply to space resource governance. This refers to the evolution of the rules and norms that promote the satisfaction of underlying human needs and preferences given changes in understanding, objectives, and the social, economic and environmental context. The pivotal point is that the normative criteria used to judge whether a change in governance arrangements is 'adaptive' or 'good' is derived from values and preferences. According to the widely used gamification theory of Argyris and Schön, and depending on the forms, such as closed simulation game or open policy game, the serious game can serve as a powerful tool for acquiring in-depth knowledge by identifying and rectifying behaviours that do not align with changed situation or values of the participants. Thus, the game can be regarded as an instrument for facilitating adaptive governance. Rawl's concept of the veil of ignorance has the aim to nullify the effects of specific contingencies which put men at odds and tempt them to exploit social and natural circumstances to their own advantage. To achieve this, the parties should not know how the various alternatives will affect their own particular case and they are obliged to evaluate principles solely on the basis of general considerations. This is possible to realize by the placing decisionmakers under a constraint of ignorance about their own identities and attributes. Although the decisionmakers know or can guess whether they will occupy position, the rule introduces uncertainty about whether they will reap greater gains from the decision. Both possibilities could be realised through gamification.

## Space for Earth and Earth for Space: Towards a Future Research Agenda for the 18th Sustainable Development Goal

Ioana Bratu – Vrije Universiteit Amsterdam

The potential of outer space in achieving the 17 Sustainable Development Goals (SDGs) has already been recognized by the United Nations, via the “Space2030” Agenda. For example, satellite technology plays a crucial role in monitoring climate change, tracking deforestation, melting ice caps, and greenhouse gas emissions, hereby supporting SDG 13 (Climate Action). Additionally, space-based communication systems enhance global connectivity, contributing to SDG 9 (Industry, Innovation, and Infrastructure) by enabling advanced telecommunication networks. Space technologies may also facilitate the fulfilment of SDG 11 (Sustainable Cities and Communities) by providing timely data required for emergency responses during crises and catastrophes. Given such important contributions of space technologies to the sustainable development goals, several initiatives are currently advocating for the formulation of a new SDG 18. Generally, this new goal emphasizes the responsible and sustainable development and utilization of outer space to further support worldwide sustainability efforts for planet Earth. However, the proposal for a “space SDG” does not come without challenges. Achieving international consensus on regulatory and governance frameworks for space activities has proven historically difficult. The main international treaties representing the *Corpus Juris Spatialis* required extended timeframes and the lack of political consensus led to legal lacunae in their provisions. The existing geopolitical climate and differing national interests can still impede the establishment of an international set of rules necessary for sustainable space operations. Additionally, the technological and financial barriers associated with developing and implementing sustainable space technologies pose significant obstacles, since the economic power of nations varies significantly. In such context, the purpose of this paper is to explore a potential research agenda for the future adoption of SDG 18. It will analyse the conceptual frameworks of existing initiatives on SDG 18; potential benefits and challenges associated with integrating space into the sustainable development agenda as a separate goal; necessary governance and regulatory frameworks, as well as novel policy recommendations.

### **Presentation Panel 5: Anticipatory Space Governance**

#### The crimes of outer space

Julia Muraszkievicz – University of Amsterdam

In 2019, Summer Worden made history by filing the first accusation of a crime committed in outer space, alleging that her estranged then-wife, NASA astronaut McClain, had wrongfully accessed their bank accounts from the ISS. This case highlighted the emerging legal challenges posed by human activities beyond Earth. As humanity expands its presence in space, from prolonged ISS missions to future endeavors on the Moon and Mars, understanding and preparing for space-related crimes becomes imperative. Yet the domain is in its infancy, with few scholars writing about it (e.g., Sachdeva, 2023). This paper explores the types of crimes likely to occur in outer space, but readers should note it is not about jurisdiction, for that see the work of Gorove (1972). Potential crimes in space can be categorized into traditional terrestrial crimes and novel offences unique to the space environment. Traditional crimes, such as theft, assault, and fraud, may arise from interpersonal conflicts, resource disputes, or financial incentives. Novel offences could include tampering with spacecraft systems, biocontamination breaches, or forced labour on asteroids. This paper focuses particularly on novel offences in space. The aim is to serve as a tool for preparedness, engaging in forecasting to aid those working in this field. It is unclear which of the proposed crimes will become widespread or a reality. Nevertheless, as Virdee and Hughes note, scenarios need not materialise to offer value to decision-makers. Instead, they aid decision-makers by integrating uncertainty into policy formulation, questioning traditional wisdom and fundamental assumptions in existing ideologies. By pinpointing potential paths that might otherwise be overlooked, scenarios facilitate preparation and innovation for the future. What makes this paper presentation unique is that the author aims to leverage the audience's expertise, to collect further data by running an engaging crowdsourcing exercise.

## Living Amongst the Stars: Conceptualising Freedom of Movement to and from Future Extraterrestrial Human Settlements

Anna Marie Brennan – University of Waikato, New Zealand

Humankind is clearly “in the preparatory stages of a new form of mass migration” but the possibility of becoming a multi-planetary species in the continued absence of a coherent human rights framework tailored to outer space activity, and extraterrestrial settlements more specifically, raises questions about the future responsible and sustainable exploration of celestial bodies. Crucially, will individuals have a right to freedom of movement to and from future settlements as well as within the settlements themselves? If this right does exist in outer space what are its precise parameters and how will it be enforced in a realm that lacks an enforcement mechanism? Scholars have only recently turned their attention to hypothesising the future intersection of immigration law with outer space law but a determination of whether freedom of movement will exist as a right in extraterrestrial settlements and to what extent has not yet been delineated. With no international treaty on the horizon to regulate future extraterrestrial human settlements this paper will analyse whether Earth-based human rights systems can provide a starting point for developing an interstellar migratory framework. In addition, this paper will consider the precise parameters of an individual’s freedom of movement in isolated extraterrestrial settlements millions of miles from Earth. Living conditions are predicted to be difficult, dangerous and harsh so it is conceivable that restrictions will be implemented to inhabitants’ freedom of movement not only within the settlement itself but also between the settlement and Earth. In what circumstances might it be legitimate and indeed permissible to restrict inhabitants’ freedom of movement within the extraterrestrial human settlement? If the contours of this right will be more limited in scope and application than on Earth what safeguards will be possible to ensure that extraterrestrial settlements do not descend into tyranny leading to abuses such as forced displacement and expulsion?

## Ecocide in Outer Space: Countering Irreversible Harms to the Space Environment

Fiona Naysmith – Open University

As the world prepares for a climate-led ecological and political transformation, Outer Space stands at the forefront of this revolution. Already housing critical infrastructure, from earth-observation systems to the potential for pollutant-free energy such as space solar power, Outer Space’s interconnectedness with human flourishing on Earth is sealed. Despite this, the safe and sustainable use of space is already under grave threat from State authorised private actors operating in near-permissionless regimes aimed at accelerating growth of a commercial space sector. The Outer Space Treaty 1967 (OST) does not explicitly safeguard the space environment. Moreover, protections afforded, such as the prohibition against sovereign appropriation (Articles II OST), have undergone a paradigm shift in their narrative reshaping the space agenda towards privatization. The proposed international crime of Ecocide offers a solution allowing action where States are unwilling or unable to legislate against irreversible harms to the space environment. Three case studies will be considered, each capable of causing irreversible harm to Outer Space and jeopardy to life on Earth. First, space debris accumulation risking a catastrophic collisional cascade rendering the near-Earth environment unusable for centuries. Second, forward contamination carried from Earth to Space risking destruction of pristine environments and the possible discovery of extraterrestrial life contained therein. Third, threats arising from controversial technologies such as Solar Radiation Modification intended to mitigate Greenhouse Gases, counterpointed with the risk of destabilising Earth-Space systems, and significantly, risking termination shock causing an uncontrolled overheating spiral. This paper invites us to not repeat in Outer Space, the terrestrial *modus operandi* which has inflicted grave injustices upon the peoples and the environments of the world; to realise instead a vision of Outer Space that upholds freedom of use for the genuine ‘benefit and in the interests of all countries’ (Article I OST) in Space and on Earth.

## Situating Astrobiology in a Future-Oriented Earth-Space Governance Model

George Profitiliotis – Blue Marble Space Institute of Science

The reinvigoration of humanity’s interest in the exploration and use of outer space that we are currently witnessing renders the challenge of governing its global commons even more critical in our “NewSpace” era of space activities that are no longer exclusively the domain of spacefaring states. Emerging space activities, not unlike other cases that involve novel technologies, are accelerating at a pace that exceeds the capacity of regulatory regimes to keep abreast

of the progress. A particular space activity that is still plagued by a number of policy gaps, especially concerning the involvement of non-state actors, is astrobiology research. Unfortunately, up until now, astrobiology has been a largely neglected topic in space diplomacy, policy, and governance, perhaps because of the presumably low probability of a successful discovery. Nevertheless, as emerging space actors increase the intensity of their operations in space, and given that scientific discoveries can also occur via serendipity, i.e. unintentionally, accidentally, and luckily, the need for addressing the looming policy gaps becomes imminent. The global nature of this serious issue calls for a harmonized future-oriented governance approach in anticipation of diverse discovery scenarios. Earth-Space governance has been defined as an "integrative governance model" with the explicit goal of promoting "a just and sustainable future for all life forms on Earth and beyond in a multi-planetary setting". From highlighting the present gaps in planetary protection policies to contouring the forward-looking needs of preparing for and managing the multiple socioeconomic, geopolitical, and environmental ramifications of a potential discovery of extraterrestrial life, this talk aims to situate astrobiology research in the Earth-Space governance model and to ignite an in-depth dialogue for advancing the necessary transdisciplinary agenda towards a prudent and responsible governance of astrobiology.

## **Presentation Panel 6: Space in Future-Making**

### **From Globalization to Planetization: How Changing the Historical Narrative Can Draw Attention to Earth-Space Sustainability**

Brad Tabas – ENSTA Bretagne

Since the invention of the term "globalization" in 1983, mainstream historiography has focused on the contractive forces reshaping relationships between locations on Earth. The downside of this way of thinking is that it precisely leaves out of consideration the role played by extraterrestrial infrastructure. Looking backwards, we can assume that the neglect of orbital space might have seemed reasonable: if one believes that there is a near-infinity of space in space, then future-oriented concerns about orbital holding capacity and the risk of Kessler syndrome must seem abstract. Today, these fears are no longer idle. We are approaching the limits of orbital holding capacity. Moreover, extraterrestrial growth indicates that uneven extraterrestrial development has taken place. If globalization brought about a levelling of the global playing field, satellitization has yielded an augmenting disparity with respect to extraglobal agency: it is the wealthiest individuals in the most technologically advanced nations who are most benefiting from the booming Space Economy which is currently rendering orbital space unsustainable. This intervention will detail the limits of the globalization while proposing planetization as an alternate narrative. Planetization differs from globalization insofar as it understands recent history in terms of the increasing exploitability of the planetarity of the planet. If globalization ignores the outside, planetization explores how the extraterrestrial has progressively been included within the everyday life of the inhabitants of planet Earth. This alternate account of the past not only allows us to understand differently global contraction, but also draws attention to the present crisis in sustainable space development. Thinking about our history in terms of planetization likewise helps us to relevantly frame future-oriented discourse on extraterrestrial development. It does this in a twofold way. First, it makes it clear that it is only on the condition of focusing on the short-term problem of rendering an already crowding orbital space sustainable that we can even entertain any long-term visions of a human future beyond the planet. Second, by focusing attention on the social costs of uneven extraterrestrial development, it establishes a horizon within which discussions regarding how to integrate redistributive justice into the next wave of planetization.

### **From craft to debris: A narrative analysis on how space objects become waste**

Renne Vantola – National Land Survey of Finland / University of Lapland

Social Studies of Outer Space (SSOS) scholarship generally frames space debris as a space industrial by-product. My argument is that this conception is misleading. Space debris is not an unintended side-effect, but the global space industry anticipates and accepts that space hardware become waste as a rule. I support my argument with a narrative analysis on the space debris mitigation guidelines of the Inter-Agency Space Debris Coordination Committee (IADC). Theoretically, my argument proceeds in three steps: First, I approach the IADC guidelines through the waste regime concept which allows me to observe the logic of the generation of space debris instead of conceptualising how space debris are regulated, tracked, or avoided only once they have been produced. Second, in terms of ontological politics, I

note that the IADC guidelines propose spacecraft and space debris as two hands-on ontologies of the legal space object concept established in the Space Treaties. Third, building on notions of spacecraft's disposability, I consider spacecraft as one-time single-use products to the materiality and functionality of which space debris is inherently inscribed as a future ontology to be enacted at a given time. Consequently, focusing on disposability allows me to see how the IADC guidelines prepare spacecraft operators to ensure that their spacecraft are ready-to-be-discarded even before launch. A disposal phase is anticipated at the end of each spacecraft mission, and spacecraft are expected to be maintained disposable until that phase. In practice, throughout their missions, spacecraft should stay under control and intact, and avoid orbital peripeteia – sudden points of no return – such as, break-ups or collisions. Eventually, I also argue that space debris itself is an unsatisfactory term to describe space objects becoming waste as not all space debris comprise of "broken or torn pieces of something larger" that the dictionary definition of debris implies.

## No time for the future? Futuring Practices and Conflicting Temporalities in European Space Policy-Making

Nina Klimburg-Witjes, Philipp Kürten – University of Vienna

Outer space has always been a prominent subject of speculation and future-making. In turn, space programs offer a vibrant narrative of opportunities and "utopian futures" (Slota & Bowker, 2017) as they reflect changing ideologies of ordering the world, urging us to attend to interplanetary and earthly spaces as intrinsically linked to each other (Clormann & Klimburg-Witjes, 2021). As the spatialized socioeconomic and political relations on Earth are likely to extend into outer space, this talk explores how future-making in European space policy might affect ideals and practices of integration in the present. Specifically, we will address techniques of futuring (Oomen et al., 2022) in the current transformation of the European space sector. While space programs always require long-term planning and mobilizations of a promising future as a source of inspiration and legitimation of budget spending, looming ecological disasters, increased competition, disruptive innovation, and geopolitical instability render the future increasingly uncertain and risky (Aradau & Munster, 2011). To address these challenges, space policy stakeholders consider multiple possible futures and expand their strategic foresight and planning activities. This is increasingly also the case in Europe, with its complex, transnational space governance system and the uncertain future of the European launcher program. Drawing on interviews, conference ethnographies, and participatory research, we trace how policy, industry, and engineering stakeholders imagine, negotiate, and plan outer space futures. We will discuss how they respond to changing global power configurations, and the implications different visions might have for broader processes of European technopolitical integration and forms of Earth-Space governance. Linking insights from Science & Technology Studies, Futures Studies, and Social Studies of Outer Space, we are specifically interested in the conflicting temporalities at play between long-term visions for sustainable space futures and short-term policy frameworks and why radically new visions are hardly articulated.

## Socio-technical imaginaries of space utilization in the Anthropocene

Margaux D'Hont – CNES, France

At a time of ecological crises driven by over-consumption and high-carbon lifestyles, a transformation of socio-cultural norms and a rethinking of the unreasoned use of technology is more critical than ever. Central to this transformation is the power of storytelling to shape collective imagination and co-create desirable futures. Space, with its profound impact on human consciousness, has historically intertwined with political, cultural, and literary influences, which today are still actively shaping socio-technical imaginaries and visions of the future. Therefore, understanding these influences and evaluating whether they lead to narratives consistent with the required transformations is critical. To this aim, the paper first examines the historical and contemporary intersections of astronautics, astroculture, and environmentalism, and how these interactions have influenced our collective understanding of ecological crises and our perceptions of the viability of different sets of solutions for a sustainable future. In particular, we analyze how they affect visions of influential figures and major projects of the NewSpace, and compare them with key consensual knowledge from transition research and recent findings in space sustainability research. We find that multiple influences have shaped narratives of space utilization into a dominant vision where space colonization is seen as the only long-term viable escape hatch to environmental and societal problems on Earth, which has led to view manned space exploration as self-evident. These beliefs experience a vivid revival in influential NewSpace narratives. However, beyond their questioned technico-economic feasibility in existing research, in the 21st century, environmental

dynamics both on Earth and in space render space colonization narratives increasingly obsolete. Therefore, more Earth-centered alternative imaginaries of space utilization we are seeing emerging are welcome to guide humanity towards a sustainable future by leveraging space as a tool for planetary stewardship rather than delusional escapism or economic growth supposedly liberated from planetary boundaries.

## **Presentation Panel 7: Global Equity**

### **The North-South Structure of the Global Satellite Industry**

Florian Rabitz – Kaunas University of Technology

Satellites are the centerpiece of the contemporary space economy and give rise to complex patterns of global interdependence. We explore the North-South structure of the global satellite sector via social network analysis of ~20.000 partnerships between satellite contractors, owners, and operators, both public and private, covering all satellites launched since 1990 for which data is available. Our results highlight a curious bifurcation into North-North and South-South cooperation, each dominated by organizations located in, respectively, the USA and China. Conversely, partnerships across the North-South divide are rare and, when they do occur, primarily involve Northern contractors manufacturing satellites for use by large telecommunications providers in emerging economies. Our analysis indicates a high risk of socio-economic inequity in the global satellite sector due to asymmetrical collaboration patterns and highly uneven geographical concentration of technology access and control. This, in turn, raises the broader question of how to ensure adequate levels of global equity in the emerging space economy in line with relevant international political commitments and legal principles. We conclude with a discussion of institutional models for enhancing satellite technology access and control for developing countries, including through pooled ownership and mechanisms for scaling-up technology transfer.

### **Earth Observation as a Tool to Advance Neocolonial Regimes: The Case of Africa**

Smit Rajshekhhar Patel

The advent of space technology lies at the intersection of the decline of colonialism and the formulation of a new world order. Although colonialism formally ended, the structures that promised the former colonial powers political, and economic hegemony and stronghold over the former colonies only changed form. The development of earth observation science and space technology, primarily pioneered by the former colonial powers, has been one of the arenas that has established and strengthened the neocolonial structures, particularly over the least developed nations of the African Union(AU) where indigenous space technology infrastructure remains underdeveloped. In today's ubiquitous employment of geoinformation and space technology, a significant majority of the world's satellites are owned and operated by countries from the Global North, with African nations largely consuming earth observation data and technology rather than participating in the development, production and commercialization aspects. Only a handful of AU countries such as South Africa, Nigeria, Egypt, and Algeria have been able to develop space technology while other nations rely heavily on data provided by foreign satellites. This consumption pattern echoes colonial structures, perpetuating dependencies across scientific, technological, military as well as economic domains. In this context, this paper argues that debates around sustainability and governance in space exploration and earth observation extend beyond purely scientific advancement to encompass broader neocolonial mechanisms at play. Through a systematic review of the development of space technology and earth observation, this paper specifically examines how inequitable access to earth observation technologies perpetuates neocolonial mechanisms, with a focus on countries within the AU. It underscores the dependency of multiple AU countries on developed nations for pathways to sustainable development, military surveillance, as well as economic advancement. Addressing these disparities requires international cooperation and governance that prioritize the interests of all nations, particularly those historically exploited by colonial legacies.



## North-South Dynamics in Global Environmental Governance: Comparing Outer Space with Other Areas Beyond National Jurisdiction

Philippe Evoy – Université Laval and VU Amsterdam

North-South divisions have long shaped global environmental politics. In the 1970s, early efforts to draft multilateral environmental agreements were met with skepticism from the Global South, which prioritized socio-economic development. Despite the growing participation of developing states in environmental negotiations in the following decades, this pattern has persisted. Existing literature predominantly attributes the South's reluctance to concerns over equity in global environmental governance (GEG). However, the governance of areas beyond national jurisdiction (ABNJs) challenges this explanation. While equity issues also shaped regime development in ABNJs, the Global South has frequently led efforts to promote strong environmental measures. By comparing the case of outer space with the cases of Antarctica and the deep seabed, this article theorizes that sovereignty concerns play a pivotal role in shaping developing states' attitudes towards GEG. In these ABNJs, sovereignty was not something to gain or lose, but to define. As such, their status had to be negotiated and codified into international agreements, while also determining whether and how their environment would be protected. Through mixed-methods content analysis of international agreements, the paper explores the interplay between environmental rules and sovereignty clauses in these unique contexts. Findings suggest that existing literature underestimates the significance of sovereignty in shaping the South's approach to environmental governance, particularly when contrasted with issues within national jurisdiction.

### **Presentation Panel 8: Pluriversal & Cultural Perspectives**

#### Kinship and living in Treaty with outer space

Hilding Neilson – Memorial University of Newfoundland & Labrador, Canada

Indigenous peoples on Turtle Island (North America) have lived on their respective lands since time immemorial and have developed specific and (w)holistic methods for understanding and living with nature. This includes a relationship with the sky and outer space. In this discussion, I will review Indigenous methods of learning from the perspective of an Indigenous person in North America, along with the current question of Indigenous rights and how both relate to humanity's current actions in outer space from the Artemis Accords to colonial fantasies about the Moon and Mars. In particular, I will discuss how Indigenous treaties, and UNDRIP requires inclusion of Indigenous methodologies and interests and how we can use these knowledges to better build a relationship with outer space, think about how we live in kinship with outer space and build a future that goes beyond the current goal of exploitation and colonization in space.

#### Integrating Indigenous outlooks in international space law: a relational approach to the environment

Giuliana Rotola - Scuola Superiore Sant'Anna, Italy

This research paper aims to summarize the core themes and findings of my PhD work, which explores the evolution of sustainability concepts from the Brundtland Report to the present, extending these ideas to an interconnected Earth-space ecosystem. By analyzing the transformation of sustainability from a terrestrial focus to a broader cosmic perspective, this paper investigates how and which sustainable practices can be implemented in space activities. The research is structured around a multidisciplinary approach, beginning with an analysis of historical and contemporary definitions of sustainability. It looks into the technical aspects of the Earth-space system, proposing hypotheses for future studies that examine the interplay between terrestrial and extraterrestrial environments. Then, the investigation is complemented by a legal and political analysis, assessing how current international space laws can evolve to incorporate a more holistic and sustainable framework. A significant component of this study is the incorporation of Indigenous perspectives, with a particular focus on Māori legal and political tools, cosmology and environmental stewardship principles such as that of kaitiakitanga (guardianship). The research highlights how this Māori principle exemplifies the ecocentric and interconnected ethos vital for cosmic stewardship. By examining Māori resource management practices in Aotearoa New Zealand, the research draws parallels to potential governance models for space activities. The findings suggest that integrating Indigenous knowledge systems into international space law could enhance sustainability and equity in space, fostering a more inclusive and comprehensive governance model.



conclusion, this research aims to shift from traditional Western knowledge and governance perspectives to a framework informed by Indigenous legal and political systems. By bridging technical, legal, and cultural dimensions, the study seeks to develop a transformative and ethical framework for future space activities and emphasizes the importance of an interconnected Earth-space system, opening up new possibilities for sustainable and equitable space governance.

### **Star-Spangled Speeches: Spaceflight's Agendas in Asia**

Valentine Hoffmann – University of Vienna

States engage in space exploration for multiple, interconnected reasons. Space exploration has consistently served as a marker of national power. Initially driven by technological and military objectives, prestige became increasingly important, especially after Sputnik's launch and the 1967 Outer Space Treaty. During the Cold War, space "firsts" became powerful tools to capture global attention. As the pinnacle of scientific advancement, spaceflight also allows states to demonstrate modernity and assert global status. The rhetoric surrounding space programs often echoes national cultural imaginaries. This connection is evident in mission nomenclature - Chang'e, the goddess of the Moon in Chinese mythology, or Chandrayaan, "Moon Vehicle" in Sanskrit - and in broader discourses, like the extension of the American Frontier myth to space, as exemplified in Reagan's Challenger eulogy. Space is also a realm of international cooperation. The Apollo-Soyuz docking stands as a symbol of détente between the US and the Soviet Union, with the International Space Station continuing this legacy. Probe instruments are the products of multinational contributions. Postcolonial studies have demonstrated that scientific knowledge "travels" and is never completely indigenous, but rather characterized by fluid exchanges of people and ideas. Contemporary space endeavors prioritize Earth-centric benefits, from climate monitoring to economic stimulation through innovation and industry growth. This shift has broadened state engagement in space activities, as governments recognize space technology's potential to address domestic challenges and boost socioeconomic development. This paper seeks to understand why states engage in space exploration, focusing primarily on China and India as great powers using space programs to assert their global status. It may extend to other rising Asian nations, examining how space initiatives serve as instruments of geopolitical advancement. The central research question is: How do official narratives about Chinese and Indian space programs reflect their national ambitions and motivations for spaceflight?

### **How to stop Captain Kirk becoming the next Cortez, Coen or Cook**

Adrian Young – Inspectie Leefomgeving en Transport (ILT) / Leiden University Graduate

Many ideas about how to use space and space resources have been proposed. Most address technological issues. Rebecca Lowe, writing on lunar human settlements for the Adam Smith Institute in 2022, adopted a view that treats outer space as a terra nullius; an empty space that humankind could colonise. This view, if followed, may well result in outer space being colonised in a similar fashion to the way that many parts of our world were colonised by the European powers between about 1500 and 1900. The cultural and environmental issues that we, rightly, strive to apply to earthly policies should not be ignored when considering current and future activities in space. How can we protect human heritage in space? Should we protect particular places on planets as conservation areas? How do we respect human reverence for the moon whilst still continuing to explore space? These and other questions require a field of space ethics to be developed and applied. Whilst we live in age where international space treaties are a thing of the past, the current legal instruments are too vague as is Section 9 of the Artemis Accords.

## **Presentation Panel 9: Law & Institutions**

### **Integrating Outer Space into the Regulatory Regime for Environmental Protection to Promote Earth-Space System Governance**

Merve Burger – University of Neuchatel; Aylin Yildiz Noorda – University of Lisbon / University of Bern

The integration of outer space into Earth System Governance to better manage planetary crises raises further discussions from social, scientific, political and legal perspectives. In this study, I attempt to approach the discussion from a legal perspective and discuss whether we can integrate the legal regime of environmental protection of Earth System Governance with the element of outer space as a legal tool for Earth-Space System Governance. Secondly, I

will explore the application of the main principles of environmental law to outer space and outer space activities. In this case, I will discuss how outer space can be integrated with the principles of international environmental law (such as no harm, prevention, precaution, cooperation, prior informed consent, environmental impact assessment, polluter pays, common but differentiated responsibilities, and intergenerational equity) and what would be the outcome of integrating these principles with respect to the regulation of outer space and outer space activities. In conclusion, I intend to identify the gaps in the space law regime that need to be addressed and suggest further steps to fill the gaps in this integration.

### Protecting Ocean Ecosystems from Outer Space Activities: Reflections on regime interaction after the Recent Advisory Opinions of the International Tribunal for the Law of the Sea

Vito De Lucia – Norwegian Centre for the Law of the Sea

Cognizant of the integrated Earth-Space approach championed by this conference, this paper shall look at the question of the protection and preservation of the marine environment from outer space activities in light of the recent Advisory Opinions of the International Tribunal for the Law of the Sea. Relevant points raised by the Opinion relate to article 195 of the Law of the Sea Convention, which prohibits the transformation of one type of pollution into another, and the transfer of pollution from one area to another, and the role of compliance with regime-specific rules towards the fulfilment of the obligations States have under Part XII of the Law of the Sea Convention in relation to the protection and preservation of the marine environment. The case study is offered by the long standing practice of controlled re-entry of space objects in the Pacific Ocean, in the so-called “space cemetery.”

### Legal Issues of Space Resource Activities: The path towards a new international legal framework?

João Marques de Azevedo – NOVA School of Law

The matter of space resource activities is currently one of the hot topics for space lawyers. Whilst the activities, at least in terms of commercial exploitation, are yet to take place, the truth is that we could see them happen in the next 20 to 30 years. Moreover, projects like the Artemis programme and the International Lunar Research Station are looking to make use of resources in their ventures. Meanwhile, there are still many “unknowns” regarding the current legal framework which is mostly made up of the Outer Space Treaty (since the Moon Agreement only counts 17 ratifications). As it is, the reality of space resource activities can put well established principles to the test. What is the consequence of the prohibition of appropriation for these activities? What about the freedom of access to all areas of celestial bodies? Could it conflict with bases established for exploitative endeavours? Can space resources be subjected to ownership rights? These are some of the questions that this work assesses. It starts with a look at the current framework and the issues it raises. The second part considers the needs and proposals for the future such as a dedicated international legal framework and possibility of an international authority. The conclusion underlines the necessity of clarifying the existing framework and to develop specific norms for space resource activities, starting with a set of internationally agreed legal principles.

## **Presentation Panel 10: Power Dynamics**

### Cosmolocal production for sustainable space technology

Lucas Lemos – Tallinn University of Technology

'Earth-space sustainability' posits the interdependence of terrestrial and space-based technologies (Yap and Truffer, 2022). However, space technology's inherent high costs and complexity present a barrier to all but technologically advanced nation-states and multinational corporations. Also, having space technology production monopolised by large actors driven by geopolitical and commercial interests jeopardises future access to space. Therefore, identifying alternative approaches to democratise space technology production is critical for achieving Earth-space sustainability. 'Cosmolocalism' is a framework emerging through digital communication networks. It proposes "localising collaborative forms of production whilst sharing resources in the form of digital commons" (Kostakis et al., 2023). In cosmological production, grassroots technology initiatives organise production around the commons, prioritising socio-ecological well-being. This approach enables these initiatives to embed their values into the technology they produce. Moreover, Earth-bound and space-based cosmological space technology already exist, exemplified by ground stations

and small satellites. SatNOGS, an open-source global ground station network based in Greece, provides shared access to extended communication with orbiting satellites. ESTCube has produced two CubeSats –open-source platforms for building small satellites capable of carrying multiple payloads– while also contributing to educating the first generation of space engineers in Estonia. Besides utilising open-source platforms and tools, SatNOGS and ESTCube are governed by their non-profit organisations, are supported by their local research ecosystem, and partake in global multi-stakeholder projects and initiatives (Lemos and Giotitsas, 2021). Cosmolocal production aims to interconnect Earth-bound and space-based sustainability by empowering grassroots initiatives to 'locally' produce sustainability-embedded space technology. It offers an alternative pathway to space for communities that may, in the future, challenge the current Earth-space ecosystem, much like Wikipedia disrupted traditional encyclopaedias 15 years ago. Over the coming decades, grassroots technology initiatives may emerge as leading actors in areas of Earth-space sustainability well-suited for their characteristics.

## Cosmic Commons: Envisioning Governance and Power Dynamics in the Earth-Space Nexus

Srishti Prabakar – Frankfurt University of Applied Sciences

As the final frontier, outer space presents a unique opportunity to reconceptualize the idea of commons within the framework of global urban governance. This research explores the notion of space as a global urban commons, drawing on theories of urban commons (Harvey, 2012; Foster & Iaione, 2016) and global governance (Held & McGrew, 2002). The paper critically examines the governance structures and power dynamics that influence space activities, assessing the role of international treaties such as the Outer Space Treaty (1967) and the emerging norms under the Artemis Accords (2020). Building on Ostrom's principles for managing common-pool resources (Ostrom, 1990), this study evaluates how these can be adapted to space governance. Ostrom's design principles, including clearly defined boundaries, collective-choice arrangements, and monitoring and sanctioning, provide a foundational framework for analysing how space as a commons can be managed effectively. The research investigates the implications of treating space as an urban commons, focusing on critical issues such as equitable access, sustainable resource use, and the distribution of benefits from space activities. The geopolitical tensions between established and emerging space powers are highlighted. Additionally, the influence of private sector actors is examined. Furthermore, the paper explores the concept of anticipatory governance (Guston, 2014) that emphasises the need for proactive and inclusive governance frameworks that can adapt to the rapidly evolving landscape of space exploration and utilisation. This approach advocates for forward-thinking policies that consider the long-term sustainability of space resources, ensuring that current actions do not compromise future generations' ability to benefit from space. In conclusion, by integrating urban commons theory with global governance perspectives, this research shares insights into equitable and sustainable management of space, highlighting the importance of collaborative international efforts and the inclusion of diverse stakeholders in the governance of space as a global urban commons.

## Technological Borders in Space: Taiwan's Pursuit of High-Resolution Satellite Capabilities Amidst Geopolitical Tensions

Yi-Ting Chang – University of Oxford

Space technology has a dual-use nature, raising questions about how politically sensitive, high-end space technology moves across different regions and states. This article examines Taiwan's space technology acquisition process over the last 20 years and introduces the concept of the "technological border." Positioned at the frontline of geopolitical tension, Taiwan has aimed to establish high-resolution satellite capabilities earlier than many major European countries. However, as a de facto state seeking to acquire potentially dual-use space technologies, Taiwan faces vivid and tangible technological borders imposed by Western countries to prevent certain technologies from flowing to it. Drawing from political geography and border studies literature, this article uses Taiwan's case to argue that technological borders remain decisive in shaping modern geo- and astropolitics. Methodologically, this case study includes a nine-month organizational ethnography at the Taiwan Space Agency (TASA) from 2023 to 2024, along with interviews with TASA engineers. It demonstrates how these engineers navigate the geopolitical control of high-tech satellite products. By highlighting the personal experiences of those affected by the technological borders erected by advanced Western countries, this study argues that these borders are a critical battleground for medium-sized space-faring countries pursuing space programs. This research has two main implications. Theoretically, it sheds light on the concept of the technological border, which defines the flow of high-tech across borders. This adds to existing border

studies and provides new vocabularies for understanding the increasingly stringent border control in high-end industries. Practically, the article challenges the notion of a purely commercial space society and demonstrates how the movement of global high-end space components is still subject to dual-use or arms trade control.

### **Towards Effective Governance: Drawing Lessons to Prevent a Hiroshima in Space**

Justine Dousset – Institute of Space and Telecommunications Law (IDEST)

The growing recognition of the crucial role that space plays in achieving sustainability on Earth underscores the urgent need to protect space sustainability itself. The increasing militarization of space and geopolitical tensions on Earth highlight the need to safeguard space as a common good. Despite this awareness, significant gaps and challenges persist in existing space law, governance, and institutions. Current frameworks, both at the international level, such as those discussed at the Committee on the Peaceful Uses of Outer Space (COPUOS) and the World Radiocommunication Conference (WRC), as well as at the national level, remain largely ineffective in their implementation and enforcement. Consequently, states continue to launch hundreds of satellites, and new satellite constellation projects emerge almost monthly, exacerbating the risks associated with space debris and orbital congestion. The current space governance regime is fragmented and lacks robust enforcement mechanisms. Addressing these issues requires substantial reforms, including binding international treaties, enhanced coordination among international bodies, and global standards for space activities. Historically, nations have successfully negotiated international governance frameworks for activities such as arms proliferation and nuclear regulation, with the latter having dual-use dimensions. However, nuclear governance today is far more effective than space governance, with issues deliberated at high levels such as the Security Council. Such a governance model could, and even should, be applied to space if activities and military stakes continue to escalate. This paper will explore the synergies between the governance of space and nuclear activities at the international level, identifying gaps in both legal and institutional frameworks. Despite the catastrophic effects of nuclear events in World War II, which largely influenced the proactive behavior of states to regulate and internationally collaborate, proactive measures for space can still be taken before similar disasters occur, whether environmental (collision) or military (attack). In conclusion, a concerted effort to reform and integrate space governance, inspired by international governance models of dual-use activities that work better, is essential to ensure the long-term sustainability of space activities.

## **Opening: Planetary Stewardship in view of Earth-Space Sustainability**

Xiao-Shan Yap, PlanetStewards Project – Utrecht University

Earth and space are increasingly coupled in terms of their sustainability challenges, governance issues, and future-making. Approaching 'outer space' as a separate entity from Earth is no longer sufficient to address our planetary crises. From the rising number of satellites to missions on the Moon and beyond, the global society is confronted with environmental, economic, social, and political challenges beyond a single planetary scale. To this end, treating Earth and space as integrative 'Earth-Space systems' offers the potential to address challenges in this era. The opening session will introduce the PLANETSTEWARDS project, outline a preliminary view of the key elements to be considered as constituting Earth-Space systems, and invite leading experts to share their insights based on their respective fields. The discussion will focus on state-of-the-art development, the dynamics of the Earth-Space systems, and implications for sustainability and governance.

## **Breaking Captured Futures: Co-Mapping Earth-Space Systems**

Jeroen Oomen & Xiao-Shan Yap – Utrecht University

This session will dive deeper into the transition from 'outer space' to 'Earth-Space'. The session will begin with an introductory talk on futuring by Jeroen Oomen, followed by interactive activities for participants to share their diverse perspectives. We will jointly discuss how outer space became a governance object in global space history, in what ways Earth-Space system(s) may be thought of as a new governance object, and the differences between the two.

## **Transdisciplinary Approaches to Earth-Space Systems**

This panel invites experts from different fields to offer a transdisciplinary view on addressing challenges in the Earth-Space systems. Each speaker will present their work in their respective research or policy fields, including space debris mitigation, the protection of dark and quiet skies, Astronomy from the Moon, and advocacies for space cultures. The discussion will focus on the emergent issues, the different methodological approaches (e.g. engineering modeling, risk assessments, and art sciences), and what might be some potential synergies to better address the challenges of the Earth-Space systems.

### **Space debris mitigation at the European Space Agency**

Francesca Letizia – European Space Agency (ESA), ESTEC

While our societies are becoming more and more dependent on services provided from space, the satellites that we use for those services are exposed to a growing threat from space debris objects. In the short term, space debris makes the operation of satellites more complex because of the need for monitoring debris and planning avoidance manoeuvres. In the long term, the results of simulations indicate that continuation of our current behaviour in the future would lead to an unstable environment with collision rates increasing exponentially, meaning that certain orbits would become unusable. Over 20 years ago, the technical community put forward a series of international guidelines covering different mitigation measures, which are currently reviewed and evolved worldwide, in response to the fast change in the use of space witnessed in the recent years. At ESA, for example, we have developed the so-called "Zero Debris" approach, resulting in having more stringent rules for our own missions. For the future, we are also working on risk-based approaches to quantify the potential of a spacecraft to contribute to the debris environment and how this metric can be used to assess which is the "capacity" of the space environment. The talk will give an overview of these concepts and of some of the challenges related to space debris mitigation and its contribution to space sustainability.

### **Protecting Lunar Sites of Extraordinary Scientific Importance (SESIs)**

Martin Elvis – Harvard & Smithsonian; International Astronomical Union (IAU)

The Moon provides unique environments for astronomical detectors that offer enormous gains in performance spanning many techniques. Although astronomers have only recently begun to realize the opportunities being opened up by the return of humans to the Moon several features of the Moon have been identified that could lead to great advances in astronomy. The four cases for astronomy are: (1) the radio quietness of the farside for cosmological studies of the "Dark Ages" before there were any stars or galaxies and for detecting magnetospheres around exoplanets, a possible key to habitability; (2) the global seismic quiet for gravitational wave studies in new bands; (3)

the cold of the permanently shadowed regions (PSRs) for far-IR studies of early galaxies and of the cosmic microwave background (CMB); (4) the stable platform in a vacuum for ultraviolet to near-infrared interferometry to image supermassive black holes. The challenge is that these special environments are fragile and have competing uses. Their properties that make them so valuable are in need of protection. The International Astronomical Union set up a Working Group on 'Astronomy from the Moon' [8]. We are chair (RG), co-chair (ME), and member (AK) of this WG. This IAU WG is seeking guidance on appropriate mechanisms that might be put in place to enable the protection of these SESIs.

### **Planetary Public Stack: 'More-than-Planet'**

Miha Turšič – Waag Futurelab

The Planetary Public Stack is an exploration of the underlying concepts, knowledge cultures, enviroing technologies, narratives, and interfaces from which the planet Earth today appears so flat and square. Understanding these building blocks of planetary imaginaries is essential for improved public literacy on the cultural influence on the environment and, as such, an entry point into a more inclusive and diverse making of the planet.

Results of three-year project resulted in four research priorities:

**Creating of New Planetary Concepts:** The Planetary Public Stack emphasizes the public's role in understanding planetary challenges, shifting from colonial perspectives to empowering of marginalized groups. It aims to reshape narratives around ecology and technology by drawing from diverse cultural and historical insights.

**Recognizing the Multiplicity of Knowledge Cultures:** Different cultures, especially Indigenous and non-Western, view planet relationally rather than as a resource. The PPS fosters comparative studies of variety of knowledge cultures to address ecological and social crises, recognizing the impact of these perspectives on planetary well-being.

**Public Planetary-Scale Enviroing Infrastructures:** With the principle "If you don't open it, you don't own it," the PPS highlights the importance of open, public, and transparent infrastructures. It identifies areas where public and community driven collaborations and global institutions can enhance access and knowledge-sharing.

**Reclaiming Planetary Matherings:** Shifting from resource extraction to planetary health, the PPS advocates for frameworks that prioritize ecological and social well-being, emphasizing a holistic approach to planetary care.

### **FutureSpace(s) and Futuring Practices in Earth-Space Governance: An Exploratory Strategic Foresight Workshop**

Philipp Kürten, Nina Witjes – University of Vienna

Outer space has always been a place of imagination onto which competing future visions could be projected. Today, in an unfolding new space race, driven by new geopolitical dynamics and commercial competition, these visions are utilized for outlining precise and goal-oriented long-term strategy. To anticipate change and to integrate uncertainties and resilience into the long-term visions of space programs, strategic foresight practices become increasingly employed by space policy stakeholders. Ambitious, strategic visions are published by space agencies worldwide, yet little is known about the practices, challenges, and assumptions underlying such futuring practices (Oomen et al., 2022) of collectively envisioning near and long-term futures of outer space. In this mini workshop, we propose to open the "black box" of strategic foresight and explore how these practices inform the political, socio-economic, and sustainability dimensions of Earth-Space systems (Yap & Kim, 2023). Given that the European space sector is currently both at a watershed in terms of institutional and organizational controversies and in search of a new joint vision (Klimburg-Witjes, 2023), we will use Europe as a case for this workshop to explore how strategic foresight and collective futuring practices shape and transform Earth-Space systems and how they contribute to European integration or disintegration. This interdisciplinary mini workshop will explore the interplay between structured foresight processes and the collective and contested visions within European space futures. Participants are invited to engage in a structured strategic foresight process and develop multiple scenarios of Europe's position for the year 2050. We aim to mimic the futuring practices that become increasingly relevant in the new space race and explore how these can shape and influence the discourses, politics and socio-technical imaginaries. Specifically, we will discuss how the future is mobilized in foresight processes for Earth-Space Governance.

## **The Construction of Nature in Space: Governing Novel Extraterrestrial Ecosystems**

Timothy Pape – Bowling Green State University

Is there nature in space? How much of Mars is wilderness? What makes asteroids natural resources? Drawing on the work of William Cronon, Ian Hacking, Bruno Latour, Carolyn Merchant, and Steve Woolgar this interdisciplinary mini-workshop will bring experts and thinkers from various fields together to discuss how (social) constructivist theories may assist in Earth-Space sustainability challenges, governance issues, and future-making endeavors. How things like nature, wilderness, and natural resources are framed within Earth-Space discourses will be investigated as a means of understanding gaps and synergies that may have policy and governance implications. With more humans set to interact with the extraterrestrial, it is a pressing need to stimulate debate on whether human activities constitute being of, in, or one with space. The goal of this mini-workshop is to initiate a multi-authored perspective paper which will propose broad theoretical conceptualizations of how novel extraterrestrial ecosystem governance schemes may be constructed.