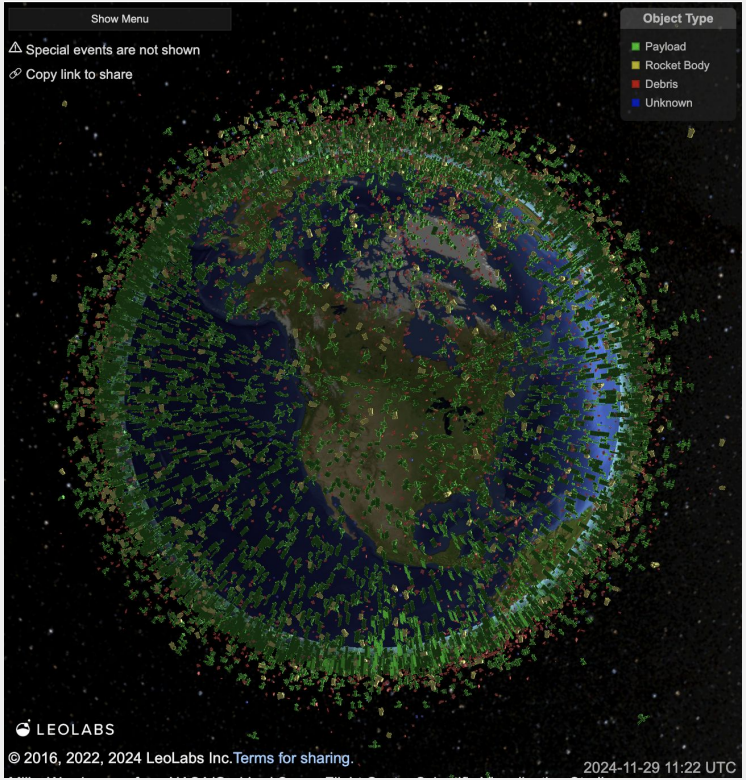
IAU Centre for the Protection of the Dark and Quiet Sky

How the IAU CPS plans to use the Zero Debris Technical Booklet

Siegfried Eggl

Space is changing rapidly

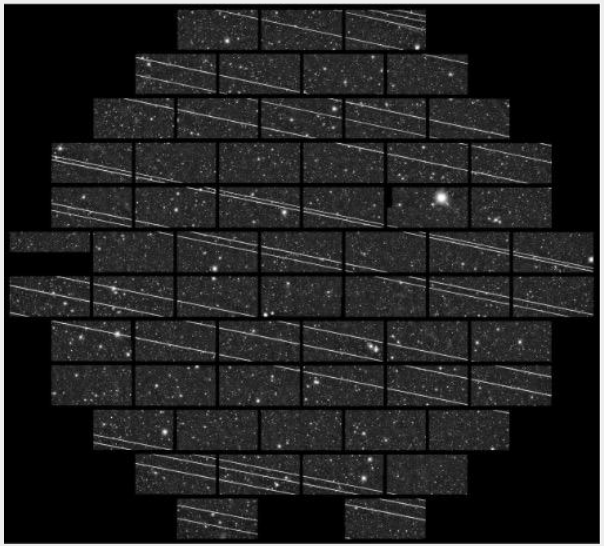
- 11,500+ satellites in Low Earth Orbit
- Plans for > 500.000 satellites by 2030s
- Major concerns:
  - Effects on optical astronomy
  - Effects on radio astronomy
  - Effects on the night sky
  - Space traffic management
  - Space debris



Effects of Artificial Space Objects on Astronomy

Unintended emissions:

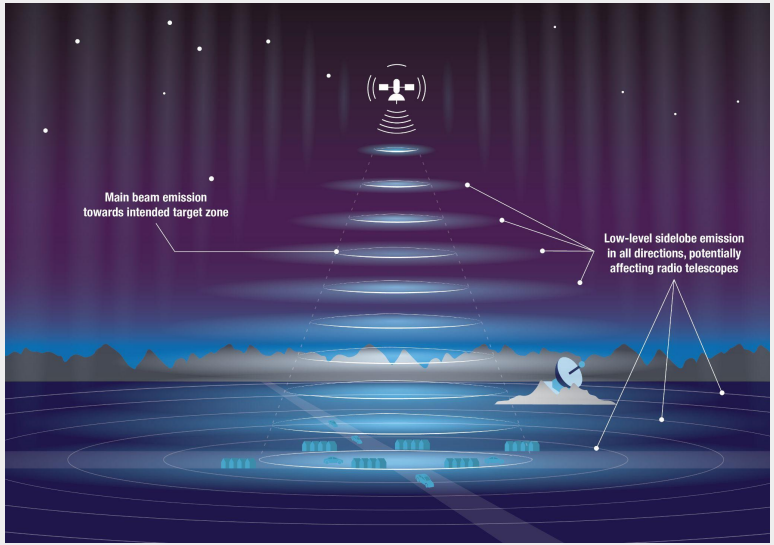
- Impact on Optical Astronomy (reflected sunlight)
- Impact on Radio Astronomy (UEMR)



Credit: CTIO/NOIRLab/NSF/AURA/Decam DELVE Survey

Intended emissions:

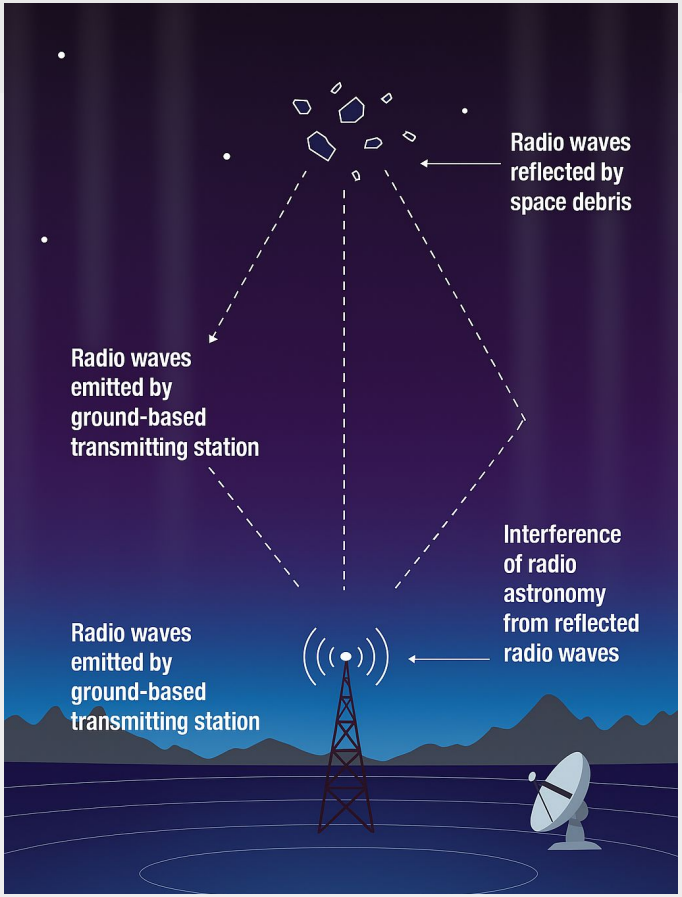
- Impact on Radio Astronomy (i.e. strong downlinks, power in sidelobes, RQZs)



Credit: SKAO

What about Space Debris?

- **Impact Discharges:** Small space debris impact induced discharge (SSDIID) and the subsequent electromagnetic interference
- **Radio Wave Reflection:** Radio waves can also reflect off space junk, potentially interfering with radio astronomy observations.
- **Thermal interference:** “warm” space debris can interfere with mm-wave or IR observations.
- **Optical interference:** raising background noise / sky brightness



The International Astronomical Union

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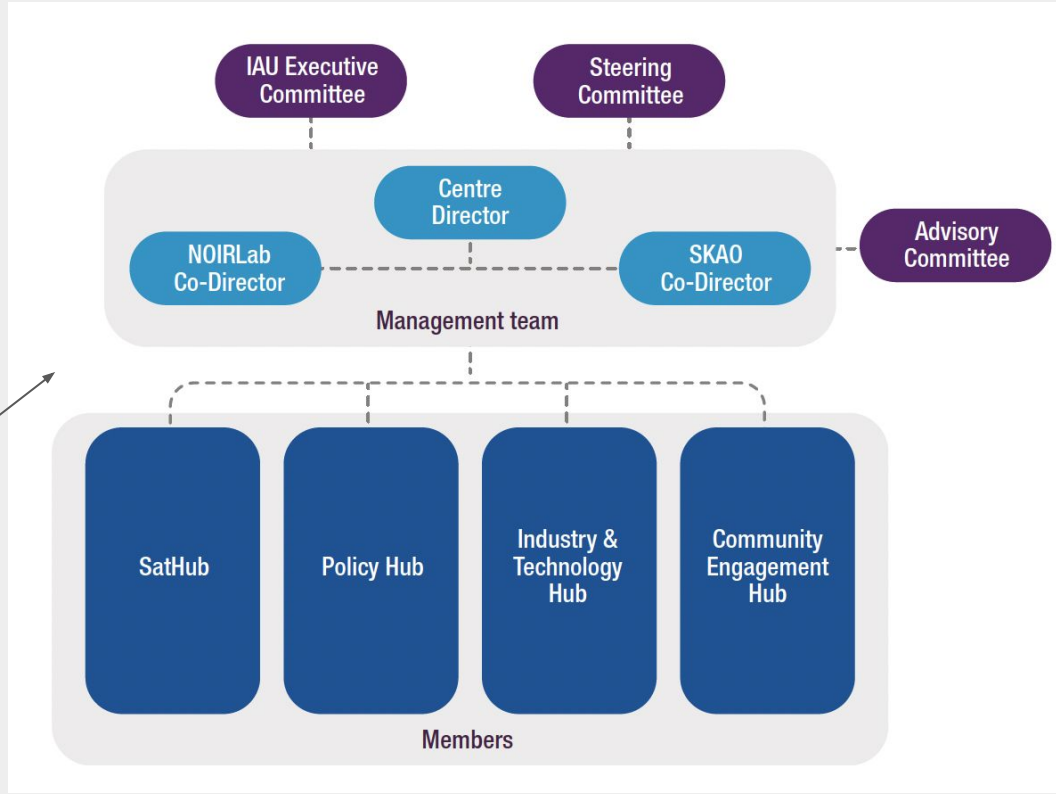

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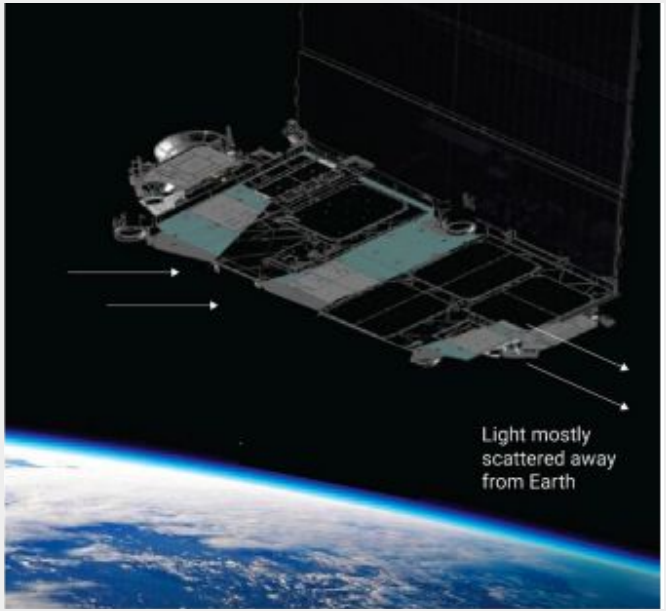
Zero Debris Technical Booklet
Chapter 6.2

How we plan to use the Zero Debris Technical Booklet

- **Motivation for Industry to include Dark & Quiet Sky** (D&QS) in their design considerations
- **Outlining Challenges, possible Solutions and Investment Needs** for Policy Makers and Regulators
- **Guidance on Priorities for Technology Development** for both Industry and Astronomy to Enable Effective Mitigation
- **A “shining beacon of hope”** that Concerns of Astronomers and the D&QS as Cultural Heritage are being addressed.

Technical Mitigation Strategies

- Good-faith mitigation efforts of Astronomy and Industry
- Fewer satellites
- Control of unintended emissions of all kinds
- Operational Data Sharing (telescope pointings / satellite orbits and attitude)
- Materials engineering: coatings (specular reflectivity)
- Reflectivity simulation and testing labs (growing need)
- Steerable radio beams / Attitude Control (enable direct illumination avoidance)
- Minimise sidelobe emission



Credit: SpaceX

Space Policy

- **Raise awareness** of astronomy requirements in space policy-making circles
- **Promote mitigation technologies** and best practices among industry partners worldwide
- **Coordinate policy work** conducted by national societies and observatories
- **Foster reasonable policy**, in coordination with national points of contact
- **Coordinate spectrum management** processes, along with optical astronomy issues

Strategic Outcomes

Industry is aware of the issue and of the solutions

Policy makers are aware of the issue and of the solutions

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UNITED NATIONS
Committee on the Peaceful Uses of Outer Space

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Together, we can do this!

Pentre Ifan burial chamber, Pembrokeshire, Wales - Max Alexander “Our Fragile Space”

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