

Preserving the dark and quite sky: The IAU's mission



Credit: South African Astronomical Observatory

Willy Benz
International Astronomical Union

International Astronomical Union (IAU)

To promote and safeguard the science of astronomy in all its aspects including research, communication, education and development through international cooperation

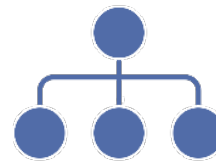
- Worldwide union of professional astronomers
- Officially approves the names for astronomical objects or features
- Founded in 1919, headquarters in Paris, France



12,550
Individual and
Junior Members



92 countries worldwide
85 national members



9 Divisions
39 Commissions
48 Working Groups



4 Offices
1 Center

Four Offices and a Centre



International Astronomical Union (IAU)
est. 1919, Paris



Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interferences (CPS)
est. 2022, Paris



Office for Young Astronomers (OYA)
est. 1967, Oslo



Office of Astronomy for Education (OAE)
est. 2019, Heidelberg



Office for Astronomy Outreach (OAO)
est. 2012, Tokyo



Office of Astronomy for Development (OAD)
est. 2011, Cape Town





- Executive Committee Working Group
Dark and quiet sky protection
- Commission B7
Protection of existing and potential observatory sites
- Inter-division B-C Commission Working Group
Astronomy from the Moon



- IAU is permanent observer at the UN Committee on the Peaceful Uses of Outer Space (COPUOS)
Has been instrumental to put D&QS on the agenda



established 2022
with SKAO & NOIRLab

- Centre for the Protection of the Dark and Quiet Sky
Center of own competences



SKAO

#DarkAndQuietSkies
for Science and Society

Vienna, December 9-11, 2025

The workshop brought together the community of astronomers expert in this topic, stakeholders from the satellite industry that develop or deploy mitigation measures to reduce their impact on astronomy and the diplomatic community preparing technical and legal contributions to COPUOS and its sub-Committees.



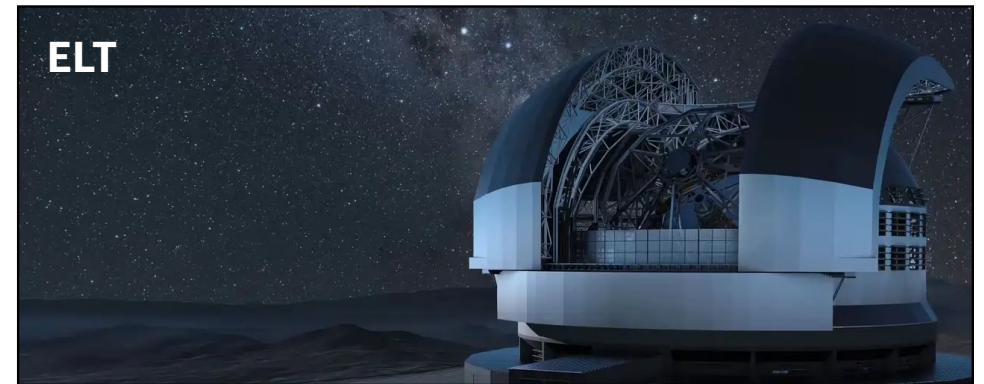
Detecting the faintest signals

The largest astronomical facilities are built to detect the faintest possible signals coming for the universe with the highest possible resolution

Credit: ESO

Optical domain:

- Detection limit ~ apparent magnitude 30
- Analogy: Detecting the light from a single candle at a distance equivalent to that of the Moon.



Radio domain:

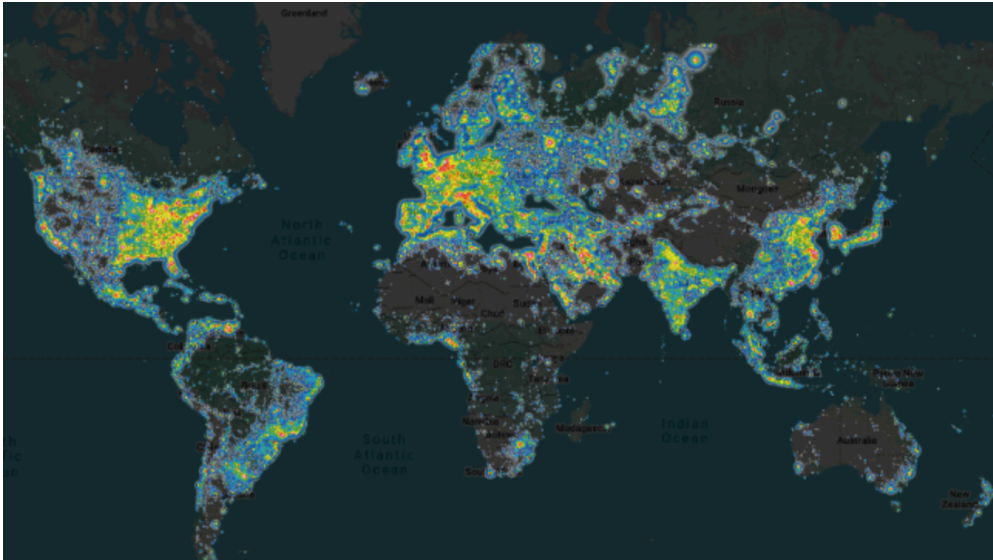
- Detection limit ~ a few μJy
- Analogy: Detecting the leakage of a single radar at an airport on a planet 50 light years away...



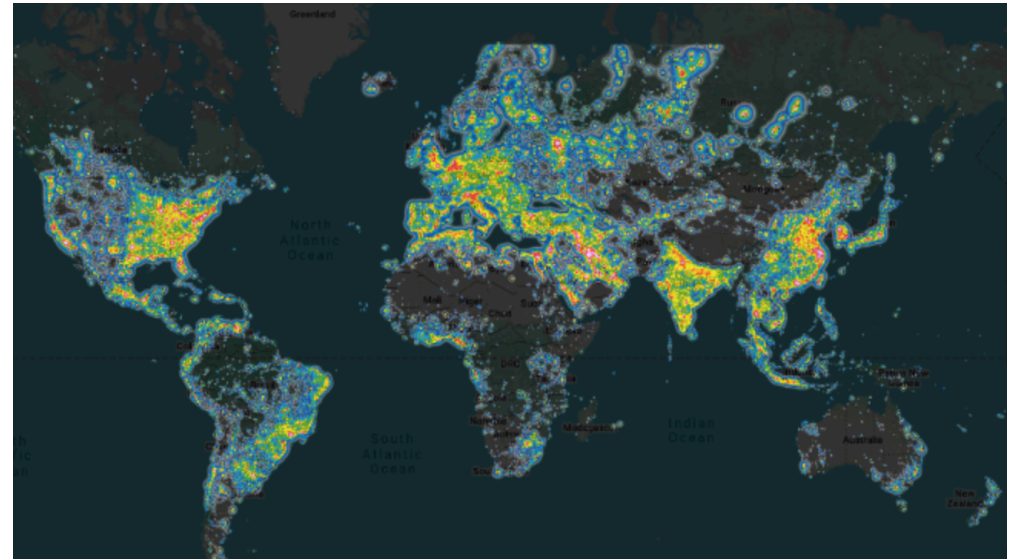
Credit: SKAO

Losing the darkness

2012

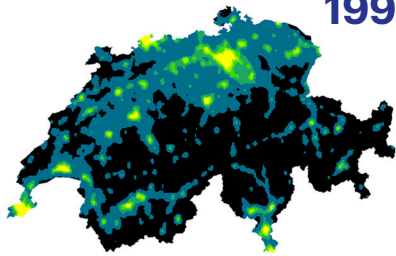


2025

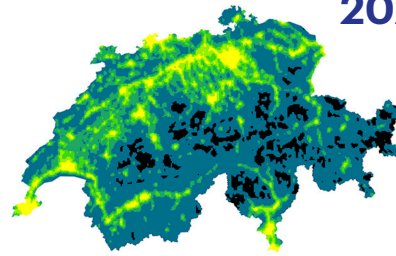


Credit: D. Lorenz, Light pollution atlas

1994



2020



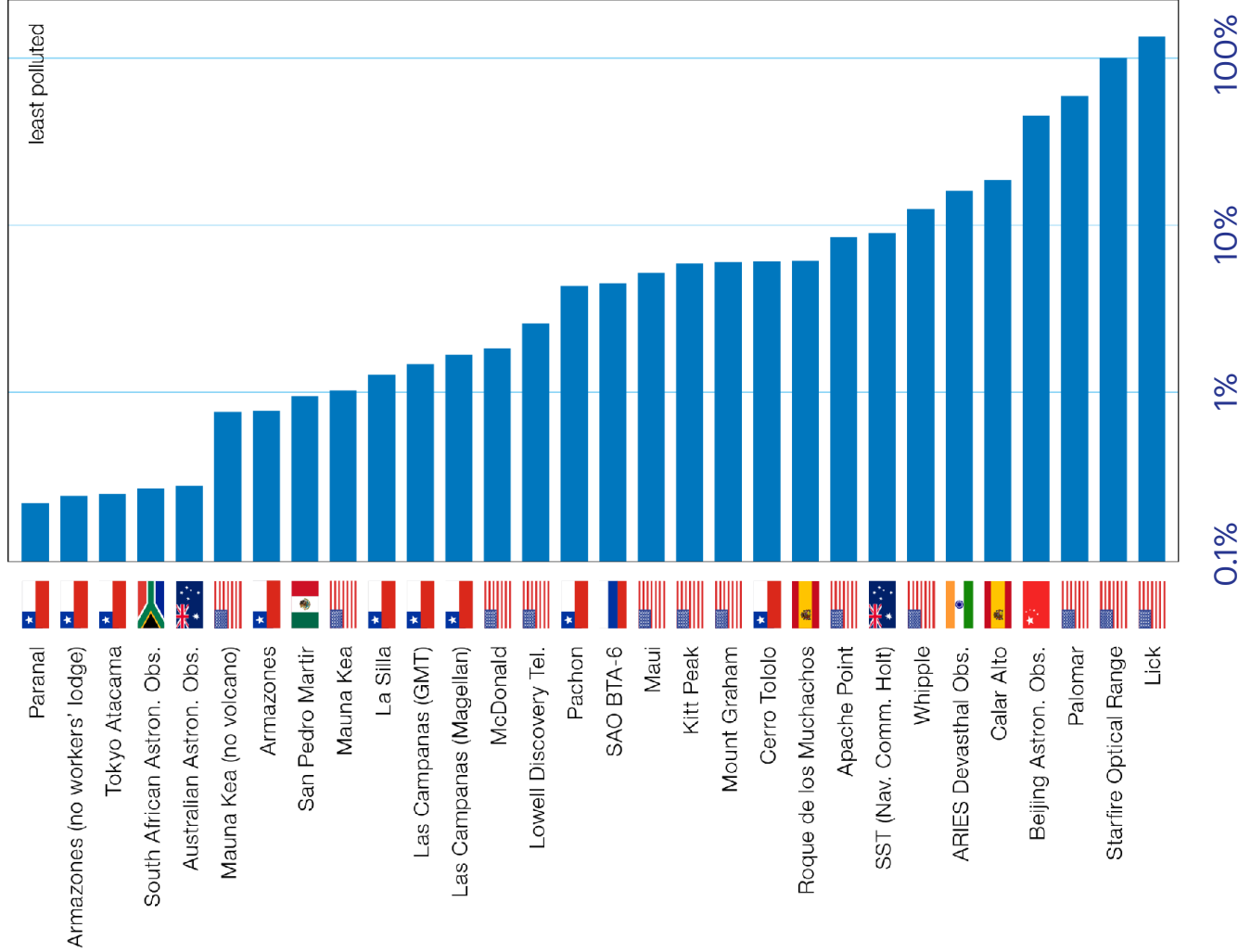
Credit: Canton Fribourg

Regions with pristine dark sky are becoming increasingly rare.

Losing the darkness



Light pollution over major observatories



Sky brightness over natural background

Major observatories are under threat

Credit: ESO, adapted from Falchi+ 2023

Emerging new threats: Ground

The AES Andes INNA project: 3 solar farms, 3 wind farms, battery storage system, production of liquid hydrogen and ammonia with storage facilities, desalination plant, storage, pipeline to maritime terminal. Cost: ~10 bn US\$

- **Artificial light contamination**

- ELT: +5% VLT: +35% CTA: +55%

- **Vibrations**

- limits exceeded on ELT and VLT

- **Atmospheric turbulence**

- “seeing”: degraded up to 40%

- **Dust contamination**

- 75% dust increase during construction, CTA most affected



Space-News: February 2026

It is time to take astronomy off Earth

by Fredrick Jenet, Teviet Creighton, Hoyt Davidson, Grant Henriksen, Alma Miller, Volker Quetschke, Dale Skran and Paul Wunderl February 12, 2026

Moving observatories into space and onto the lunar surface is a logical extension of decades of scientific progress. Off-planet observatories eliminate problems faced by terrestrial observatories including atmospheric distortion, interference and discontinuous observation.

Space-News: February 2026

The future of astronomy is both on Earth and in space

by Dara Norman and Kelsey Johnson February 25, 2026



The challenges facing ground-based astronomy — optical interference from satellite trails, radio contamination, orbital congestion — stem from policy choices and engineering decisions. They are not inevitable consequences of progress in our space ambitions.

Two international workshops: The Dark and Quiet Skies (D&QS) for Science and Society 1 and 2 (Oct. 2020 and 2021), led to the following Recommendation for the Protection of Astronomical Sites:

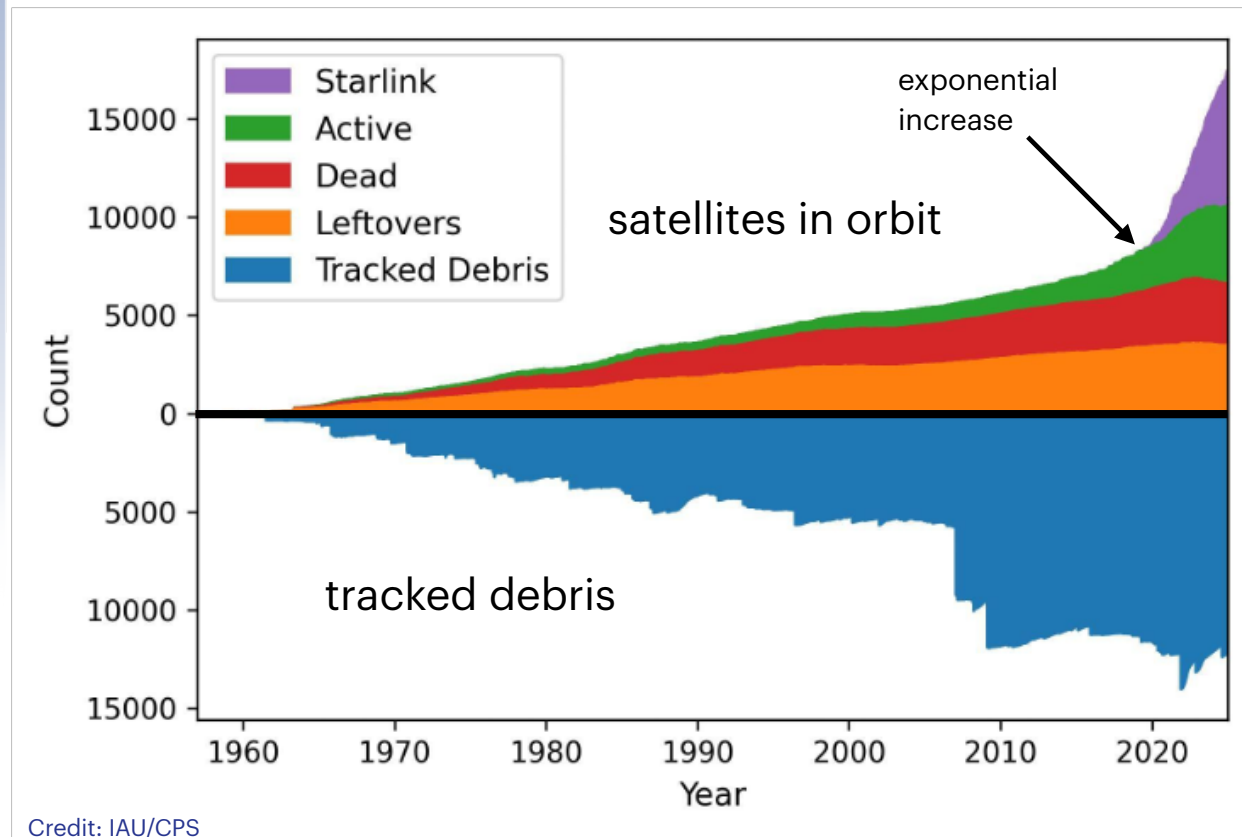
Reduce, stop, and then reverse, on the timescale of a decade, the growth of Artificial Light at Night (ALAN) at major astronomical observatories

The condition that the ALAN growth rate must be brought to zero and reversed at a site that now has an extremely low artificial contribution sets strong constraints.

A resolution to be voted at the IAU GA in 2027 is in preparation



Vote on resolutions at the IAU GA in Cape Town 2024



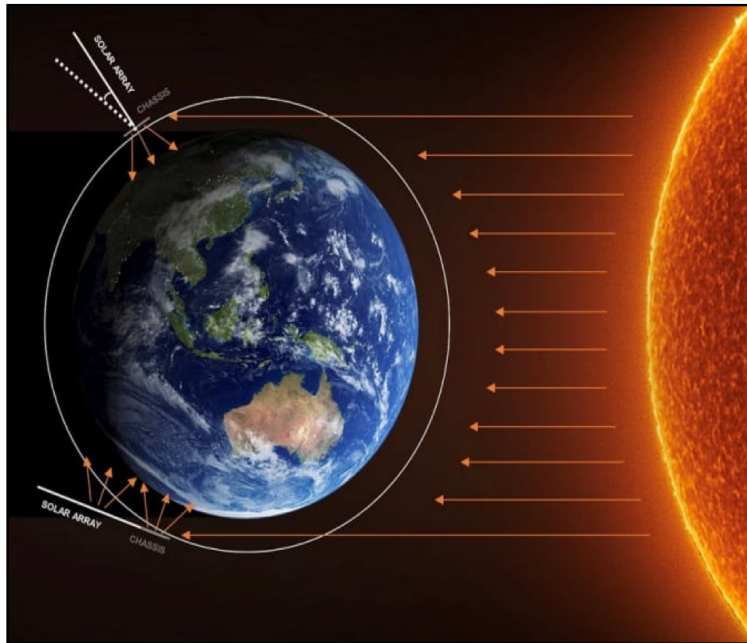
“Commercial space” represents a paradigm shift in space activity development.

Active Satellites in low Earth orbit
2019 May : ~ 2,200
2023 Nov. : ~ 6,800 (3x in 4 years)
2025 May : ~ 12,000 (2x in 18 months)
2030 (forecast): ~ 40,000

The International Telecommunication Union (ITU) has received requests for ~ 2 million (!!) satellites in the next 5-10 years.

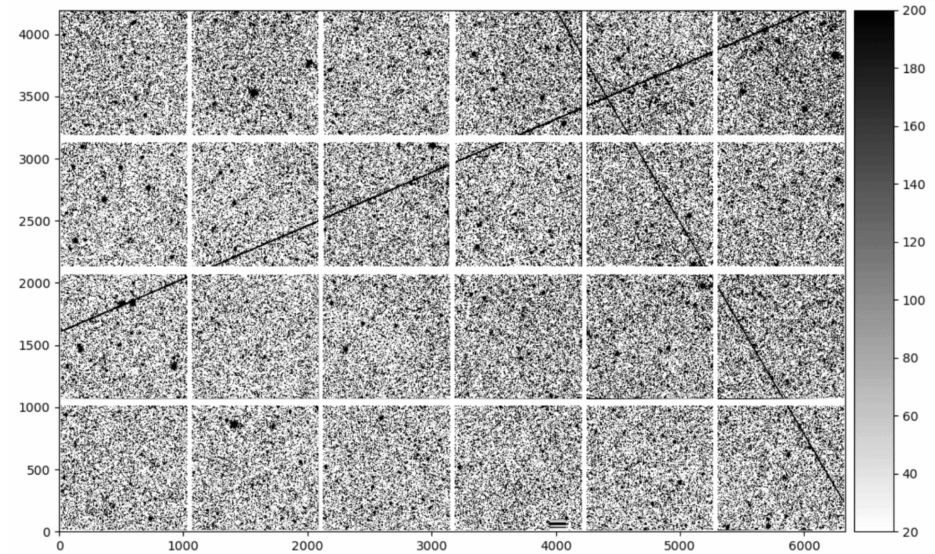
Effect on optical astronomy: Ground-based

Sunlight is reflected by the satellites



Credit: SpaceX

Credit: Rubin Obs.

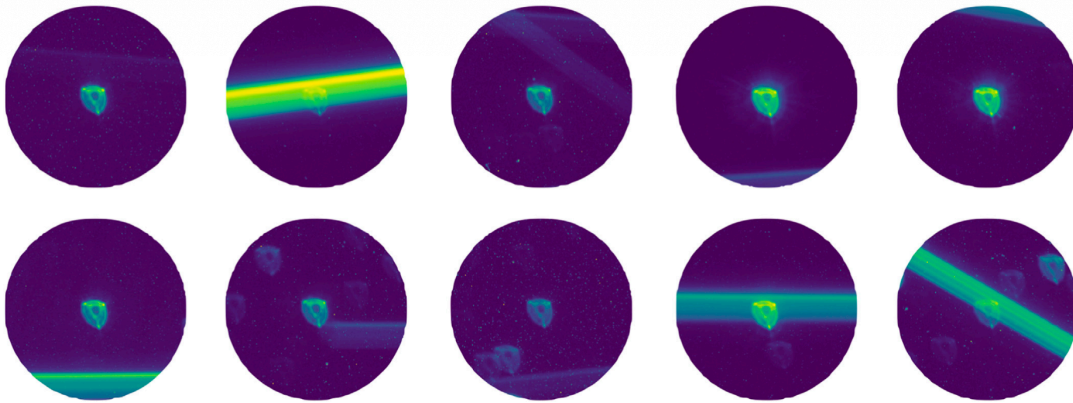


- Example of two faint satellites streaks crossing the LSST field on July 11, 2025

Most affected:

- Wide-field time-domain surveys
- Large aperture wide-field imaging
- Observations during twilight

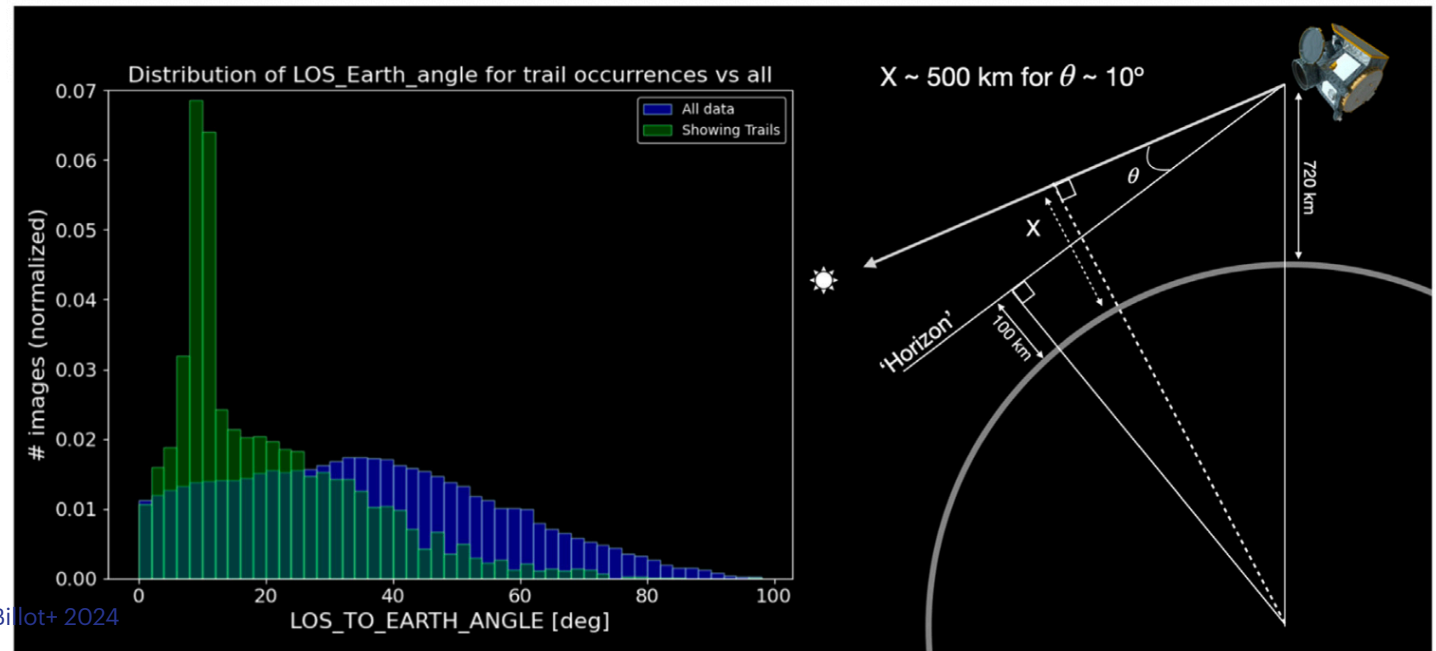
Effect on optical astronomy: space-based



- Examples of trails seen in the defocused images of CHEOPS orbiting at 700 km altitude in a sun-synchronous orbit

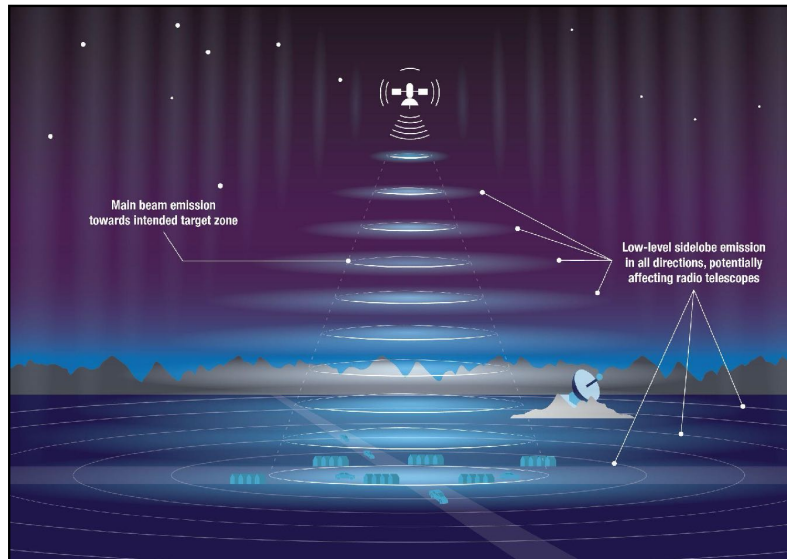
Billot+ 2024

- Shell of satellites and debris in the range 500-700 km



Billot+ 2024

Effect on radio astronomy



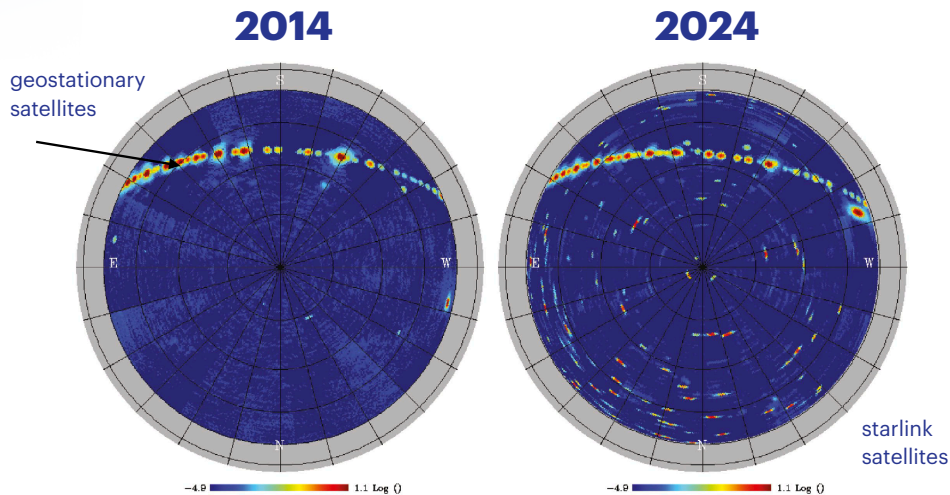
Credit: SKAO

- Low-level sideline emission spread much beyond the target zone
- Electronics used in the satellite generates very low-level unintended electromagnetic radiation (UEMR) including in protected frequencies
- Radio telescopes are designed to detect extremely faint radio signals
 - 10 million times fainter than UEMR of latest Starlink

Largest impact: Wide-field and highly sensitive observations drowned by satellite interferences

Examples

- Study of pulsars, fast radio-bursts, galactic centers etc.
- Time-domain astronomy made more difficult
- Molecular clouds and star formation



Credit: Quijote 10-14 GHz

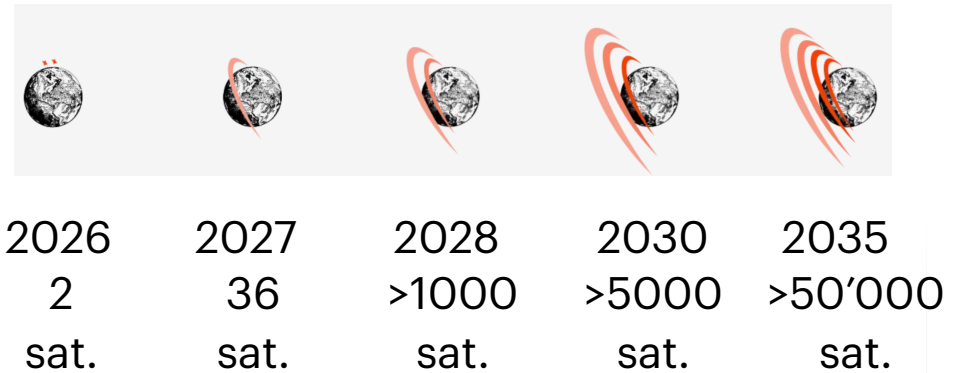
Emerging new threats: Space



Deliver sunlight on demand with a constellation of in-space (submitted application to FCC).



Timeline



Energy
Expand solar potential, making clean power dispatchable and available when you need it.

Response
Illuminate disaster zones and search-and-rescue missions.

Industrial
Extend working hours, improve safety, light remote sites.

Defense
Uninterrupted solar power and lighting for critical defense operations.

Experience
Unforgettable nighttime experiences for events and public spaces.

Agriculture
Tailor growth cycles, extend seasons, boost yields.

Civilizational
Replace streetlights, reduce light pollution, enhance urban life.

IAU responded to FCC consultation and submitted comments.

Emerging new threats: Space



Space-based data centres or orbital AI infrastructures

In January 2026, Space X filed plans with the FCC for millions of satellites to extend cloud and AI computing into orbit. Other US and Chinese companies have similar plans.



Starcloud-1 deployment from a Space-X Falcon 9 rocket hosting the first Nvidia H100 GPU in space on November 2nd, 2025

IAU responded to FCC consultation and submitted comments.

- It is essential to raise the awareness of policymakers about the effects of ground-based light pollution and the growth of space activities on astronomy and many other areas. The IAU is an important actor in this.
- Local policies can address ground-based light pollution, whereas space-based activities are much more complex to regulate as they require global discussions.
- An objective scientific assessment of the impact of these activities is important for developing best practices and garnering broad support.
- The challenge is that the timescale for developing consensus and best practices is much longer than that for developing new space activities.

Thank you for your attention!

more information at

<https://iau.org>

