



IAU NOIR Lab SKAO

Dark and Quiet Sky a wake-up call for the New Space Economy

Piero Benvenuti

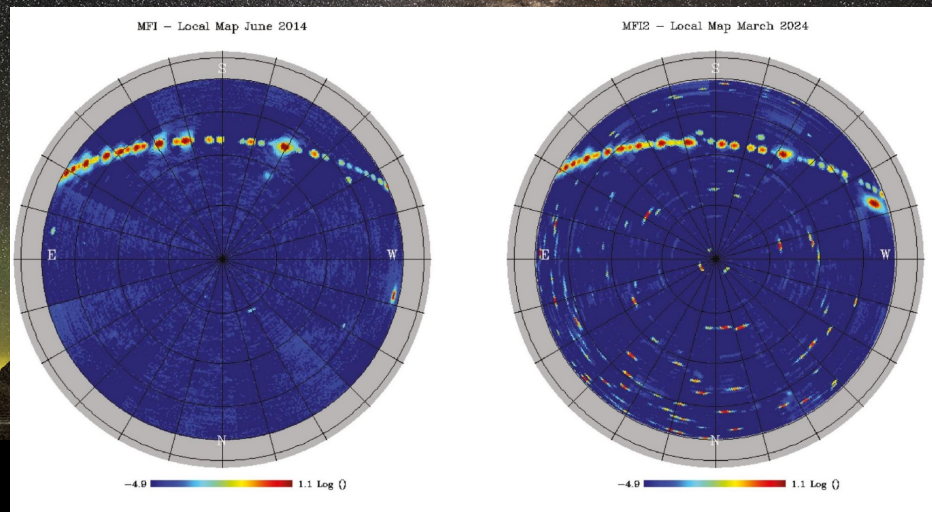
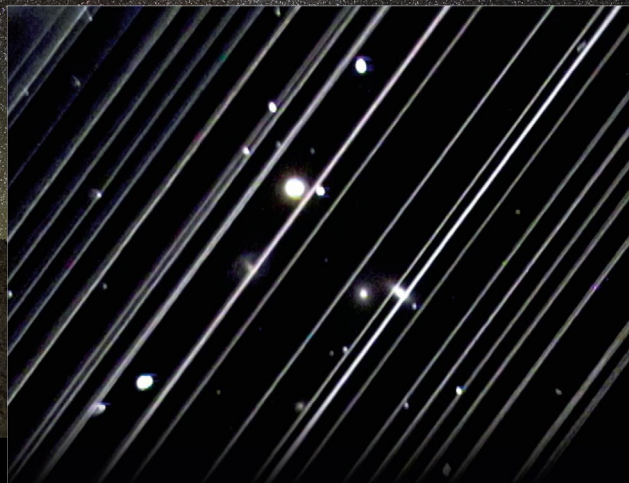
Director, IAU CPS

Dark and Quiet Sky

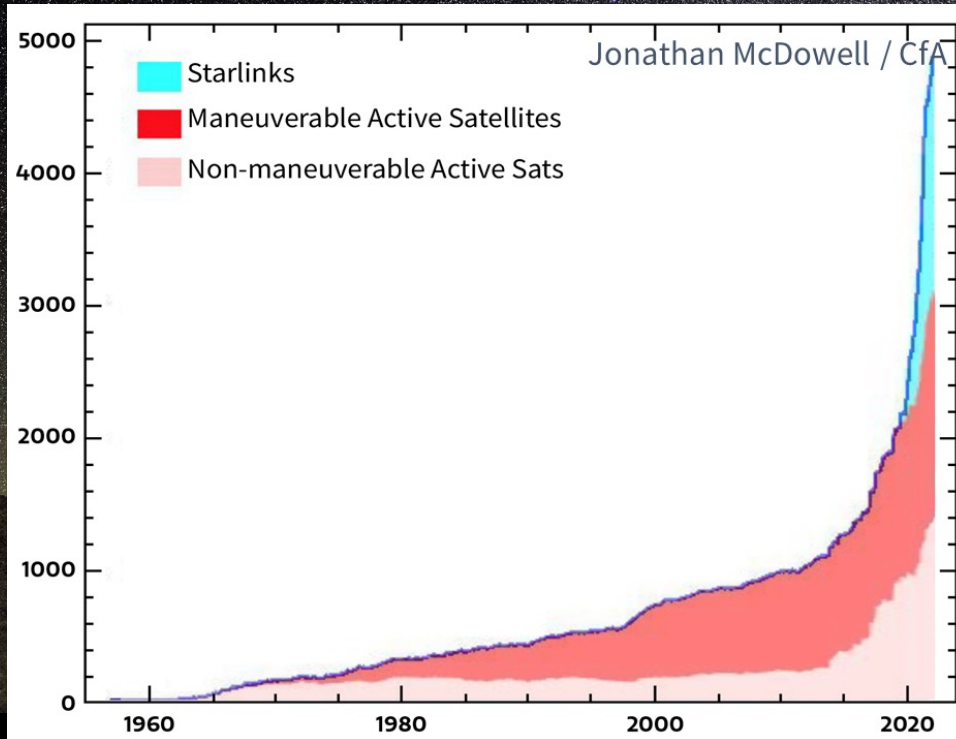


- The interference of the large satellite constellations on astronomy and the pristine night sky is now well assessed by direct measurements.
- The satellites in LEO reflect the sunlight and emit intentionally and unintentionally electromagnetic radiation

NOIR Lab SKAO



The root of the problem: an exponential increase in space activity



Active Satellites

2019 May : ~2,200

2023 Nov : ~6,800 (3x in 4 years)

2024 July : ~ 13,000 (2x in 8 months)

Disturbing Reality: ~ 1,700,000 (!)
constellation satellites are planned
(according to FCC+ITU application)



IAU NOIR Lab SKAO

Is mitigation possible? (CPS recommendations)



IAU NOIR Lab SKAO

- Satellites **should** be made less reflective (below magnitude 7):
 - The pristine vision of the night sky is preserved
 - The astronomical detectors are not saturated or damaged and the satellites' trails can be partially removed by post processing
- The apparent position of the satellites **should** be accurately predicted:
 - The astronomical observation can be interrupted during the passage of the satellites within the field of view of the telescopes
- The radio emission of the satellites **should** not land over radio telescopes and possibly interrupted or deviated when transiting the field of view of radio telescopes (Radio quiet zones)
- The wavelengths bands of radio-astronomical interest **should** continued to be protected (an ITU-R matter)



Mitigation: state-of-the-art



IAU NOIR Lab SKAO

- Satellite Companies are becoming aware of the issue and have, so far, a collaborative attitude. However, complying with the CPS recommendations presents technological and operational difficulties.
- Implementing and offering mitigating solutions worldwide has a cost.
- All mitigations will fail if the number of satellites in LEO will exceed ~ 100,000 – 150,000.

Back to numbers: how many satellites in LEO?



- Nobody believes that 1.7 Million satellites will be launched, however...
- The message is clear: Internet connectivity from space is strategic and cannot be left in control of a single national private enterprise.
- Hence, everybody is planning his own constellation.
- The issue goes well beyond the interference caused to astronomy, the long - term operability of the LEO orbit shell is at stake:
 - Traffic control becoming unmanageable
 - Increased risk of collisions (Kessler syndrome)
 - Unknown effects of massive satellites' re-entry (see [AAS statement](#))
- The key question is: how many satellites can we afford to have in LEO?
- What to do?

NOIR Lab SKAO

From the UN “Pact for the Future”



IAU NOIR Lab SKAO

- “Reaffirm the importance of the widest possible adherence to and full compliance with the **1967 Outer Space Treaty** and discuss the establishment of **new frameworks** for space traffic, space debris, and **space resources** through the Committee on the Peaceful Uses of Outer Space.”
- As stated by the COPUOS STSC in its 59th Report, **space resources** include astronomy and astronomical observations: “**Astronomy is instrumental to space activities**”.
- Astronomy has been the first to be directly affected by the satellites' interference and will continue to collaborate with all stakeholders in pursuing an acceptable compromise between technological progress and the protection of the environment-at large.

Group of Friends of D&Q_S

Aims of the Group of Friends:

- Promote awareness
 - Review best practices and mitigation suggestions
 - Discuss the overall implications of the adoption of mitigating measures
 - Discuss approaches for coordination between the various stakeholders
 - Support the development of best practices
-
- Currently adhering Delegations and Observers:
 - Belgium, Bulgaria, Chile, Colombia, Germany, Italy, Luxembourg, Mexico, New Zealand, Romania, Slovakia, South Africa, Spain, Switzerland, UK, USA
 - COSPAR, EAS, ESO, IAA, IAU, SKAO
-
- GoF webpage: <https://cps.iau.org/group-of-friends/>

