

Threats to Dark & Quiet Skies by Satellite Constellations

American Astronomical Society

The recent, massive proliferation of commercial satellites in low earth orbit (LEO) significantly threatens astronomy **unless mitigating actions are taken.**

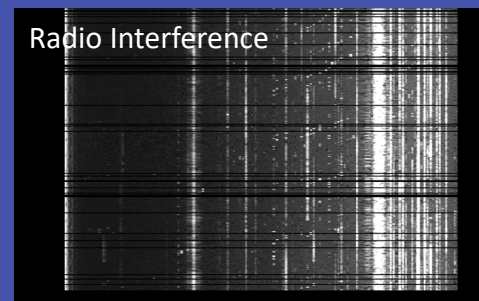
Illustration based on applications filed with the ITU and the U.S. FCC.



Current FCC license requests would result in 100,000+ satellites in LEO. This increases collision risk and the **possibility of rendering LEO unusable to all** without careful management.



Satellites & debris reflect sunlight, leaving streaks across science images. Their radio transmissions interfere with radio telescopes as they pass overhead. **Remote sites and software solutions are no longer enough.**



All ground-based optical, infrared, and radio observatories are affected, but NSF's brand new \$400M Vera Rubin Observatory, with its wide field of view, could have **streaks in 30% of images (and up to 90% at twilight)**. The current technical goal of 7th magnitude brightness for satellites is driven by Rubin Observatory science needs.

Other issues

- Orbital and spectrum crowding, space traffic management
- Space debris, ASAT weapons tests, and possible diffuse sky brightening
- Environmental concerns: greenhouse gases from launches, aluminum deposition in atmosphere from de-orbiting, effects of launch and night-sky brightness on wildlife
- Loss of cultural relationship to the sky for indigenous peoples, general dark skies for all humankind



What can be done?

- Operators and regulators need to **consider the aggregate impact** of these constellations.
- **Coordination agreements** between orbital space and night sky users (i.e., NASA, NSF, satellite operators)
- Increasing **international collaboration** between the US agencies and UN COPUOS, IAU, and others.
- Continued/improved **financial support for mitigation efforts**
- Consideration of application of environmental laws to low Earth orbit

There are no current protections for optical astronomy, and limited protections for radio astronomy. AAS is collaborating with satellite operators, but all harm mitigations have been voluntary. **Mitigation of harm to astronomy should be a requirement of licensing.**