Satellite constellations and LSST: new tools and impact assessments

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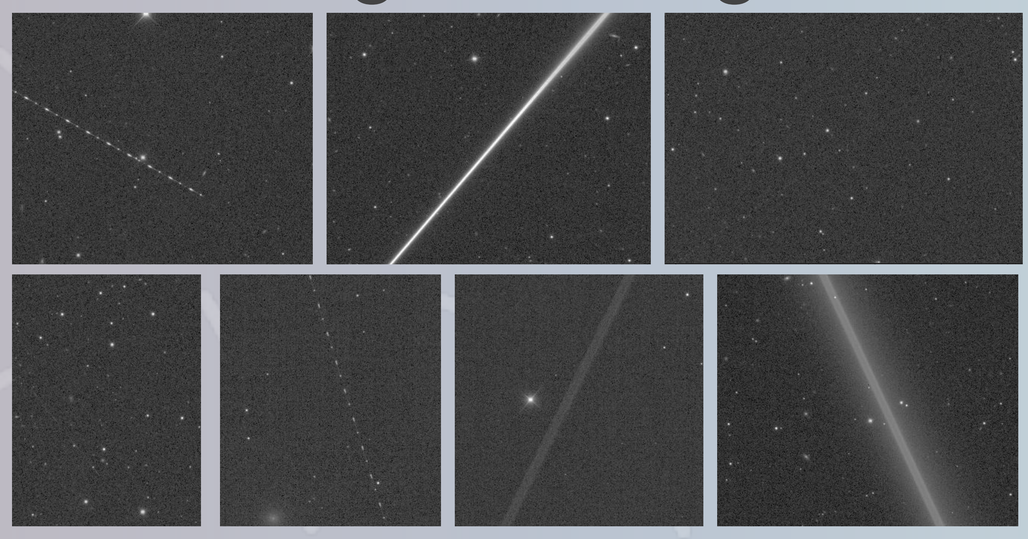
More satellites during LSST will require a range of mitigations

With 100,000+ satellites likely to launch in the near future, trails in astronomical images will become frequent enough to require some form of mitigation in Rubin's Legacy Survey of Space and Time (LSST). While pixel loss will be low [SMTN-018] due to large field of view (FOV), science impacts are not yet known.

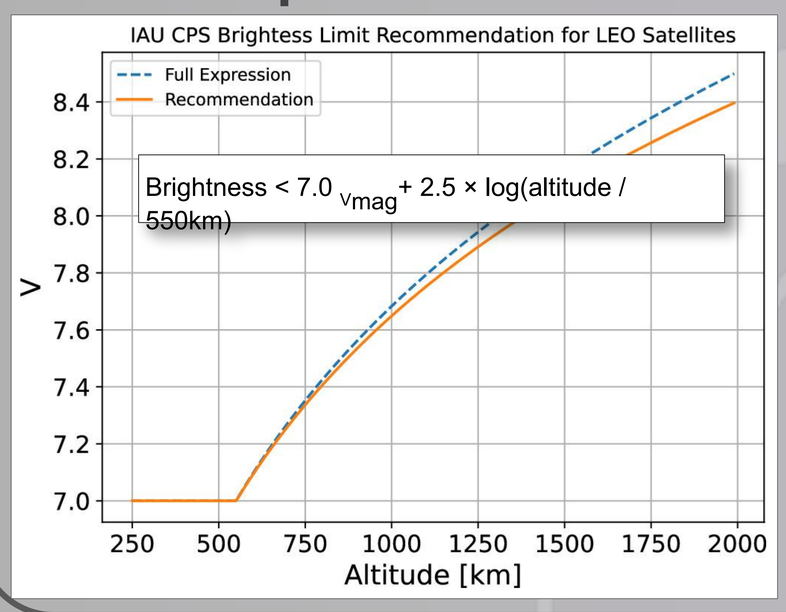
Key strategies include: satellite design and deployment in dialog with operators [e.g., 3, 6], avoiding bright satellites [2], excluding known satellites from alerts [DMTN-199], rejecting transients from coadds [DMTN-080], detecting and masking streaks and glints in difference images, and addressing systematic errors from faint signals that fall below the detection threshold.

To learn more, visit **ls.st/satcon**.



Satellite trails in ComCam and LSSTCam images, Nov 2024 – May 2025

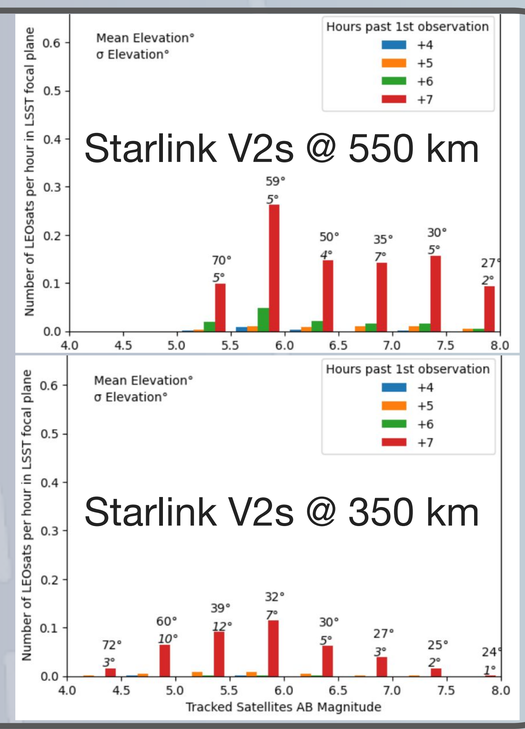
New SpaceX Starlink efforts toward 7th mag



The IAU CPS optical brightness recommendation for satellites in LEO takes into account higher streak surface brightness for slower-moving, higher-altitude satellites [1]. Many constellation satellites significantly exceed this limit [4].

LSST can avoid some bright satellites [e.g., 5] in principle with the feature-based scheduler, but doing so would effectively decrease observing time and thus coadded depth [2].

Recent findings demonstrate that lowering satellite orbits, while increasing maximum satellite brightness, may reduce the overall impact of Starlink V2 satellites on LSST [3].



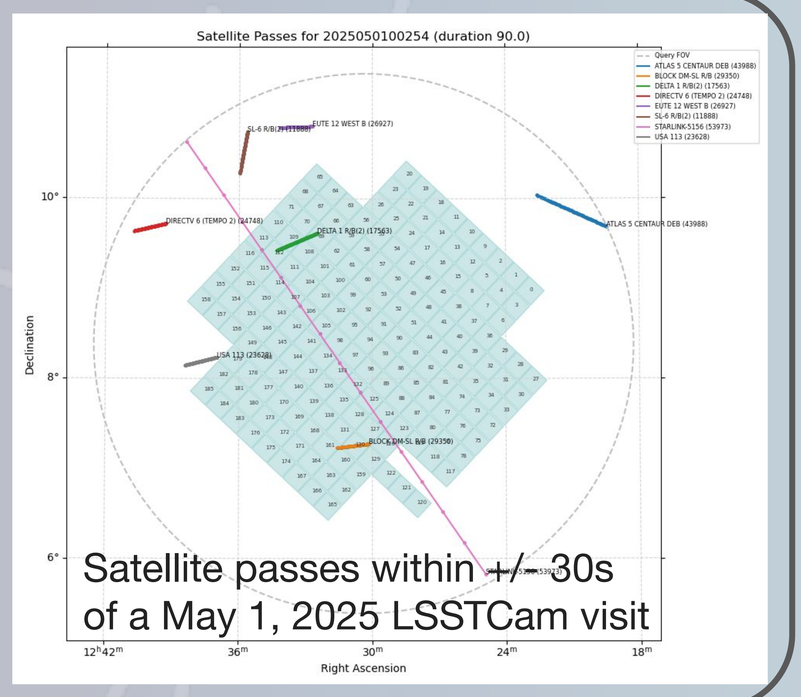
SatChecker enables satellite position lookup and avoidance

SatChecker uses public TLEs (two-line element sets) from CelesTrak and Space-Track to predict satellite positions at a given time and location. SatChecker provides additional information like range, on-sky velocity, and an "illuminated" flag for each prediction point. SatChecker uses the TLE with the closest epoch available to the requested time.

In the future, SatChecker will use higher accuracy ephemerides.

Documentation, including APIs and examples: **satchecker.readthedocs.io**

Recreate this figure with a FOV query (Butler access req'd): **tinyurl.com/whats-that-streak**



References

[1] A. C. Boley et al. 2025, RNAAS, 9(3), p.60
[2] J. A. Hu et al. 2022, ApJL, 941(L15), p.6
[3] P. Kandula et al. 2025, arXiv:2506.19092
[4] A. Mallama & R. E. Cole 2025, arXiv:2507.00107
[5] R. E. Cole et al. 2025, arXiv:2505.05820
[6] NSF and Amazon's Project Kuiper establish satellite coordination agreement, 2025 June

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