

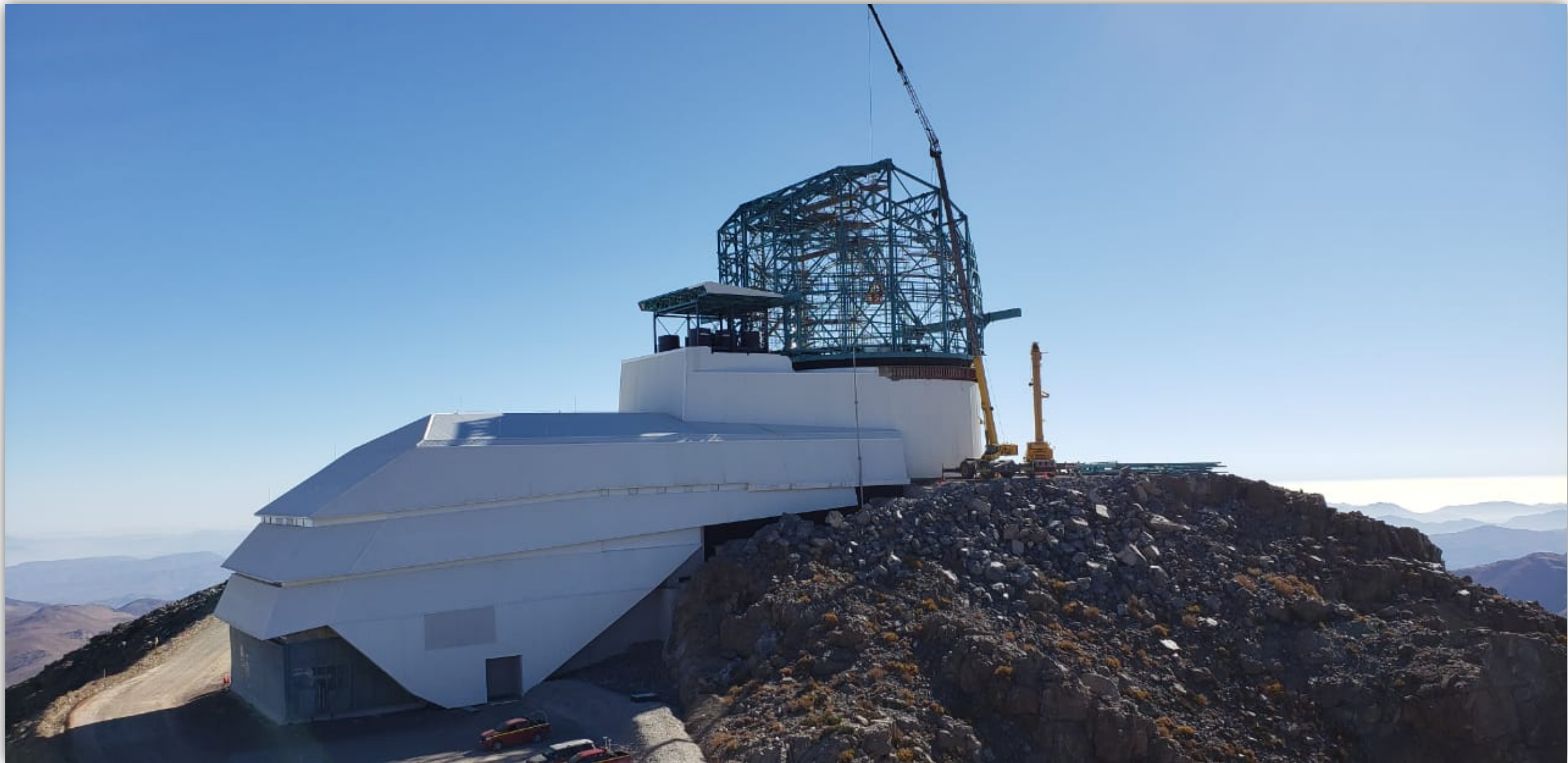
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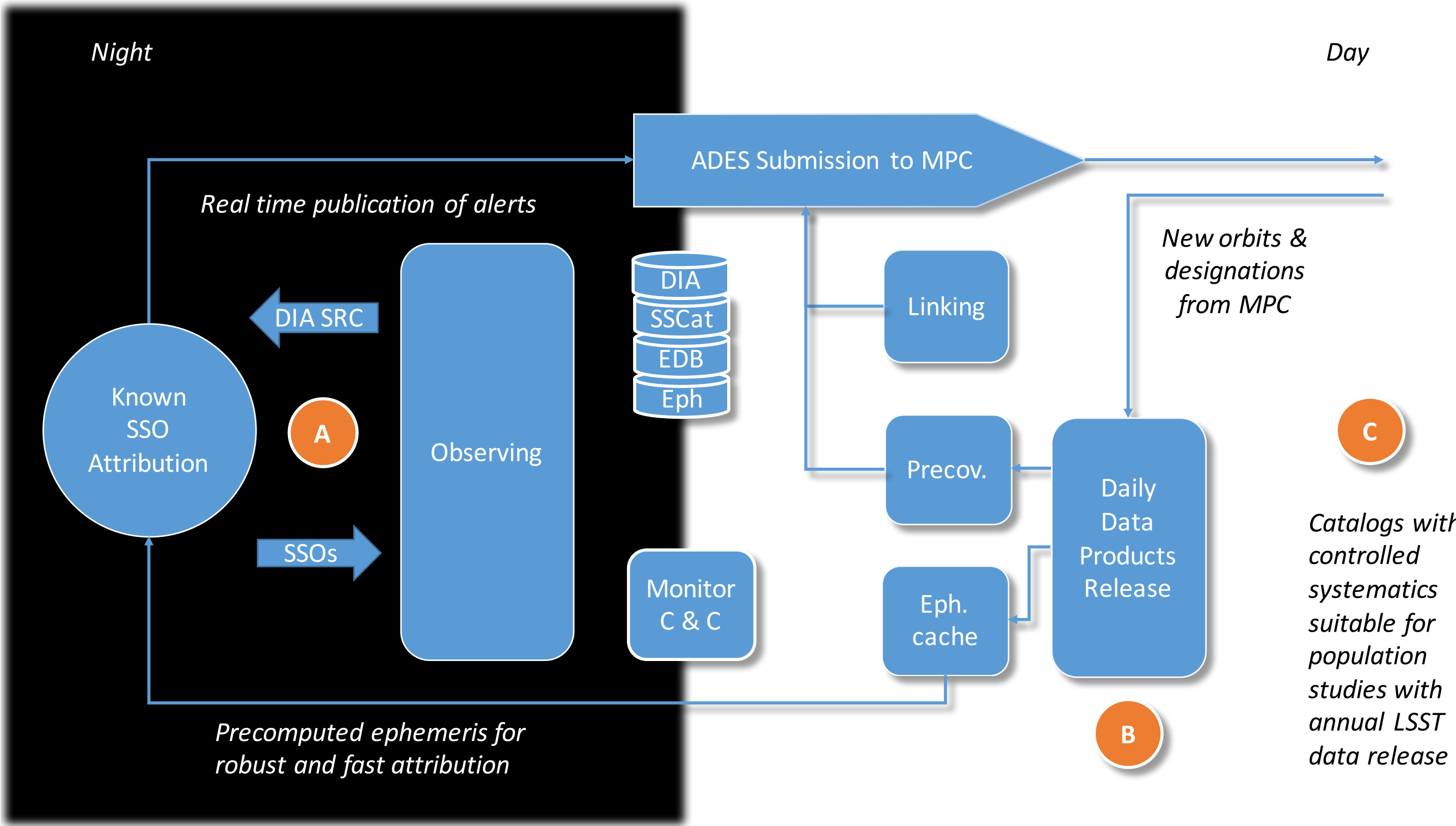
The Large Synoptic Survey Telescope (LSST) is an 8m-class observatory currently under construction on Cerro Pachón, Chile. During its 10-year survey starting in 2022 LSST is expected to catalog roughly 60% of all near-Earth Objects (NEOs) with absolute magnitude $H < 22$, i.e. 140 m diameter and larger [1,2]. This impressive contribution to planetary defense is made possible by LSST’s 9.6 square degree field of view, a 3.2 Gigapixel camera and a rapid observational cadence that covers the entire visible sky every 3-4 days throughout the observing season.

At the heart of LSST’s capabilities to observe and discover solar system objects (SSOs) lies the moving object processing system (MOPS). The current layout of the LSST SSO processing framework is shown in the graph to the right. The modular design aims to provide clear interfaces between the components allowing, for instance, to test different linking algorithms [4,5]. Integration with the Minor Planet Center (MPC) allows for a minimum delay in publishing observations and discoveries of SSOs. At the same time LSST ephemeris predictions benefit from the most up to date SSO orbits including data from other ground based and space borne observatories. Orbit catalogs exclusively based on LSST astrometry will be available on a yearly basis to serve survey simulation and debiasing needs.

The LSST will deliver groups of data products in support of Solar System Object (SSO) science, at prompt and annual cadences:



The Large Synoptic Survey Telescope at Cerro Pachón, April 2019



LSST processing with data products supporting Solar System Science

A Prompt Processing, within 60 seconds of observation: measurements of all detections on difference images, including known and unknown SSOs. Suitable for real-time discovery of trailed objects, and activity of known objects.

B Prompt Processing, daily: Catalogs of SSO physical properties and orbits, including new objects identified by MOPS.

C Annual Data Releases: Catalogs with controlled systematics and suitable for population studies.

A. Real-time Alerts (~ 1M SSO observations/night)	
Astrometry	±10 mas (bright; ±140 faint)
PSF flux	±10 mmag (bright end)
Aperture flux	±10 mmag (bright end)
Trailed source fit	Flux and on-sky motion for fast-moving (trailed) objects
Appearance characterization	Moments and extendedness of the object’s image
Spuriousness score	Probability that the detection is an artifact
Nearby static objects	Information on adjacent objects (up to three)
MPC designation	Given for known objects
Predicted position and magnitude	Given for known objects

B. Daily Solar System Products (>= 5M objects)	
Orbits	Computed by the MPC
Characterization	Light curve features
Absolute magnitude estimates	Estimates of (H, G12) in u,g,r,i,z,y bands
MOID	Minimum Orbit Intersection Distance to Earth
Extendedness indicators	Comet-like?

C. Solar System Data Release Products (every year)	
High-fidelity reprocessing	Catalogs derived from re-reductions of all survey data using improved calibrations and a single, well-characterized, software release.
The LSST Catalog of Solar System Objects	A catalog, suitable for population studies, of objects detected by LSST with orbits estimated using only LSST data.

More information:
[a] [LSST Overview Paper:](#)
[b] [Data Products Definition Document:](#)
[c] [Solar System Data Products Schema:](#)

<http://ls.st/lop>
<http://ls.st/dpdd>
<http://ls.st/ouq>

References: [1] Jones, R.L. et al. 2018. *Icarus*, 303, pp.181-202. [2] Vereš, P. & Chesley, S.R., 2017. *AJ*, 154(1), p.12. [3] Holman, M. et al., 2018. *AJ*, 156(3), p.135. [4] Denneau, L., et al. 2013. *PASP*, 125, p. 357.

