#PeloFuturoDaCiência
#PeloFuturoDaAstronomia

The LIneA Solar System Portal

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What is the purpose of the LIneA Solar System Portal?

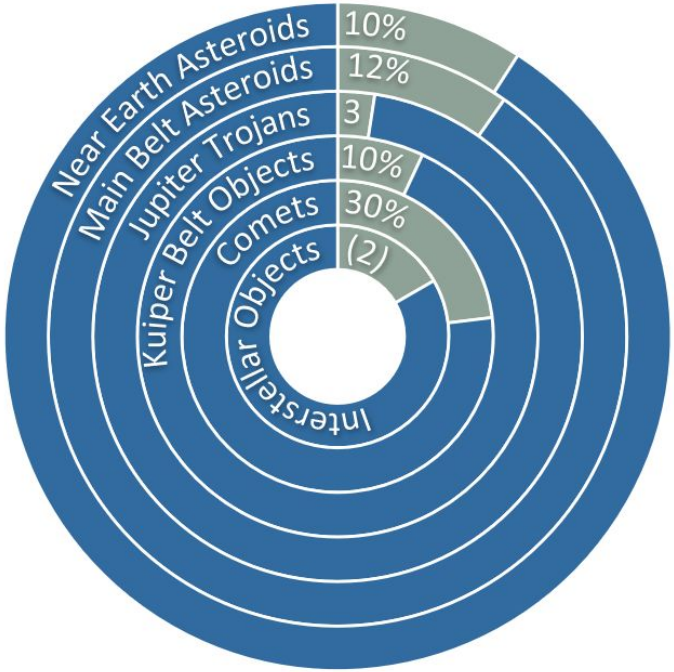
- Universalize access to occultation prediction data, easing computational demands for both professional and amateur astronomers.
- Deliver reliable and regularly updated predictions using trusted sources such as Gaia DR3, JPL, MPC, and others, supported by a high-performance computing system.
- Make available diverse tools for querying and visualizing prediction data relevant to users' interests.
- Provide predictions covering all asteroids in the Solar System.
- Enable users to generate customized predictions by offering a secure platform for inputting private data.

THE LSST CONTEXT: A 6X LARGER SOLAR SYSTEM

What will LSST provide?
Large amounts of small body positions, with competitive accuracy (20 - 50 mas) achieved over a decade of observations provided by the LSST.

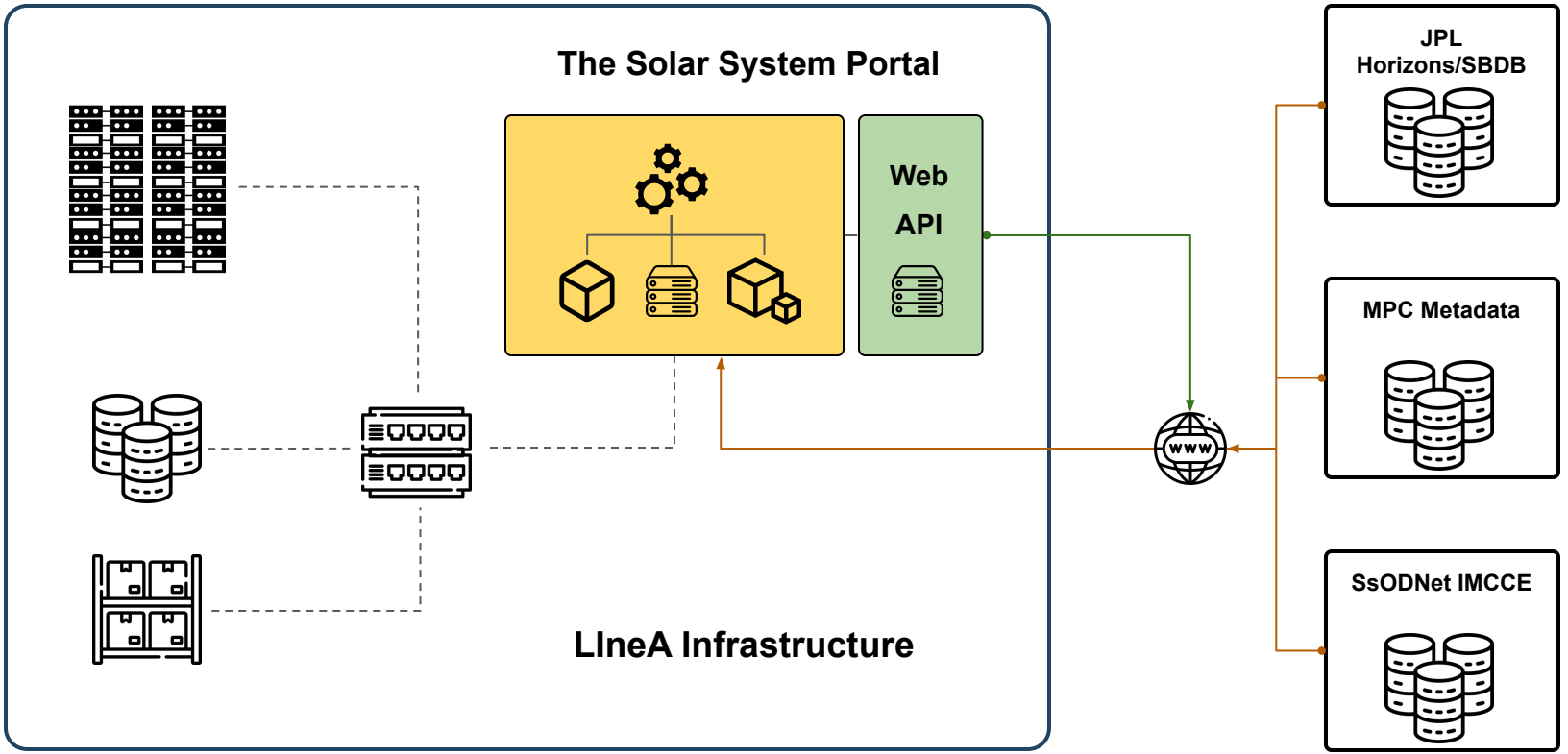
LSST era (~ 10 million asteroids):

- **Average pred/day: ~10 Million**
- **Average pred/year: ~3.5 Billion**



LINEA SOLAR SYSTEM PORTAL

PORTAL OPERATION



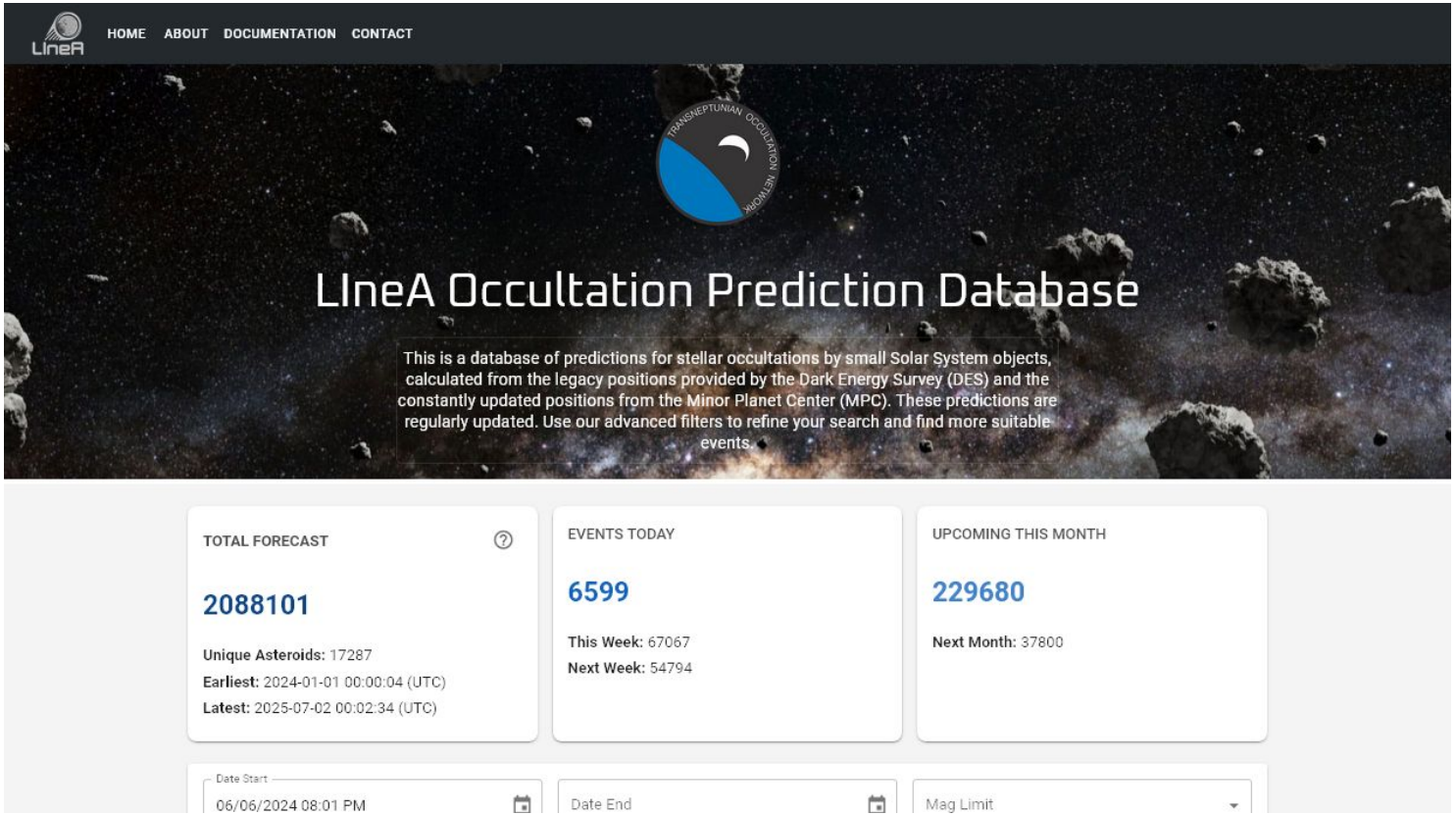
NUMBERS

Computing Predictions for 1 Year

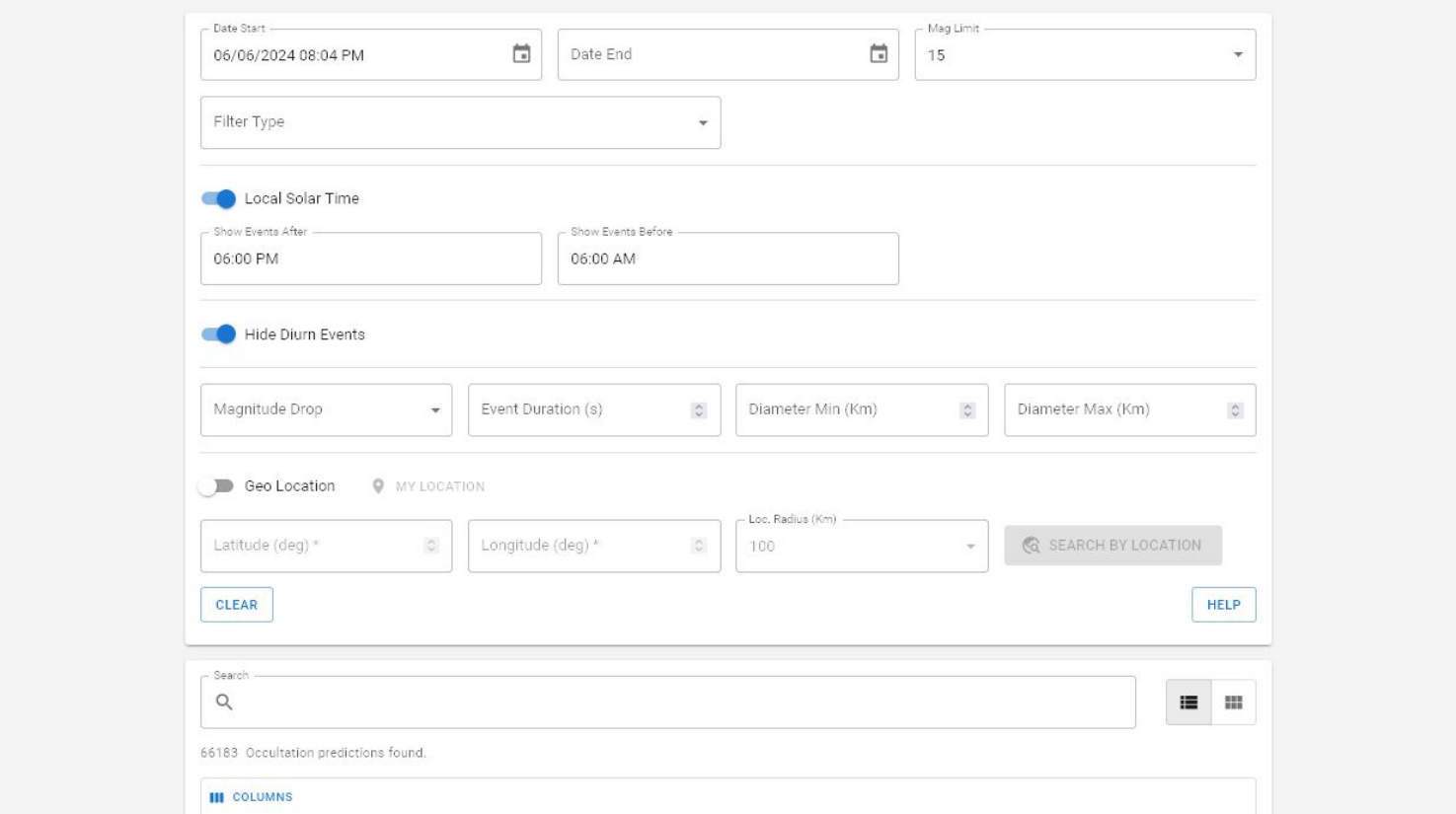
- **Current prediction capacity:**
  - 18K Asteroids in ~23h (19K ast/day);
  - 1.35M Asteroids in ~ 70d;
  - (the avg PC ~ 250-1000 ast/day);
- **Near future capacity:**
  - 1.35M Asteroids in ~7d (200K ast/day);
  - (the avg PC would take 4 to 15 years);

- Number of asteroids with predictions: **~ 36,000**
- Number of event: **~ 39.5 M**
- Latest prediction: **March 31, 2026**
- Asteroid dynamical classes included: **Centaurs, Trojans, KBOs & NEAs**
- Asteroids ephemerides: **JPL/NASA**
- Planetary ephemerides: **de440 - JPL/NASA**
- Leap second kernel: **NAIF0012 - JPL/NASA**
- Star catalog: **Gaia DR3**

LINEA OCCULTATION PREDICTION DATABASE



LINEA OCCULTATION PREDICTION DATABASE



LINEA OCCULTATION PREDICTION DATABASE

Occultation by Quaoar (50000)

Jun 1, 2025

DOWNLOAD KMZ

DOWNLOAD MAP

Occultation Prediction Circumstances

Instant of the closest approach	Mon. 02 June 2025 01:33:51
Star position (ICRF)	RA 18 43 14.4925 Dec -14 53 3.933
Closest approach	59.0 (mas)
Position angle	181.24 (deg)
Velocity	-21.06 (km/s)
Geocentric distance	41.77 (AU)
Event duration	52.7 (s)
Star magnitude (Gaia)	17.961
Magnitude drop	1.2 (mag)
Uncertainty in time (1σ)	18.2 (s)
Uncertainty in closest approach (1σ)	81 (Km)
Moon separation	130.7 (deg)
Moon illuminated fraction	39.3%
Sun elongation	149.9 (deg)
Creation date	Tue Dec 03 2024 20:59:49 GMT+0000

Object

Identification	Quaoar (50000), 2002 LM60
Dynamic class (Skybot)	KBO>Classical>Main
Astrometric position (ICRF)	RA 18 43 14.4925 Dec -14 53 3.992
Uncertainty in position (1σ)	RA 12.7 (mas) Dec 2.7 (mas)
Absolute magnitude	2.420
Apparent magnitude	18.795
Diameter	1110 (Km)
Apparent diameter	36.6453 (mas)
Semi-major axis	43.1935 (AU)
Eccentricity	0.0376
Inclination	7.9912 (deg)
Perihelion	41.5694 (AU)
Aphelion	44.8176 (AU)

More information:

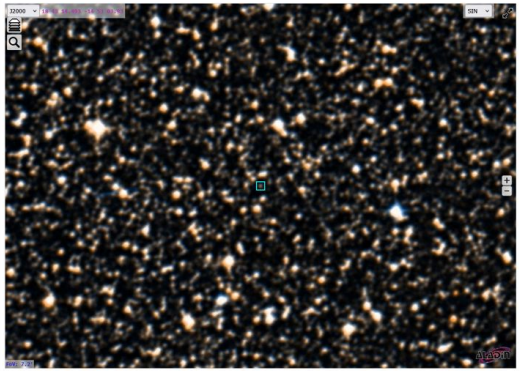
SsODNet service at IMCCE

Small-Body Database Lookup NASA/JPL

Occulted Star

Stellar catalogue	Gaia DR3
Star astrometric position in catalogue (ICRF)	RA 280.81039156 Dec -14.8844171
Proper motion	RA -2.17 ±0.14 (mas/yr) Dec -3.30 ±0.12 (mas/yr)
Source of proper motion	Gaia DR3
Uncertainty in the star position	RA 0.140 (mas) Dec 0.151 (mas)
G magnitude (source: Gaia DR3)	17.961
RP magnitude (source: Gaia DR3)	17.165
BP magnitude (source: Gaia DR3)	18.803

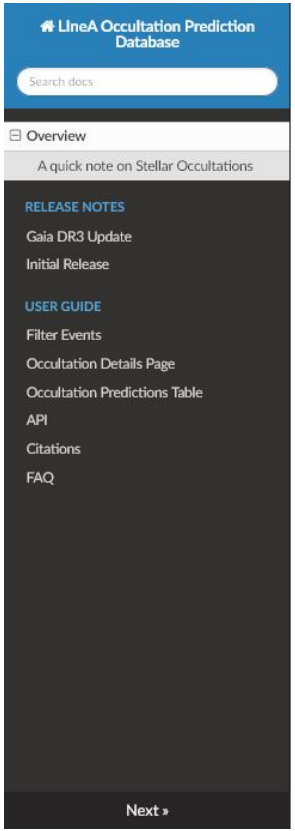
Aladin Sky Atlas



LOPD Service Portfolio

- Subscription Service;
- Dynamic and Static Maps;
- KMZ map overlays;
- Web interface Access;
- Web API Access;
- Python library (lineaSSP) for programmatic access;

LINEA OCCULTATION PREDICTION DATABASE



» / Overview

Overview

Welcome to the LIneA Occultation Prediction Database!

This database was developed to universalize access in an easy and interactive way to predictions of stellar occultations by small bodies of the Solar System. To do this, we constantly collect information about the orbits of these small bodies and, in combination with the Gaia stellar catalog and our software stack, compute updated predictions of stellar occultations using an HPC system. Our aim is to reduce the computational burden for amateur and professional astronomers by providing millions of stellar occultation predictions that can be easily accessed and to walk the preparation path for the Legacy Survey of Space and Time (LSST) era.

INITIAL RELEASE ADVISORY

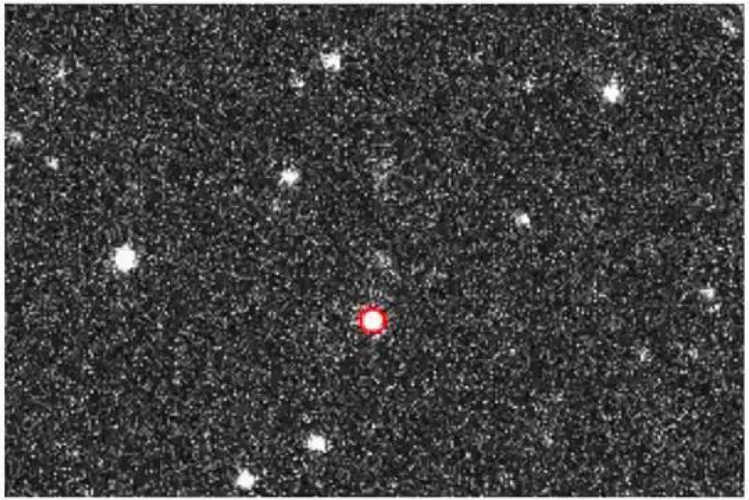
Please be aware that this is our inaugural release, and we are currently refining our database access performance. We are eager to receive your feedback regarding any challenges or problems encountered, as it will help us improve the overall user experience.

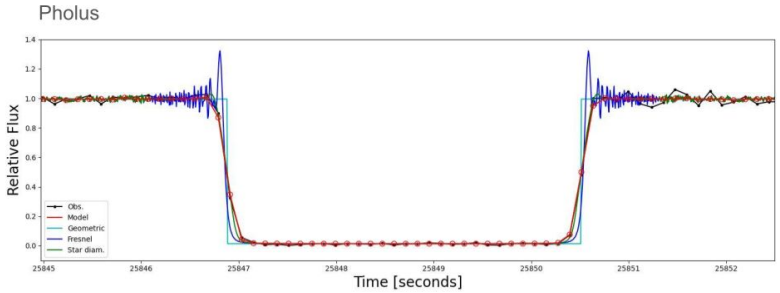
A quick note on Stellar Occultations

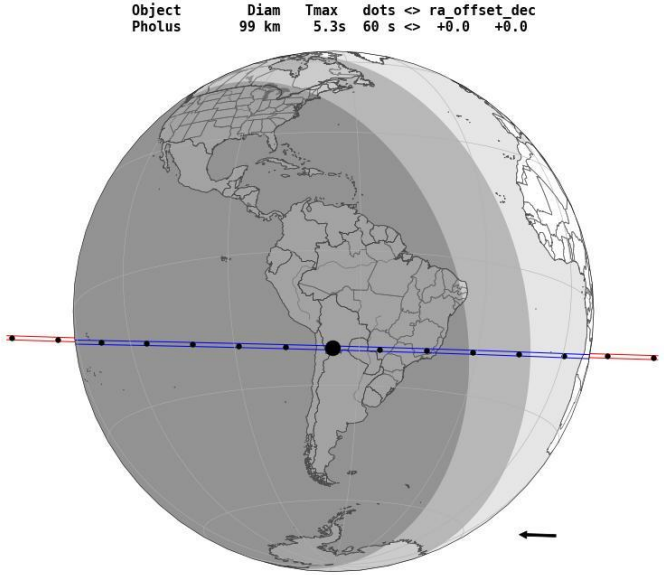
Stellar occultations happen when a moving object, such as an asteroid, passes in front of a star, blocking its light from view for a short time. These events can also be thought of from a different perspective, such as the object's cast shadow (with the source of light being the star) moving across the Earth's surface. People within the shadow's path with a telescope and the right conditions can register the occultation event.

From our point of view, stars are constantly obscured by bodies of the Solar System since they form, in simple terms, the background plane of the sky we observe every night. Therefore, these events are a goldmine for studying many aspects of our Solar System—especially the size, shape,

THE OCCULTATION BY PHOLUS IN MAY 19TH





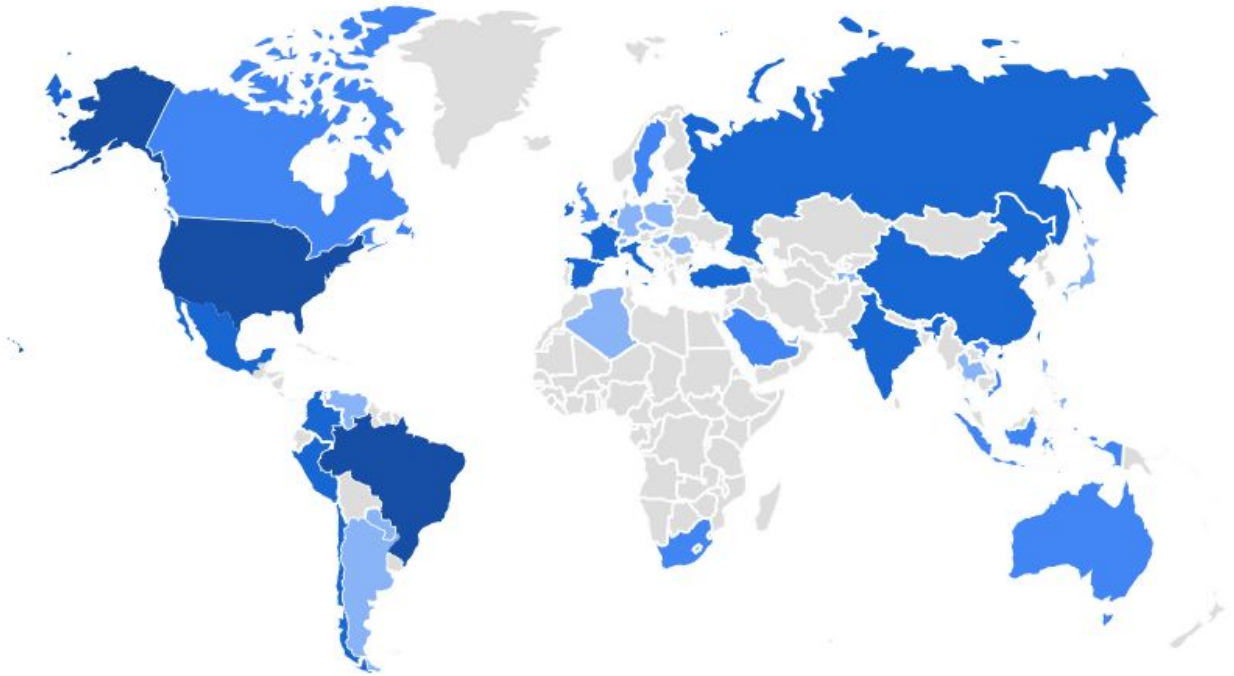


year-m-d	h:m:s UT	ra_dec_J2000_candidate	C/A	P/A	vel	Delta	G*	long
2024-05-19	07:14:29.000	18 38 36.5100 -13 28 05.439	0.042	181.76	-18.73	29.26	14.8	294

Results reported by Felipe Ribas and Giuliano Margoti include:

- Computed diameter: 68 ± 2 km
- Pholus ephemeris enhanced by an order of magnitude

LIneA Occultation Prediction Database Users



- 45 countries
- 1,000+ active users
- 40,000+ accesses

THE PORTAL TEAM

DEV

Glauber

Josiane

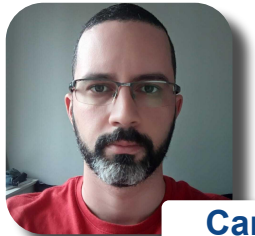
SCIENCE

Julio

Gustavo

Martin

INFRA/HPC



Carlos

Cristiano

Mariana

MGMT

Luiz

Julia

OUTREACH

SOLAR SYSTEM PORTAL HIGHLIGHTS

- Multiple filtering options: date and time interval, star brightness, object size, event duration, expected magnitude drop, object name or dynamical class, etc.
- Geographic filter for predictions;
- API access to all prediction data;
- Dynamic occultation prediction maps;
- Static prediction maps (by SORA) and KMZ files with the prediction paths;
- Detailed information on event, object and target star;
- All stars (Gaia DR3) up to mag 18 included;
- Uncertainties in Prediction Paths and Timing;
- Constantly updated up to one year in advance;
- Subscription Service;
- lineaSSP Python Library;

WHAT'S NEXT

Visit us at

https://solarsystem.linea.org.br

Working now:

- ❑ Predictions for the complete Solar System;

Working next:

- ❑ Customized predictions:
  - Reintegration of Orbit Refinement Services;
  - Reintegration of DES Legacy Data;
  - Full Integration with the MPC Mirrored Databa
  - Private User Data Integration;