

Abstract

This study engages citizen scientists in NASA's Planetary Defense program to monitor and track asteroids, including those with potential Earth impact risks. Through the Pan-African Citizen Science e-Lab (PACS e-Lab) partnership with the International Astronomical Search Collaboration (IASC), citizen scientists across Africa contribute by hosting monthly asteroid search campaigns. This research utilizes **Astrometrica**, a software developed by IASC, to analyze images from professional telescopes, detect asteroid motion, and submit reports to the IASC for verification. Validated observations contribute to the identification of preliminary and provisional discoveries, advancing planetary defense efforts.

Introduction

Asteroids are rocky, metallic, or icy remnants from the early solar system, primarily located in the main asteroid belt between Mars and Jupiter (2–4 AU from the Sun). They are classified into three main types:

C-type (Carbonaceous): The most common, rich in carbon compounds.

S-type (Siliceous): Composed of silicate minerals and nickel-iron.

M-type (Metallic): Contain high amounts of metal.

NASA's Planetary Defense program relies on global collaboration to track asteroids and refine their orbital characteristics. Data for this research is sourced from the Panoramic Survey Telescope & Rapid Response System (Pan-STARRS) at the University of Hawaii and the Catalina Sky Survey (CSS) at the University of Arizona.



Methodology

Data Acquisition:

- Downloaded image sets from the IASC website, provided by Pan-STARRS and CSS.

Asteroid Detection using Astrometrica:

- Processed datasets by comparing four sequential images to identify asteroid motion.

Data Submission:

- Prepared a Minor Planet Center (MPC) report after analyzing the data.
- Submitted reports to IASC for validation and classification.

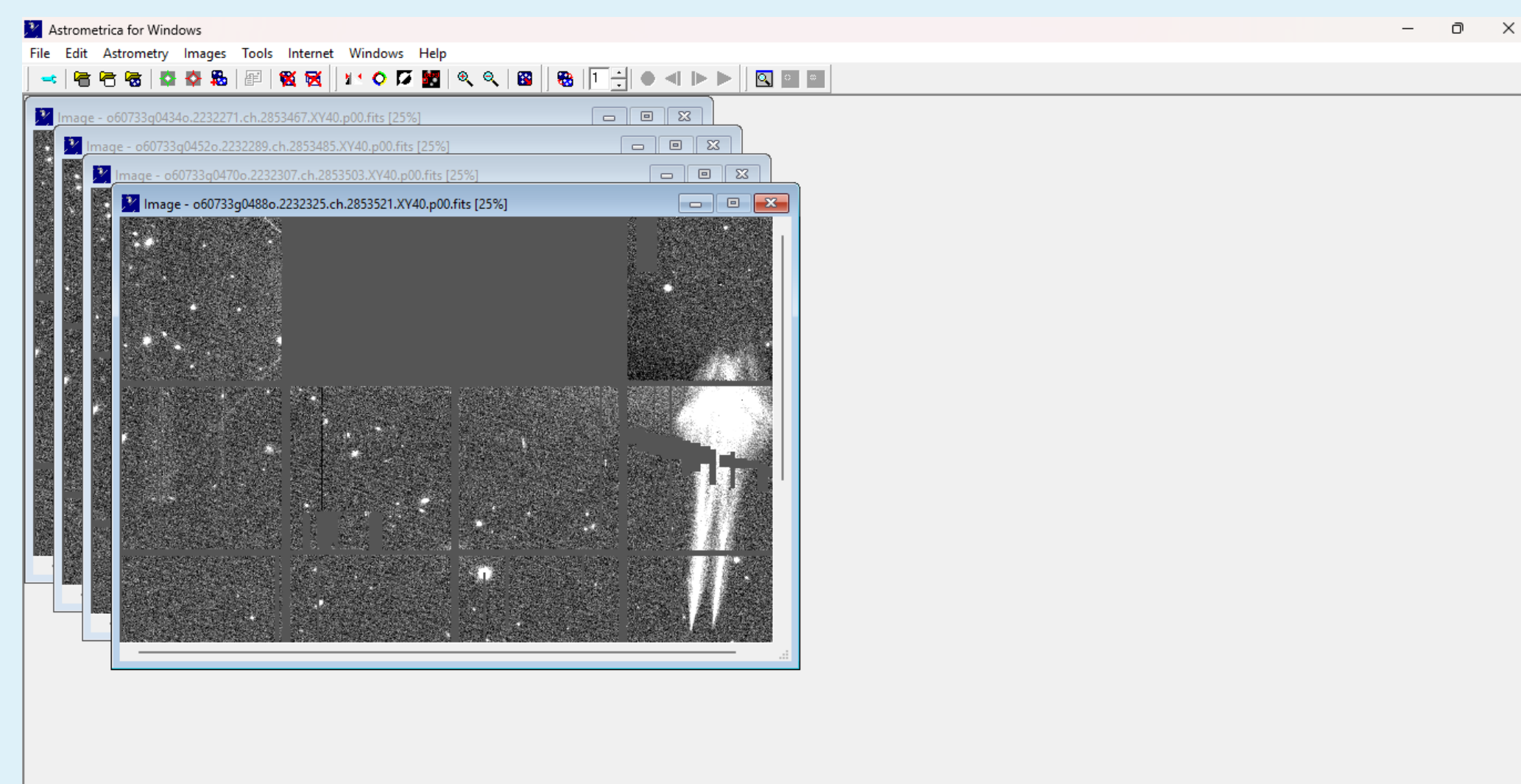


Image of data upload on Astrometrica

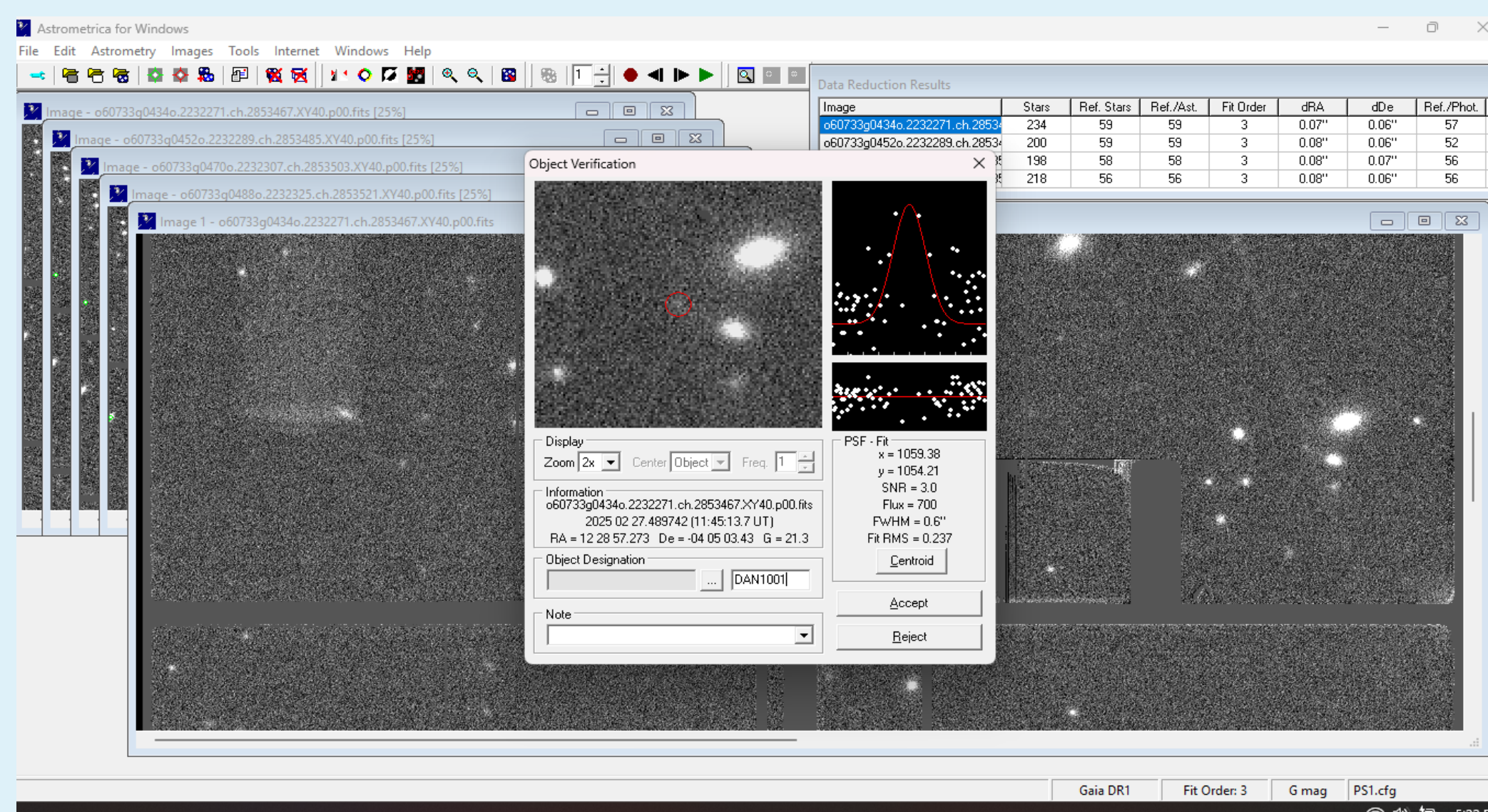


Image of data analysis on Astrometrica

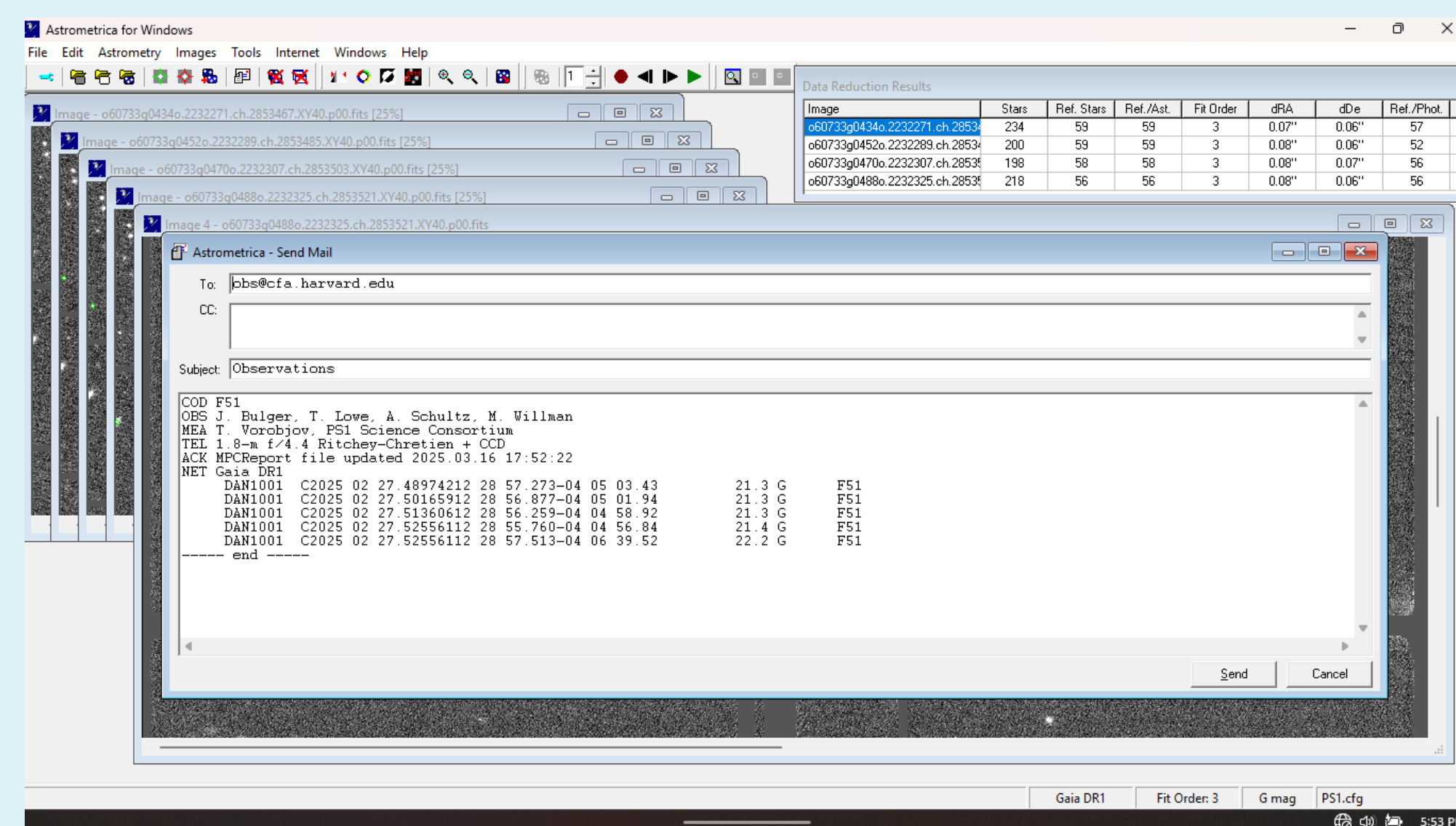


Image of the MPC report

Results/Conclusion

Observations are evaluated by IASC, typically within a week.

Valid detections are classified as preliminary discoveries.

Further analysis (spanning months to years) determines provisional discoveries.

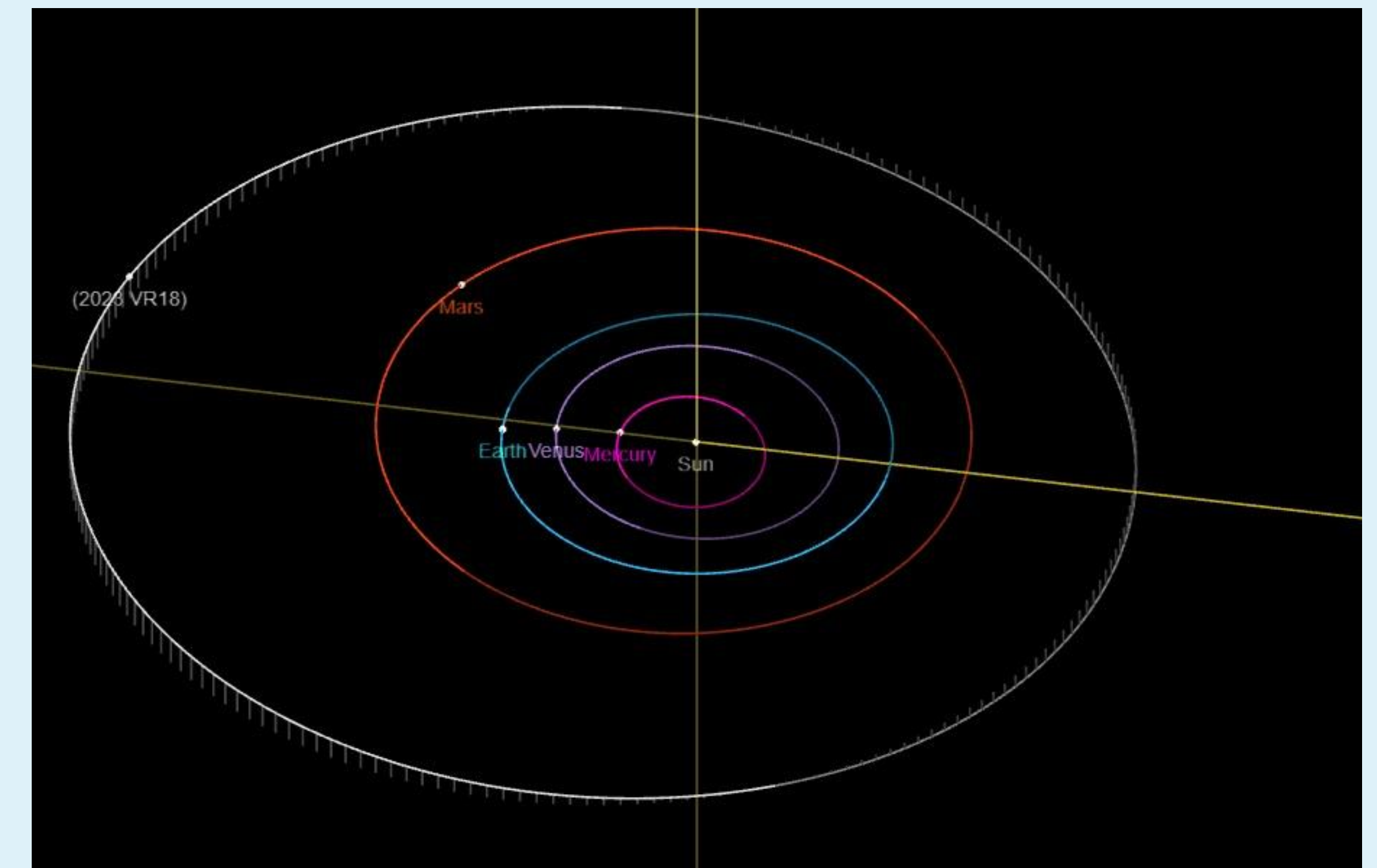
Confirmed asteroids receive provisional designations and are included in the Minor Planet Center (MPC) database, managed by the International Astronomical Union (IAU).

Provisional discoveries are also added to NASA's JPL Small-Body Database, where their orbital parameters and other characteristics are refined.

After continued observation and tracking, asteroid discoveries may eventually be named.

Notable Discovery:

During the November-December 2023 campaign, the asteroid 2023 VR18 was identified and classified as a provisional discovery.



The asteroid's aerial map of 2023 VR18

Reference

PACS e-Lab Asteroid Search: <https://pacsclab.space/>

IASC Campaigns: <http://iasc.cosmossearch.org/>

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