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IS THIS SATURN-MASS PLANET REALLY ALONE?

SEARCHING FOR A HOST STAR AROUND A FREE-FLOATING PLANET CANDIDATE

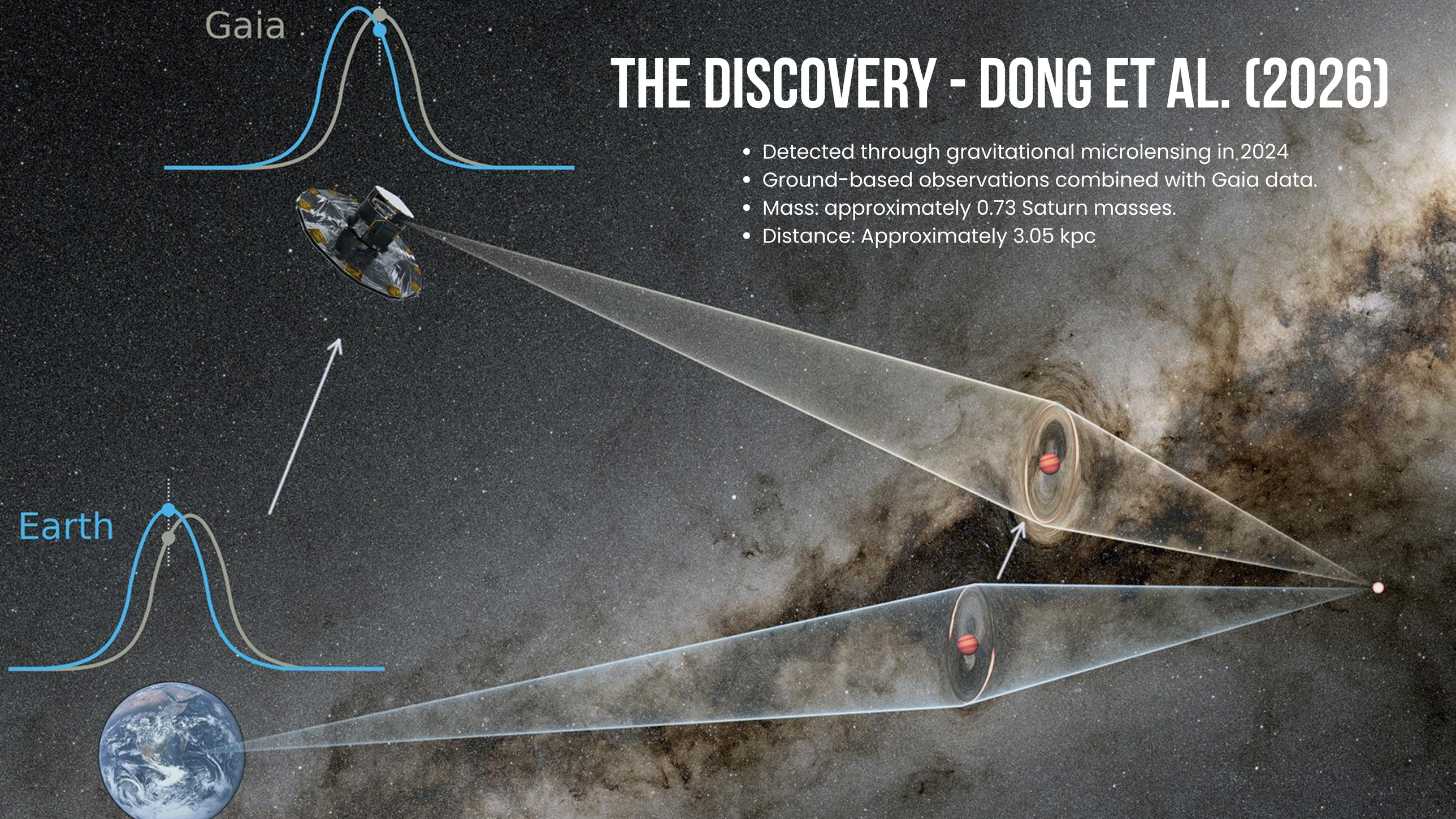


WHAT ARE FREE-FLOATING PLANETS?

- Planets that are not gravitationally bound to a star
- They may form independently or be ejected from planetary systems.
- They are difficult to detect because they are faint.

THE DISCOVERY - DONG ET AL. (2026)

- Detected through gravitational microlensing in 2024
- Ground-based observations combined with Gaia data.
- Mass: approximately 0.73 Saturn masses.
- Distance: Approximately 3.05 kpc



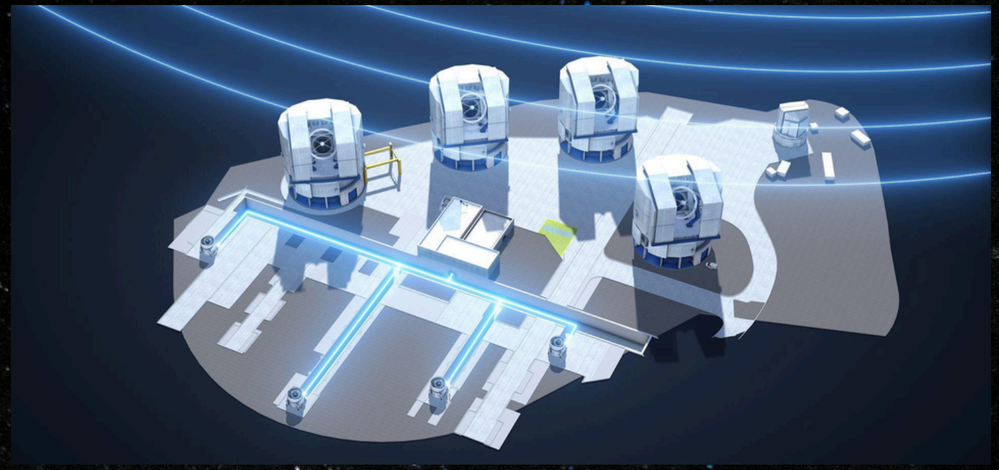
IS THE PLANET TRULY FREE FLOATING?

- Observations taken about two years after the microlensing event.
- Instrument: VLTI/GRAVITY.
- Goal: detect or rule out a possible luminous host star.



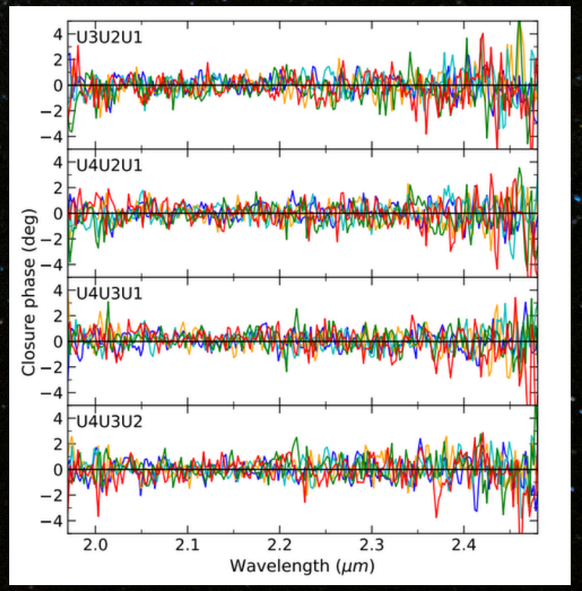


HOW DID THEY SEARCH FOR A HOST STAR?



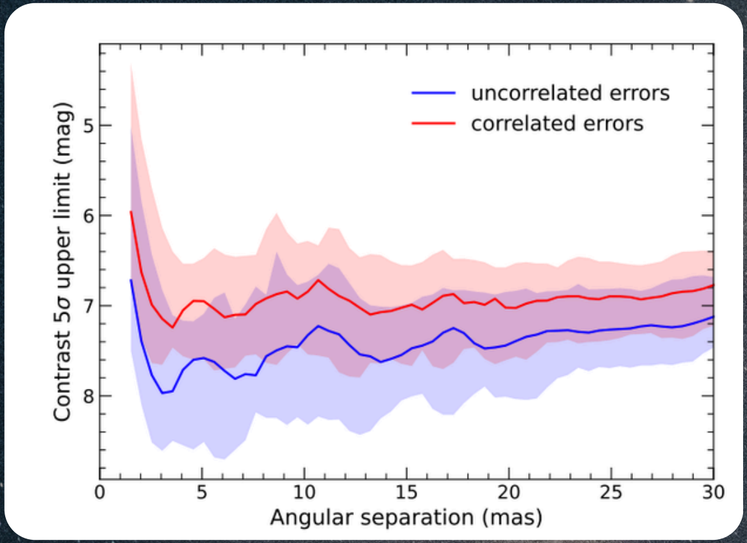
How Does Interferometry Help?

- GRAVITY combines light from multiple telescopes.
- This allows astronomers to study extremely small angular separations.
- They searched for evidence of a second luminous object near the background star.



Closure phases were used to search for a second luminous source.

RESULTS: DID THEY FIND A HOST STAR?



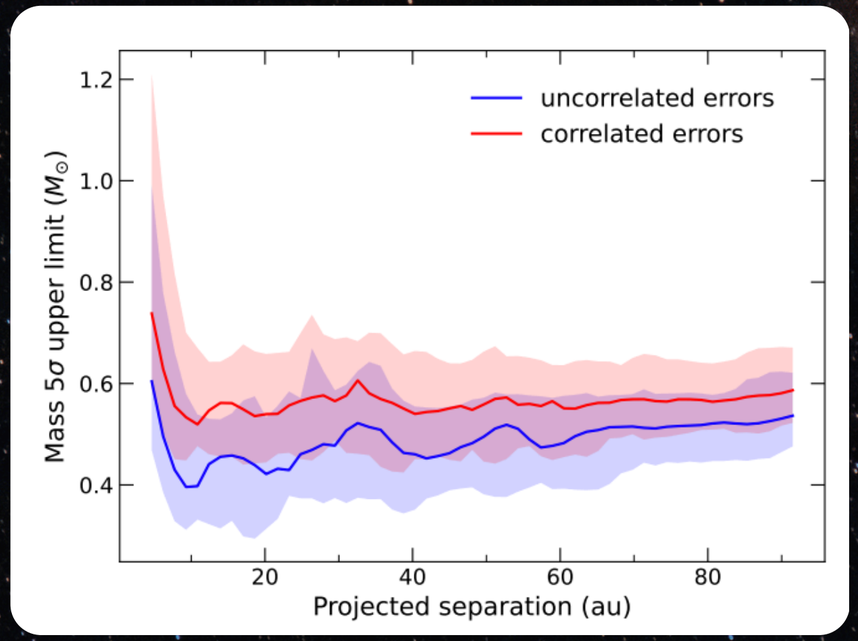
$$\Delta\chi^2 = \chi^2_{\text{single}} - \chi^2_{\text{two}}$$

- Uncorrelated errors: $\Delta\chi^2 = 51.9$
- Correlated errors: $\Delta\chi^2 = 24.9$
- Detection threshold: $\Delta\chi^2_{\text{threshold}} = 31.8$

- The researchers compared single-source and two-source models.
- An apparent signal became less significant after accounting for correlated noise.
- No statistically convincing host star was detected.

WHAT CAN THEY RULE OUT?

- No sufficiently bright host star was detected within the observational limits.
- A faint, low-mass or more distant host star could still exist.
- The results support the free-floating planet hypothesis.



- Approximately $0.5\,M_\odot$ at 10 au
- Approximately $0.6\,M_\odot$ at 90 au.

A faint or distant star could still exist

WHY DOES THIS MATTER?

- Helps us understand the possible origins of free-floating planets.
- Shows how interferometry can test for hidden host stars.
- Demonstrates the importance of accounting for correlated noise.

Main limitation

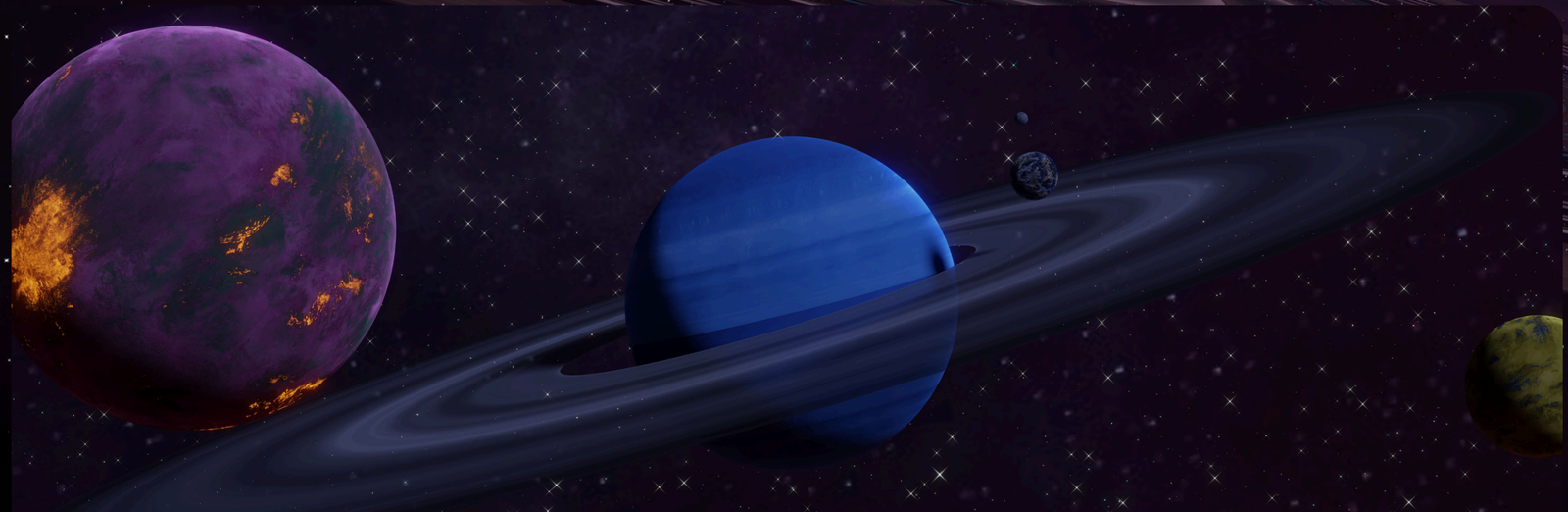
- A faint or distant host star cannot be completely ruled out.



CONCLUSIONS

- A Saturn-mass planet candidate was discovered through microlensing.
- GRAVITY observations found no convincing evidence of a luminous host star.
- The free-floating hypothesis is supported, but not definitively proven.

Is this planet really alone?
Possibly - but we still cannot be certain.



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THANK YOU

REFERENCES

- Dong, S., et al. (2026). Science, 391, 96.
- Mróz, P., et al. (2026). Limits on a Host Star around a Saturn-mass Free-floating Planet Candidate KMT-2024-BLG-0792/OGLE-2024-BLG-0516. arXiv:2609.12743.