AFTERGLOW

NASA SPACE APPS CHALLENGE

RESULTS AT A GLANCE, PLANET X AND SPHEREX

A blind pipeline recovered a real change in NASA SPHEREx data, and its motion measurements match Gaia.

2,310
stars measured in 345,952 SPHEREx measurements, April 2025 and September 2026

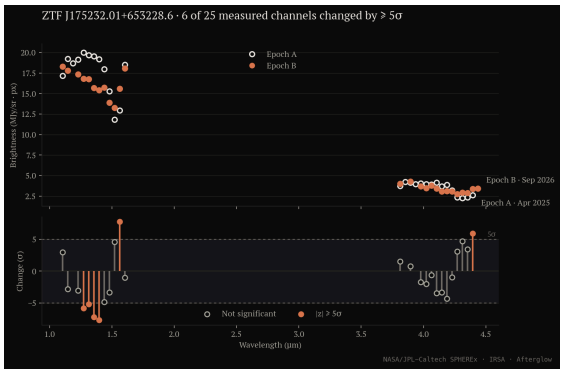
1
change survived calibration, neighbor rejection and a 5 sigma cut: a known eclipsing binary

10.24 vs 10.27
arcsec moved by Barnard's Star between passes, measured by us and predicted by Gaia DR3

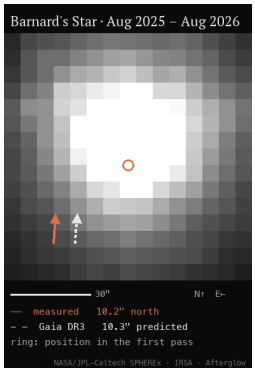
37 vs 43
of 47 blind cases: an AI vision model against a simple measurement. We kept the measurement

What we found

In a one degree field near the north ecliptic pole, 1,500 of 2,310 stars were clean enough to compare. Exactly one changed by 5 sigma or more in at least three channels: ZTF J175232.01+653228.6, an eclipsing binary already catalogued, found without knowing it was there. Across the five test objects of the challenge, Afterglow flags as moving exactly the two that Gaia says should move, and none of the other twelve sources.



Spectrum of the surviving candidate in both epochs, and the significance of the change in each measured channel.



Barnard's Star: measured displacement against the Gaia prediction, at the same scale.

What the public tool does

1. Plays every SPHEREx image of any position or named star as a time lapse aligned north up.
2. Stacks each pass and subtracts passes to show what moved or changed.
3. Measures the motion of every source and shows the Gaia prediction next to it.
4. Flags sources seen in only one pass and marks known asteroids from NASA JPL.
5. Measures the spectrum on the fly and lets anyone report what they find.

What it cannot see yet

1. Bright stars saturate the detector; their spectrum is lost.
2. Motion under 3 arcsec between passes, half a pixel, is not claimed.
3. Very faint movers such as the brown dwarf WISE 0855 are missed.
4. Planet Nine. In 5,040 fake planets hidden in real images, one pass reaches AB 17.8; Planet Nine is predicted at V 22 to 25.

See it yourself. The candidate: `https://afterglow.work/demo.html#/c/1`
Barnard's Star: `https://afterglow.work/demo.html?ra=269.44627&dec=4.7682&fov=3&t=barnard`
Go deeper. Technical report: `https://afterglow.work/assets/docs/Afterglow_Technical_Report.pdf`
Open data: `https://afterglow.work/assets/docs/afterglow_open_data.zip`

Team Afterglow, NASA Space Apps Challenge 2026. Data: SPHEREx Data Release 1 and Quick Release 3 (NASA/JPL Caltech, NASA/IPAC IRSA), AllWISE (NASA/IPAC), Gaia DR3 (ESA), SIMBAD and VizieR (CDS), NASA JPL Small Body Identification API. This publication makes use of data products from SPHEREx, a joint project of the Jet Propulsion Laboratory and the California Institute of Technology, funded by the National Aeronautics and Space Administration. Code written with the help of AI coding assistants; no data or results were generated by AI.