Astronomers use precision pulsar positions to break record

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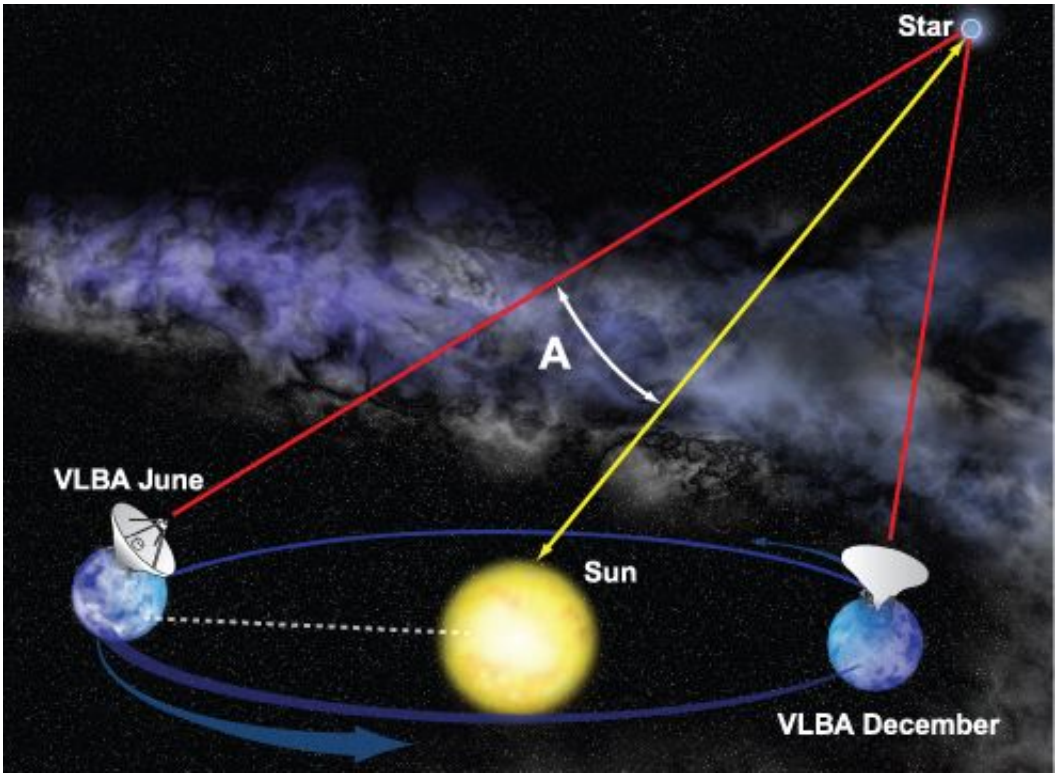

Illustrating trigonometric parallax: the VLBA can measure the slight apparent shift in the position of an object as seen from opposite sides of the Earth's orbit. The size of this position shift is dependent on the distance of the object from Earth. Credit: Bill Saxton, NRAO/AUI/NSF.

An international team of scientists led by astronomer Adam Deller (ASTRON) have used the Very Long Baseline Array (VLBA) to set a new distance accuracy record, pegging a pulsar called PSR J2222-0137

at 871.4 light-years from Earth. They did this by observing the object over a two-year period to detect its parallax, the slight shift in apparent position against background objects when viewed from opposite ends of Earth's orbit around the Sun.

With an uncertainty less than four light-years, this distance measurement is 30 percent more accurate than that of the previous-best pulsar distance. The VLBA observations were even able to discern the orbital motion of the pulsar around its as-yet undetected companion object, despite this motion being no larger than a small coin observed at a tenth of the distance to the Moon.

The results of the research have been published in The *Astrophysical Journal*.

By showing that PSR J2222-0137 is 15% closer than previous estimates, this impressive achievement can advance our understanding of the system. With the distance to the pulsar pinned down, proposed highly sensitive visible-light observations should determine the nature of the undetected companion. If no source can be found, the companion must be a neutron-star, while a white-dwarf companion will show up as a faint optical source.

The accuracy of the new measurement promises to help in the quest to detect the elusive gravitational waves predicted by General Relativity. By monitoring an array of pulsars across the Milky Way galaxy, scientists hope to measure the distortions of space-time caused by the passage of gravitational waves. Knowing the distances to these pulsars extremely precisely can improve the sensitivity of the technique to detect individual sources of gravitational waves. The VLBA is operated by the National Radio Astronomy Observatory (NRAO).

More information: dx.doi.org/10.1088/0004-637X/770/2/145

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