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ASTRONOMY

Einstein's relativity theory stands up to tests for now

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By Kenneth HICKS



If you want to hear a heated argument among physicists, just bring up the topic of gravity. The issue is that Newton's law of gravity is incomplete -- it has been superseded by Einstein's theory of general relativity.

But will general relativity be trumped by some other new and better theory?

Some new observations presented this month at the American Physical Society meeting are examining the validity of Einstein's theory.

In one experiment, a multi-university team shot a pulsed laser beam at the moon. The beam was reflected by a mirror placed on the moon by Apollo astronauts. By measuring the time it takes light to get to the moon and back, this group measured the moon's orbit to an unprecedented accuracy -- about four-hundredths of an inch.

With such accurate measurements, Einstein's theory was put to the test, and it passed with flying colors.

Another report on two neutron stars orbiting each other, called binary pulsars, gave spectacular confirmation of Einstein's theory, suggesting that general relativity won't soon be replaced. Michael Kramer of the University of Manchester reported that the orbital motion of these pulsars was measured precisely, giving four independent tests of general relativity.

On the other side of the argument, not all results were in agreement with the theory. One effect, known as the Pioneer anomaly, measured the distance to one of NASA's oldest satellites, Pioneer 11. The results differ slightly from those predicted by gravity alone. For some unknown reason, a small force, in excess of gravity, is attracting this probe to the sun.

Slava Turyshev of the Jet Propulsion Laboratory reported that about one-third of the excess force comes from thermal radiation from the spacecraft, but most of the anomaly is unaccounted for. Although Einstein's theory is being tested at unprecedented levels, we still have no real explanation for the Pioneer anomaly.

Sometimes in science, it's one step forward, two steps back.

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