The sun and Jupiter could reveal space-time ripples

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Jupiter could be used as one half of a gravitational-wave detector (Image: NASA)

Ripples in space-time could squeeze and stretch the sun and Jupiter, forming a gigantic gravitational-wave detector in our own celestial backyard.

Einstein's theory of general relativity predicts the existence of space-time ripples – gravitational waves – but none have yet been detected directly. One way to find them might be by watching stars for vibrations caused by a passing gravitational wave, but these oscillations would be small compared to the star's intrinsic fluctuations. Spotting similar signals in stars in the same cluster would help to distinguish waves from internal effects, but the nearest star clusters are too far away for existing instruments to check.

Closer to home, however, we have Jupiter and the sun, which are large enough and near enough to oscillate in concert. "Whatever happens to the sun due to gravitational waves, similar things must happen to Jupiter," says Ibrahim Semiz of Bogaziçi University in Istanbul, Turkey. Studying the oscillations of the two together could help to detect gravitational waves, he suggests.

Could we have already found them? Astronomers use a spectrometer called SYMPA to study Jupiter's heaving surface, and several space-based instruments watch the sun's oscillations. In 2011, SYMPA spotted Jovian oscillations that matched the sun's in frequency to within 10 microhertz. Semiz went "out on a limb" and speculated that the oscillations may have been due to gravitational waves.

SYMPAthetic scientists

Patrick Gaulme of New Mexico State University in Las Cruces, who is on the SYMPA team, points out that the error bars in their measurements are too high for such detections. "The signal we detected with SYMPA cannot be explained by gravitational waves," he says. Nonetheless, he thinks the idea has merit. The trick would be to observe Jupiter and the sun over many days, so that any signal can rise above the noise. Such a signal would have to come from a long-lived gravitational wave source, such as the slow inward spiral of two neutron stars or a neutron star and a black hole.
Ilídio Lopes at the University of Lisbon, Portugal, an expert on the effect of gravitational waves on stars, says we first must understand Jupiter's internal oscillations before using it as a detector. Once we do that, then "rather than build instruments on Earth, you can use the universe around to see gravitational waves", he says.