Undetectable Waves Detected

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Scientists have detected the undetectable.

Baby energy waves, once thought too small to detect, have been spotted by researchers.

The children of solitary waves, baby waves technically shouldn't exist. The energy in a solitary wave moves in one compact spurt, like the shockwave that powers Newton's Pendulum, a popular desktop ornament. By definition, the energy in these waves is supposed to travel intact and not be broken easily.

While baby energy waves have existed in theory since 2001, many scientists thought they'd never be spotted. Even the researcher who predicted their existence in the first place had his doubts.

Surajit Sen, of the University of Buffalo, predicted that when a solitary wave hits a hard wall, it might break off a smaller, secondary wave of lesser energy. However, his computer simulations indicated that these baby waves would be too small to see.

"I didn't think they could be seen because they're very small," Sen said. When he first theorized the existence of baby waves in 2001, he predicted they would contain far less than 0.1 percent of the parent wave's original energy.

"Still, I hoped against hope that one might see them some day," Sen told LiveScience.

Now, thanks to what Sen calls a "very ingenious experiment" by Francisco Melo of the University of Santiago in Chile, Sen's wish has been answered. Baby waves, the offspring of solitary energy waves, have been detected.

Melo handles the experimental end of Sen's theories. He figured out that by making the the impact wall softer, the secondary waves would be bigger. He was right. The softer wall broke the initial solitary wave into larger baby waves - as large as 15 to 20 percent of the original energy.

The initial wave can be generated very easily. Melo and his assistant, Stephane Job, set up what was basically a super-sized version of Newton's Pendulum, only without the strings. They lined up 20 steel balls against a wall of soft material. At the end of the line furthest from the wall, they rolled one ball into the first in line, which created a shockwave that ran through the entire set and bounced back off the wall.

One of the balls - as well as the wall - had a sensor built into it. The sensor recorded the energy of the initial wave. But on the return trip, two waves passed the sensor. One was the initial wave bouncing off the wall - now with slightly less energy - and the other was the baby wave, which had "broken" off the initial wave when it impacted the wall.

"The detection is a step towards something fancy," Sen said. "When you put a shockwave through a system, you don't necessarily think that the system will reach an equilibrium-like state."

In a closed system, with a wall at each end of the line of balls, baby waves would form continuously. Even baby waves would make their own babies, although they would be very small. Eventually, the system would reach an equilibrium-like state with the energy from the initial wave spread nearly evenly throughout the system.

"This is due to the baby waves. Because you have waves of all different sizes in the system, you'll have a system near equilibrium" Sen said. "As far as I know, this is the first time that anyone has conjectured the existence of this state."

These findings were published recently in the online version of the journal Physical Review Letters.

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