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LONG-STANDING PHYSICS PROBLEM SOLVED

Ultrasound imaging and other techniques that use sound to locate and analyze objects hidden beneath surfaces could be enhanced thanks to a recent discovery by a team of researchers from the Hong Kong University of Science and Technology, the University of Pennsylvania and the University of Manitoba.

For years, scientists have tried to understand what happens to waves that attempt to pass through a cloudy medium "blocking" their passage. Questioning how much of a wave can survive the passage without being scrambled, the multi-national research team examined sound waves that passed through a wall of glass beads immersed in water and found a very small surviving signal.

But when they looked at the wave's characteristics, they were surprised by what they found."Sound waves travel very fast through glass and more slowly through water, so we were expecting the surviving wave to have a velocity somewhere in between these two values," says Prof. Ping Sheng of the Physics department at HKUST. "What we actually found was that at certain frequency ranges the velocity of the surviving wave was far lower than what we expected it to be."

Applying a mathematical technique novel to this type of problem, Prof. Sheng accurately predicted the changes observed in the velocity of the wave. "What is interesting about our new understanding of the problem is that what we see taking place in the waves passing through the medium is actually part of the medium itself. It is no longer possible to separate what is properly 'the waves' from what is 'the medium'. The two are in fact one."

"With this model, scientists will be better able to analyze the changes that occur as a wave passes through a complex medium and then work backwards to obtain information about the medium that was difficult to obtain before," says Prof. Sheng.

This innovation could lead to significant improvements in imaging techniques that rely waves, such as ultrasound. The results also have potential for wide-ranging applications using other types of waves, including light.

The research report was published in the 2 February 1996 issue of Science, the journal of the American Association for the Advancement of Science.

Note to Editors:
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