New tech improves ability to reflect sound back to its source

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Downtown Raleigh skyline rises up behind the Memorial Belltower. Credit: North Carolina State University

Researchers have developed a device that reflects sound in the direction it came from, rather than deflecting it at an angle. The "retroreflector" can reflect sound across an operating range of 70 degrees in either direction—more than doubling the effective range of previous technologies.

"The technology makes use of two engineered materials," says Yun Jing, an associate professor of mechanical and aerospace engineering at North Carolina State University and co-corresponding author of a paper on the work.

"The first layer focuses the incoming sound waves onto a second layer, which then sends the sound waves back to their source. We were inspired by a similar approach used in optics research, but we think we are the first to use this technique in the acoustics field."

Previous techniques for creating retroreflective surfaces relied on rectangular pits arrayed across a material. Sound waves would ricochet from the side of the rectangle to the bottom, before bouncing back in the direction they came from.

"However, designs using that approach can be bulky, and have a fairly narrow range of angles that they can reflect properly," Jing says. "Our technology is both slimmer and effective across a wider range of angles."

Experiments using a prototype of the new technology find that it is also fairly efficient. At 0 degrees—when the sound source is perpendicular to the surface—60 percent of the sound is sent back to the source. At 70 degrees—the extreme end of the effective range—40 percent of the sound is directed back to the source.

"We have a fully functional prototype now, and our next steps include fine-tuning the technology for use in specific applications, such as medical ultrasound," Jing says. "Frankly, we think there are likely applications that we haven't thought of yet."

The paper, "Acoustic planar surface retroreflector," was published June 25 in the journal *Physical Review Materials*.

More information: Gang Yong Song et al, Acoustic planar surface retroreflector, *Physical Review Materials* (2018). DOI: 10.1103/PhysRevMaterials.2.065201

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