PORTLAND, Ore. — Researchers say they have harnessed metamaterials to fabricate the first acoustic hyperlens, potentially offering an eight-fold increase ultrasound and sonar image resolution.

Metamaterials have previously been proposed for sonar invisibility cloaks that hide submarines by bending acoustic waves around them. Researchers at the Energy Department's Lawrence Berkeley National Laboratory say they have demonstrated that metamaterials also can be used for acoustic hyperlenses focused with sub-wavelength accuracy.

"Our acoustic hyperlens achieves deep sub-wavelength resolution with low-loss over a broad frequency bandwidth," claimed Xiang Zhang, principal investigator at Berkeley Lab's Materials Sciences Division.

Berkeley Lab's hyperlens uses metamaterials to focus on objects 6.7 times smaller than the wavelength of the sound wave used. The researchers said the acoustic hyperlens can be further improved to boost the magnification of sound-based imaging technologies such as ultrasound and sonar.

The acoustic lens prototype was constructed from 36 brass fins arranged in the shape of a fan. The fins measure 20 centimeters in length and 3 millimeters in thickness. They funneled acoustic waves from an outer radius of 21.8 centimeters down to an inner radius of 2.7 centimeters, thereby transforming what are ordinarily evanescent waves that cannot be imaged into propagating waves that produce images eight times as sharp.

Zhang's group previously demonstrated a hyperlens made from nanowires of silver and aluminum oxide that could focus visible light below its diffraction limit. The group is currently working on a 3-D ultrasound imaging system that will use pulse-echo technology used to "ping" submarines in sonar applications as well as for medical imaging.