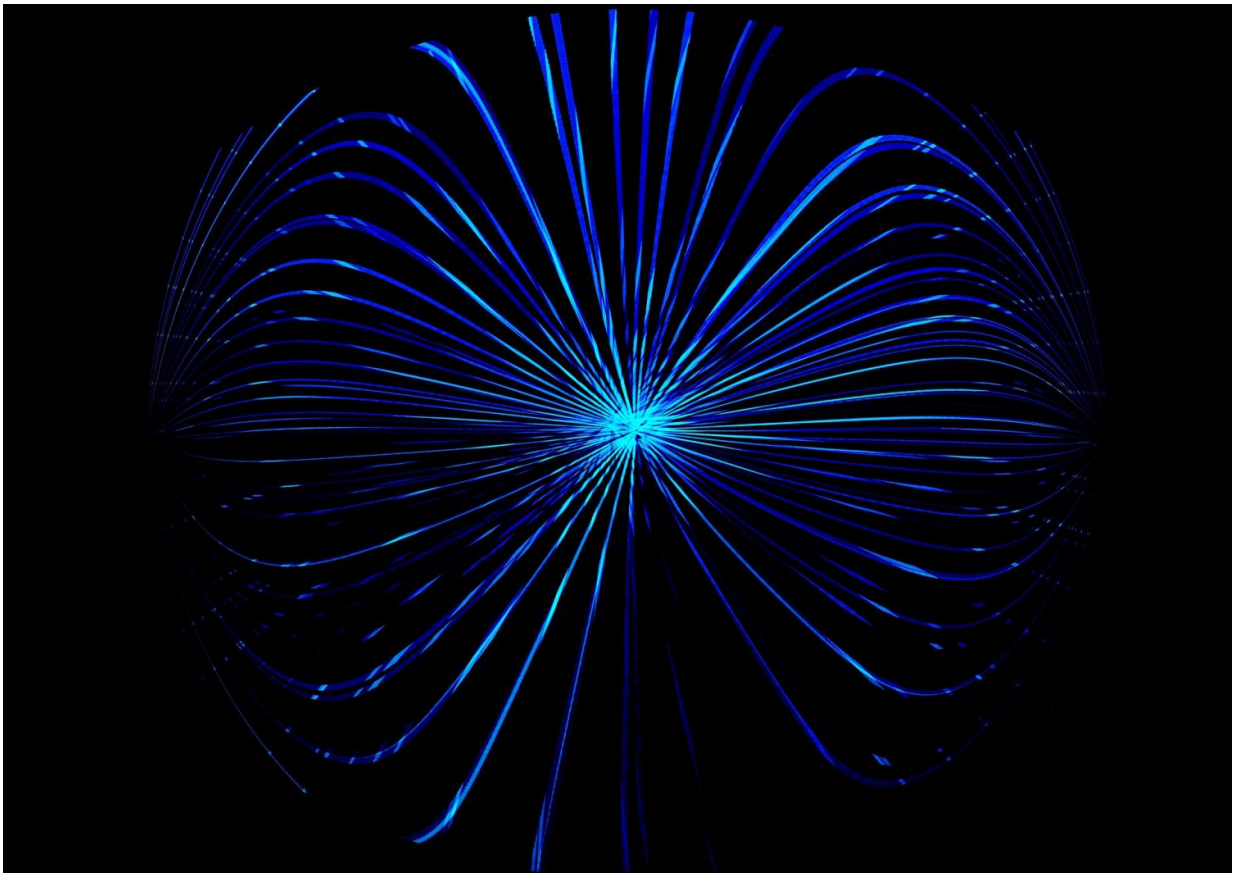
New membrane-based antenna much smaller than conventional ones

August 23 2017, by Bob Yirka



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A group led by researchers at Northeastern University in the U.S. has developed a new kind of antenna that is much smaller than conventional

antennas. In their paper published in the journal *Nature Communications*, the team describes the new membrane-based antenna and offer some ideas on how they think it might be used.

For many years, scientists have been working to make antennas smaller—doing so would allow engineers to design much smaller devices using them—but until now, such research has been stymied by the problem that conventional antennas need to be at least a tenth the length of the electromagnetic waves they receive—for a cell phone, that translates to approximately a few centimeters, because the radio waves they receive are in the range 11 to 15 centimeters. In this new effort, the researchers have taken a completely different approach to get around this problem.

The new antenna they developed is membrane-based—it has two membranes, each made of a different material. The first is piezomagnetic and is made of iron, gallium and boron layers—it converts mechanical oscillations to magnetic signals. The other membrane is made of aluminum nitride layers and is also piezoelectric—it converts mechanical oscillations to electric signals. When electromagnetic signals strike the first membrane, it induces oscillations, which results in the creation of a magnetic signal. The second membrane receives those signals and produces corresponding electric signals that are routed to a device that manipulates them for a given purpose, such as generating GPS coordinates. The antenna can also, of course, operate in reverse to transmit signals. Because they are not limited by the size of an electromagnetic wave, they can be made much smaller than conventional antennas—in some cases 100 times smaller.

The team has already tested their antenna by installing versions of it on WiFi, GPS and FM radio devices and report that they work as expected. They note that the antenna could also be used for phone

communications. They suggest that after they improve the antenna to make it more rugged, it could prove useful in a wide variety of applications, from wearable devices to implanted medical sensors.

More information: Tianxiang Nan et al. Acoustically actuated ultra-compact NEMS magnetoelectric antennas, *Nature Communications* (2017). DOI: 10.1038/s41467-017-00343-8

Press release.