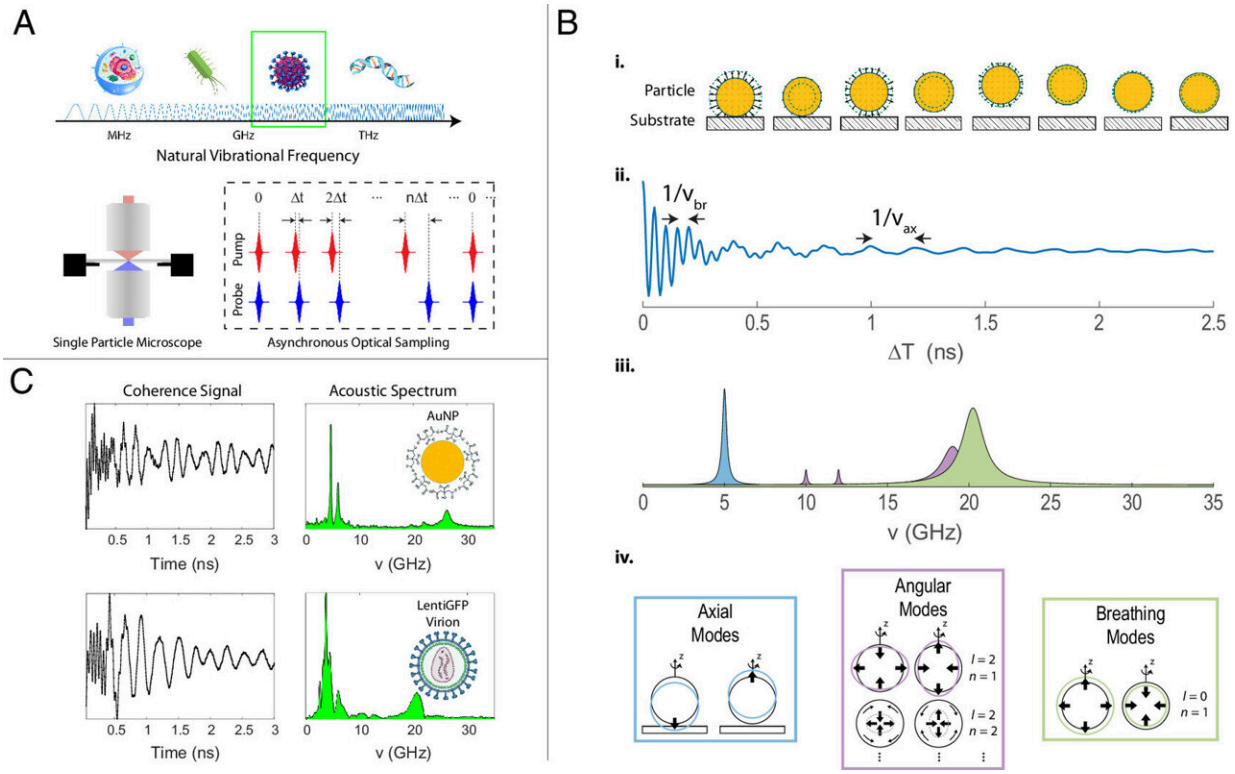
BioSonics spectroscopy can 'listen' to the sounds made by individual viruses

January 31 2025, by Bob Yirka



Principle of BioSonic spectroscopy. Credit: *Proceedings of the National Academy of Sciences* (2025). DOI: 10.1073/pnas.2420428122

A team of chemists and microbiologists at Michigan State University has found that an all-optical method can be used to detect natural vibrational frequencies made by individual viruses as a way to identify them. In

their study published in *Proceedings of the National Academy of Sciences*, the group found a way to bounce light off viruses and detect the resulting patterns of vibrations, which could be easily identified.

Light can be used to identify nanoparticle-scale objects. Prior research has shown that firing beams of light at such objects can cause them to vibrate slightly. The vibration patterns that emerge are unique for different targets. Thus, the technique can be used to identify nanoscale objects even among other similarly scaled objects.

The researchers wondered if the same technique could be used with biological agents like viruses and bacteria, so they conducted experiments that involved firing extremely tiny amounts of light at both kinds of microorganisms at such a small scale that they were able to watch the impact of single photons.

Eventually, they shifted their focus to viruses only and found that with the appropriate parameter settings, they could detect the vibrations emitted by the virus using a technique that they call BioSonics spectroscopy. The sound was not just too faint to hear with the human ear, but too high, at a frequency 1 million times higher than humans can hear.

After testing multiple viruses, the research team found that each of them vibrated in their own unique ways, distinct from one another and from all the other molecules they tested. That meant that BioSonics could be used as a sensor of sorts, enabling devices that could, for example, scan a room, detect viruses in the air and identify them.

They also note that the technology could reveal individual virus activity, opening the door to better understanding them. It could be used, for example, to watch as individual viruses assemble themselves, a phenomenon that is still not well understood.

More information: Yaqing Zhang et al, Nanoscopic acoustic vibrational dynamics of a single virus captured by ultrafast spectroscopy, *Proceedings of the National Academy of Sciences* (2025). DOI: 10.1073/pnas.2420428122