Physicists demonstrate how sound can be transmitted through vacuum

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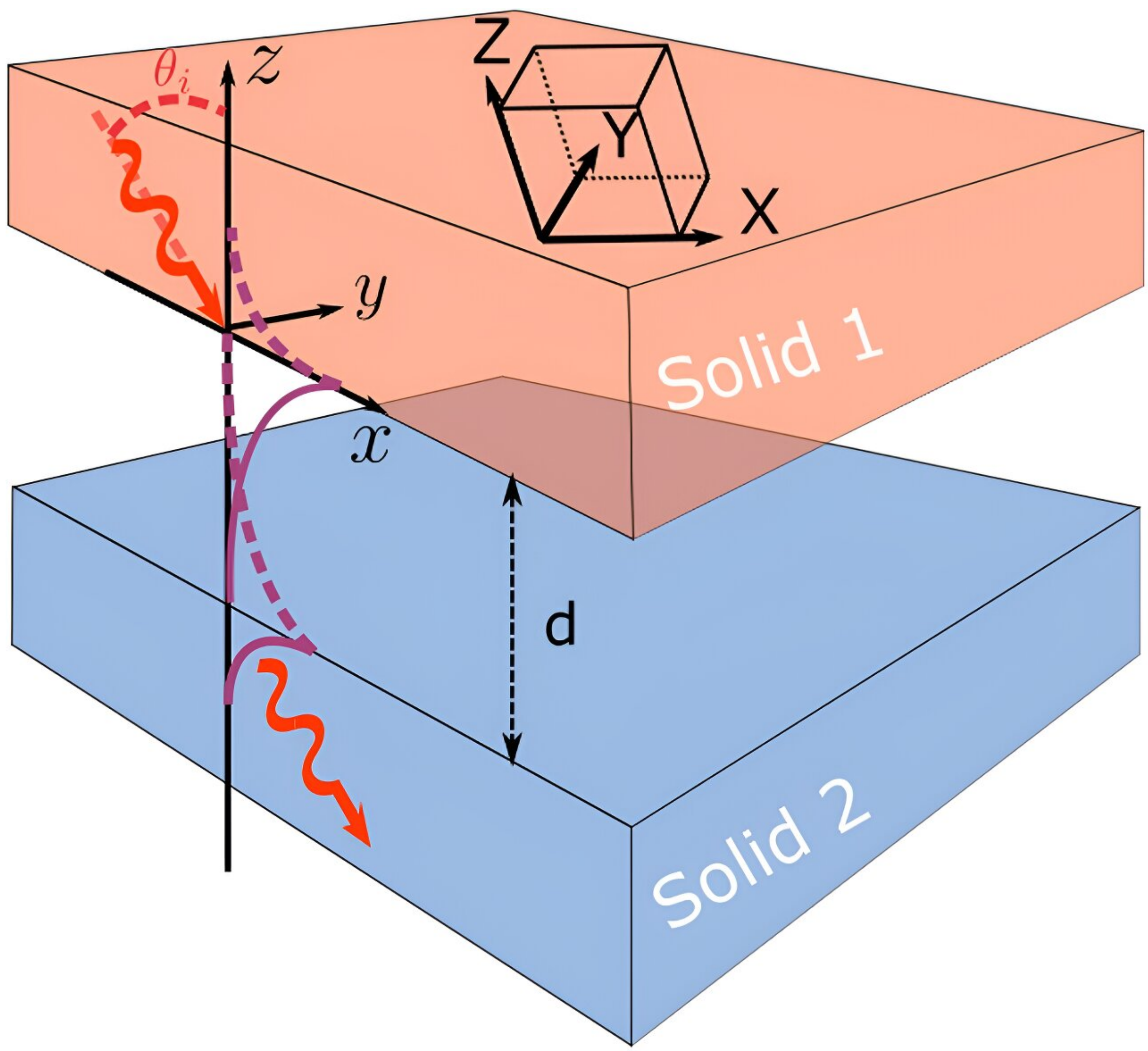

Two piezoelectric solids 1, 2 are separated by a vacuum gap of width d. An incoming acoustic wave from solid 1 (positive z-axis of a laboratory coordinates xyz) with an incident angle θ_i tunnels across the vacuum gap into solid 2 inside the xz-plane. XYZ describe the intrinsic crystal coordinates, which can be rotated w.r.t. the xyz coordinates. Credit: *Communications Physics* (2023). DOI: 10.1038/s42005-023-01293-y

The classic film "Alien" was once promoted with the tagline "In space, no one can hear you scream." Physicists Zhuoran Geng and Ilari Maasilta from the Nanoscience Center at the University of Jyväskylä, Finland, have demonstrated that, on the contrary, in certain situations, sound can be transmitted strongly across a vacuum region.

In a recent article published in *Communications Physics* they show that in some cases, a sound wave can jump or "tunnel" fully across a vacuum gap between two solids if the materials in question are piezoelectric. In such materials, vibrations (sound waves) produce an electrical response as well, and since an electric field can exist in vacuum, it can transmit the sound waves.

The requirement is that the size of the gap is smaller than the wavelength of the sound wave. This effect works not only in audio range of frequencies (Hz–kHz), but also in ultrasound (MHz) and hypersound (GHz) frequencies, as long as the vacuum gap is made smaller as the frequencies increase.

"In most cases the effect is small, but we also found situations where the full energy of the wave jumps across the vacuum with 100% efficiency, without any reflections. As such, the phenomenon could find applications in microelectromechanical components (MEMS, smartphone technology) and in the control of heat," says professor Ilari Maasilta from the Nanoscience Center at the University of Jyväskylä.

More information: Zhuoran Geng et al, Complete tunneling of acoustic waves between piezoelectric crystals, *Communications Physics* (2023). [DOI: 10.1038/s42005-023-01293-y](https://dx.doi.org/10.1038/s42005-023-01293-y)

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