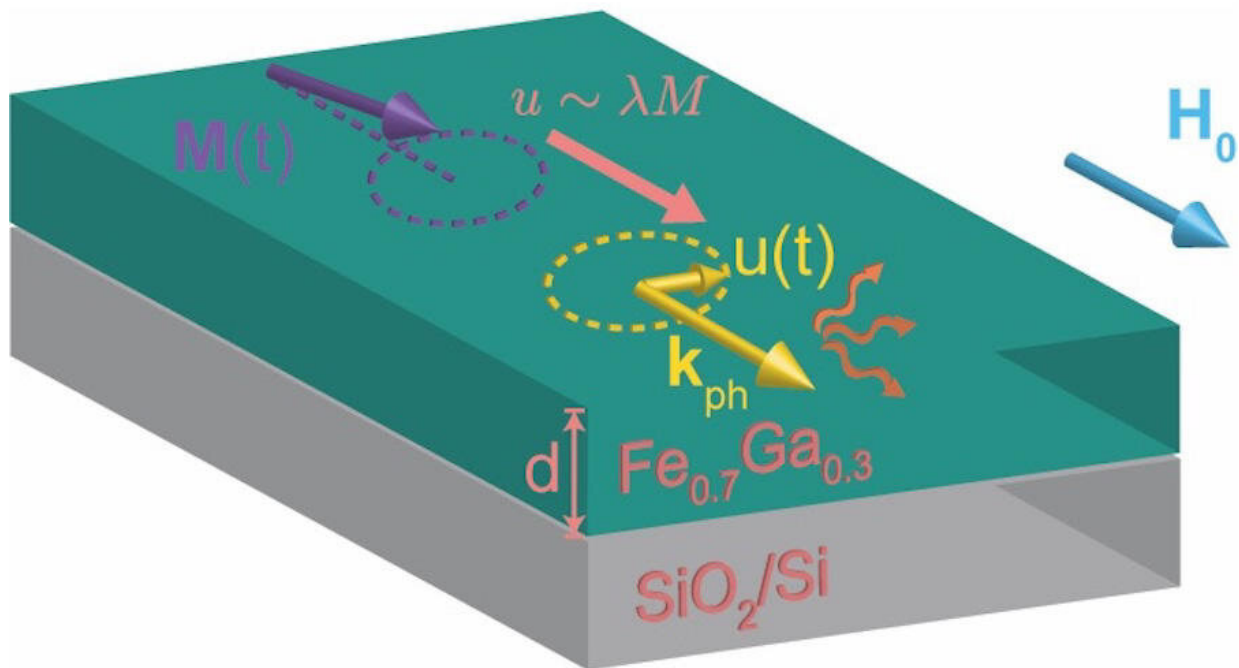


Researchers discover key cause of energy loss in spintronic materials

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Credit: Bill Peria, University of Minnesota

A study led by University of Minnesota Twin Cities researchers uncovered a property of magnetic materials that will allow engineers to develop more efficient spintronic devices in the future. Spintronics

focuses on using the magnetic "spin" property of electrons instead of their charge, which improves the speed and efficiency of devices used for computing and data storage.

The research is published in *Physical Review B*, a peer-reviewed [scientific journal](#) published by the American Physical Society.

One of the major roadblocks in developing better spintronic devices is an effect called "damping," in which the [magnetic energy](#) essentially leaks out of the materials, causing them to be less efficient.

Traditionally, scientists have blamed this property on the interaction between the spin of the electron and its motion. However, the University of Minnesota-led team has proven that there is another factor—magnetoelastic coupling, which is the interaction between electron spin, or magnetism, and sound particles.

"Our work doesn't say that [the original theory] is wrong, it just says that that's only part of the story," explained Bill Peria, lead author of the study and a Ph.D. student in the University of Minnesota's School of Physics and Astronomy. "We were able to show that in these [magnetic materials](#), we do see that behavior, but it's actually only a relatively minor fraction of the entire damping. There's also this other mechanism by which the magnetism can be damped that is not usually considered."

The researchers used a technique called ferromagnetic resonance, which measures how much magnetic energy is released or leaked. In order to understand the phenomenon, they had to perform this technique at multiple temperatures, ranging from [room temperature](#) to 5 Kelvin, just five degrees above absolute zero and the equivalent of about -450 degrees Fahrenheit.

The study's findings provide a more holistic picture of what causes damping. This will allow engineers to develop magnetic materials with

'ultralow' damping that are more energy efficient, ultimately leading to higher quality computers of the future.

"We care about low damping because we, along with our collaborators, are trying to make devices in which magnetic excitations can propagate over long distances," said Paul Crowell, senior author of the paper and a professor in the University's School of Physics and Astronomy. "We are trying to build the 'wires' in which magnetic signals can propagate across a chip without losing their strength."

More information: W. K. Peria et al, Magnetoelastic Gilbert damping in magnetostrictive Fe_{0.7}Ga_{0.3} thin films, *Physical Review B* (2021).

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