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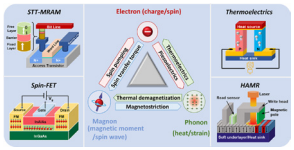
Spin-heat coupling, the interaction between the spin and heat of energy carriers, can be used to tweak materials' properties in data storage, spintronics, metrology development



The interactions of energy carriers, such as magnons, phonons, and electrons, affect the properties of materials. Physicists can take advantage of these interactions for various engineering applications.

The interaction between heat and spin carried by phonons and magnons has recently garnered interest due to its potential uses in energy, data storage, and spintronics. In their perspective paper, Zhang et al. focused on how this interaction, known as spin-heat coupling, affects the properties of magnetic materials.

"Spin-heat coupling is a common phenomenon in a lot of magnetic materials," said author Yingying Zhang. "But how magnons interact with phonons differs a lot for different kinds of magnetic materials."

Previous research has examined how interactions between magnons and phonons change materials' properties. Reviewing this work, the authors discussed magnon contribution to thermal properties, temperature-dependent magnetic properties, thermal generation of spin currents, and other processes related to spin-heat coupling.

"The existence of magnetic ordering changes the thermal properties of materials," said author Dingbin Huang. "In return, the magnetic properties of materials are affected by temperature."

The authors explored potential applications of spin-heat coupling, including the advancement of metrology (the study of measurement), heat-assisted magnetic recording technology, and spintronic devices.

"We hope this review can get people to think how to take advantage of spin-heat coupling to

advance the broad range of engineering applications and metrology development," said author Xiaojia Wang.

The authors also want this perspective to encourage more research studying coupling mechanisms and how they affect material properties, which could ultimately help produce the next generation of devices in spintronics, data storage, spin caloritronics, and quantum computing.

Source: "The spin-heat coupling and enabling applications," by Yingying Zhang, Dingbin Huang, Chi Zhang, and Xiaojia Wang, *Journal of Applied Physics* (2022). The article can be accessed at https://aip.scitation.org/doi/full/10.1063/5.0073512.

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