Colossal anomalous Nernst effect in a correlated noncentrosymmetric kagome ferromagnet

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Abstract :

The transverse voltage generated by a temperature gradient in a perpendicularly applied magnetic field, termed the Nernst effect, has promise for thermoelectric applications and for probing electronic structure. In magnetic materials, an anomalous Nernst effect (ANE) is possible in a zero magnetic field.

We report a colossal ANE in the ferromagnetic metal $UCo_{0.8}Ru_{0.2}Al$, reaching 23 microvolts per kelvin. Uranium's 5f electrons provide strong electronic correlations that lead to narrow bands, a known route to producing a large thermoelectric response. In addition, uranium's strong spin-orbit coupling produces an intrinsic transverse response in this material due to the Berry curvature associated with the relativistic electronic structure. Theoretical calculations show that in $UCo_{0.8}Ru_{0.2}Al$ at least 148 Weyl nodes, and two nodal lines, exist within 60 millielectron volt of the Fermi level. This work demonstrates that magnetic actinide materials can host strong Nernst and Hall responses due to their combined correlated and topological nature.

Reference:

https://advances.sciencemag.org/content/7/13/eabf1467