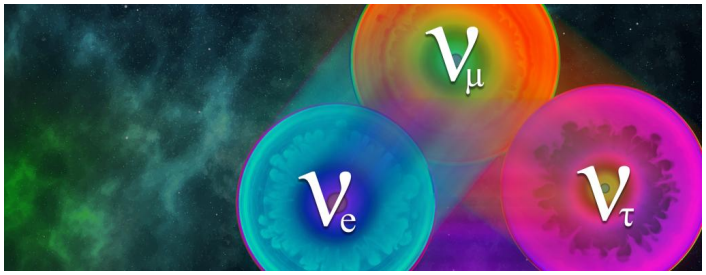

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Extended Thermodynamics and Phase Structure of Charged Rotating Black Holes with Chern-Simons Coupling

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Higher-dimensional gravity is not just an extension of Einstein's theory, and the physics of higher-dimensional black holes is not only richer, but also different from that in 4-dimensions.
In this work, we investigate the extended thermodynamics of charged, rotating black holes with equal angular momenta in five-dimensional anti-de Sitter spacetime within the framework of Chern-Simons gravity. We establish a consistent thermodynamic description by rigorously demonstrating the verification of both the first law and the Smarr's relation. Our results affirm the robustness of the formalism in this setting and reveal unique features, such as a non-trivial dependence of the total energy and angular momenta on the electric charge. This dependence provides a concrete illustration of how higher-dimensional black hole physics can differ qualitatively from its four-dimensional counterpart.

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