Review of: "Einstein-AdS gravity coupled to nonlinear electrodynamics, magnetic black holes, thermodynamics in an extended phase space and Joule—Thomson expansion"

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Potential competing interests: No potential competing interests to declare.

The manuscript titled "Einstein-AdS gravity coupled to nonlinear electrodynamics, magnetic black holes, thermodynamics in an extended phase space, and Joule—Thomson expansion" presents a comprehensive study of black hole solutions in the context of Einstein's gravity coupled to nonlinear electrodynamics in Anti-de Sitter (AdS) spacetime. The authors explore various aspects, including metric and mass functions, corrections to known solutions, thermodynamics, phase transitions, and the Joule—Thomson expansion.

The manuscript's strength lies in its systematic approach to investigating the properties of magnetically charged black holes. By obtaining new black hole solutions and studying their thermodynamic behavior, the authors contribute to the understanding of the interplay between gravity, electromagnetism, and thermodynamics in the AdS spacetime.

The presentation of results is clear and organized, making it easy to follow the authors' reasoning. The manuscript provides detailed explanations of the obtained solutions, their physical implications, and the corresponding thermodynamic quantities. This clarity enhances the accessibility of the research to readers interested in the subject matter.

However, there are a few areas that could benefit from further clarification and expansion. Firstly, the manuscript should provide a more detailed explanation of the motivation behind studying Einstein's gravity coupled to nonlinear electrodynamics in the context of AdS spacetime. What are the theoretical or phenomenological motivations for this choice? Additionally, it would be helpful to include a discussion on the physical interpretation of the obtained solutions and their relevance to current theoretical frameworks or experimental observations.

Furthermore, while the manuscript mentions that the black hole thermodynamics exhibits similarities to Van der Waals liquid-gas thermodynamics, it would be valuable to discuss these similarities in greater depth. Specifically, the manuscript could provide a comparative analysis of the equations of state, critical phenomena, and phase transitions between black hole thermodynamics and Van der Waals systems. This analysis would help readers understand the physical significance and implications of these similarities.

Additionally, it is crucial to provide a thorough discussion of the limitations and uncertainties associated with the results presented. What are the assumptions made during the calculations, and what are the potential sources of error or ambiguity? A clear understanding of these limitations would allow readers to assess the robustness and reliability of the findings.

Lastly, the manuscript's conclusion could be expanded to summarize the key findings and their broader implications. It would be valuable to discuss how the obtained results contribute to the existing body of knowledge in the field of black hole physics and how they may inspire future research directions.

In conclusion, the manuscript titled "Einstein-AdS gravity coupled to nonlinear electrodynamics, magnetic black holes, thermodynamics in an extended phase space, and Joule—Thomson expansion" provides a comprehensive study of magnetically charged black hole solutions in the context of Einstein's gravity coupled to nonlinear electrodynamics in AdS spacetime. The manuscript offers valuable insights into the thermodynamic behavior, phase transitions, and the Joule—Thomson expansion of these black holes. While some areas require further clarification and expansion, overall, the manuscript presents a well-organized and accessible research study. Addressing the suggested improvements would enhance the manuscript's scientific rigor and its impact on the field of black hole physics.