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.

This a review of the article :Einstein-AdS gravity coupled to nonlinear electrodynamics, magnetic black holes, thermodynamics in an extended phase space and Joule—Thomson expansion (Preprint v1) :

The article present a modified Einstein-Anti de Sitter theory with a nonlinear electrodynamics (NED) model to smooth out singularities of the linear Maxwell theory. The (NED) model chosen is among the simplest compared to the Born-Infeld for example, but formulas become complicated very quickly permitting only a first order evaluation, these are not sufficient to distinguish between the myriad of proposed NED models, therefore to first order and **for the calculation in this article**all these models are equivalent and no need to specify one or another.

For the author :

0/ A factor of 4π appears in Eq.(2) that is not justified.

1/ The article contains a lot of minor typos, but more important the bibliography contains a lot of self-citations. An quick examination of these reveals large similarities with the present article, in form and content, which can point to a repetition of the same article.

2/ The magnetic charge was used, it seems that the results are insensitive to whether an electric or magnetic charge is incorporated.

3/ The results are nonetheless interesting : adding nonlinear quantum corrections from QED, black hole thermodynamics becomes richer within NED models, not only the essential singularities are removed but *more structure is acquired(which was not shown).*

4/The phase structure should be more richer than what the article present first and second phase transitions exist already within Maxwell's theory. More work is needed to probe the full parameter space for new phases.

5/The author should present the evolution of the ADM mass of the black hole in terms of the NED parameters(β, q), to show different regimes.

6/ More work can be done to compare between at least to competing NED models, at least to what order predictions diverge significantly. I propose a comparison with the Born-Infeld model

7/The (figure 5) shows the variations of S(T), the comment says “entropy is ambiguous function of the temperature and first-order phase transitions occur.” which seems an ambiguous statement, a more careful justification of this statement is needed (look for example Poincaré's method). A clearer way is to plot T(S) and to show the negative heat capacity region. (somewhat done afterwards but then this statement becomes redundant)

8/Figures 4, 6 and 7 does not look good and more content/annotation must be added, especially figure 4 which presents the critical points.

9/ In Joule—Thomson(JT) expansion, the JT coefficient is not plotted showing the sign change at the inversion. A plot of μ_j against the parameter space is needed.

Overall the article is interesting although repetitive and need more work to reveal the true potential of the NED Models.

Best regards,

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