

Peer Review

Review of: "Scrambling in Charged Hairy Black Holes and the Kasner Interior"

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I studied the paper <https://doi.org/10.32388/ZVUZ7I> and found that it is publishable but after regarding the following comments.

1. Throughout the paper, typos should be checked. For instance, see 'Adressed (Introduction section), This surfaces penetrates (belove the section III line 6), while Q_3 logarithmically diverge as (below the equation 52) and etc.
2. I suggest that the calculated quantities from numerical solutions should be made dimensionless versus parameters of the model, for instance, a particular time scale or length scale throughout the paper. In other words, I have questions as follows: What are the units and dimensions of ' $r_{inv}=10^{(8)}$ ' above equation 71? What are the dimensions and units of the butterfly velocity? The Log functions in equations 32 or 37 should be dimensionless such that their dimensions are satisfied. And so on?
3. In figures 5, 7, 9, 11, 13, and 18, we see that for each value of P_t , there are two different values for the Lyapunov exponent. What can we say about these two-valued situations? Can we say that, in that case, the system is made from two different subsystems? I suggest interpreting more physical meaning of that behavior.
4. What is the physical importance of the particular interaction which you used between the Maxwell field and the scalar gauge field, ϕ , namely the first term in the action of S_3 ?
5. If the ϕ field vanishes to find the solutions given by Eq. 14, then the solution of the gauge scalar field ϕ should be determined below the solutions 14. What is its exact form? Is it a constant field or not? Why should the χ field solution be chosen as a constant field? If it does not set as a constant field, then what will be the situation of the work under consideration? Usually, in the numerical method, we should have just the initial values of the field and obtained numerical

values from the nonlinear field equations. In that case, the solutions 14 may be just one of the choices, and there are hidden other choices of the solutions which are not shown in the manuscript. Hence, the solutions 14 are not all possible solutions in my opinion. Other results and figures are based on the solution 14, and so they should be checked again by regarding exact numeric solutions which I mentioned above.

6. I suggest considering the self-interaction contribution of the scalar field 'Higgs' ϕ^4 term in the work and its behavior on the variation of the Lyapunov exponent and P_t , because this term is important in cosmic inflation.
7. Why do you use $n=1$ in equation 6? In other words, what is the physical importance of different numeric values for the n parameter? There should be more interpretation about this below equation 6.

Sincerely yours,

Declarations

Potential competing interests: No potential competing interests to declare.