Response to second referee report for Symmetry

immediate

February 19, 2023

Manuscript ID: symmetry-2201330

Title : Primordial Gravitational Wave Circuit Complexity
Corresponding Author: Sayantan Choudhury.

Dear Editor,

We thank the referee for the valuable report and appreciating our detailed effort . We request both the Editor as well as the referee to reconsider our paper for the publication in Symmetry. Below is our response to referee's comments:

1. **Referee's Comment:**
   The authors studied the quantum circuit complexity of PGW for various cosmological models, and for various initial states of PGW, by computing complexity measure and Von-Neumann entanglement entropy using both Covariance and Nielsen's wave function method. The results shows that quantum complexity could be a useful probe to study quantum features in cosmological scale. This is an interesting and timely topic, and the results are reasonable, which can be published

   Authors' Response:
   We are thankful to the referee for appreciating our effort.

2. **Referee's Comment:**
   There are various typos in the current version.

   Authors' Response:
   We are extremely thankful to the referee for pointing this crucial issue, which we have corrected and fixed in the revised version of the draft.

3. **Referee's Comment:**
   The references are not enough. For instance, Page 10, for the reheating phase with $0 < w < 1/3$, the reference is absent. Actually, the EOS of universe during reheating phase is always quite different from this one. See for instance 1509.03524 and the references therein.

   Authors' Response:
   We are thankful to the referee for pointing this issue. We have added few references

including the mentioned one the revised version of the draft. We have also added a small discussion regarding the equation of state parameter of reheating. See page 12 after eqn 3.25 for the added discussion.

4. **Referee's Comment:**
   As mentioned in the article, the potential detection of PGW is through CMB. At least, the authors should briefly discuss or forecast the effect of quantum circuit complexity of PGW on CMB, which is much more interesting for the readers.

   Authors' Response:
   We are thankful to the referee for bringing out this issue in his/her report. In the revised version of the draft we have added detailed discussion on this possibility. See page number 2,3,4. (Last paragraph of page 2 to the end of the first paragraph of page 4). We believe this discussion will be helpful for the general readers for the future purpose.

We believe that our justifications to the referee's comments along with the modification and corrections in the revised version of our manuscript has addressed all the questions raised by the referee. We, therefore, humbly request the Editor to reconsider our paper for publication in Symmetry.