

Referee's Report

Topological Field Theory of the Initial Singularity of Space Time

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« QUALITY ASSESSMENT: Q2, Sound, original and of interest.

With revisions I expect the paper to be suitable for publication.

The author's make the interesting observation that, in the limit of infinite temperature, a field theory is reduced to a topological field theory which may be a suitable description of the initial phase of the universe. I recommend the following points be clarified in the paper before publication:

(1) Through out the paper, $\beta = 0$ is stated and it would be much clearer if $\beta \rightarrow 0$ is considered which better describes the limit of infinite temperature.

(2) On page 4 (and other pages e.g. page 6) $\beta \rightarrow \dot{}$ which should presumably be replaced by $\beta \rightarrow \infty$? There is also a reference missing on page 4.

(3) Much of the details in section 2, regarding the metric independence of the partition function, are standard details which could be omitted. Also, the form of the energy - momentum tensor $T_{\{\alpha\beta\}}$, given on page 8, is true for a specific type of field theory. The authors' provide no information of the nature of field theories being considered in the paper. For example,

are they supersymmetric etc.?

(4) The authors' point out the $H=0$ (or L , which is typical for topological field theories) can, more or less, be viewed as the same as $\beta H = 0$ for $\beta = 0$ (in the limit of infinite temperature). This crucial and interesting observation needs to be supplemented with more detailed analysis since it is crucial for their ideas to work. It would be very helpful and more convincing if the authors' could provide further support. For example, can contact be made with general covariance or topology on taking the $\beta \rightarrow 0$ limit of some established standard results?

(5) I can accept that in the limit of infinite temperature, contact can be made with a topological phase of some field theory (the type of field theory needs to be elaborated on however). The crucial question, however, is how does the initial topological phase break down to a universe we see today. It would be of great interest if the authors' could at least worry about this issue.

(6) The scale of metric mentioned in proposition 2.2 is not easy to understand.

(7) In some places, the grammar used needs to be re-worded. Also, the various "black dots" which appear throughout the paper are confusing and need clarifying.

If the author's can successfully rectify the above, I will recommend the paper for publication. »