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Journal Name:	**Physical Science International Journal**
Manuscript Number:	**2014_PSIJ_10336**
Title of the Manuscript:	**Entropy and Temperature from Entangled Space and Time**
Type of the Article	**Regular research paper**

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PART 1: **Review Comments**

	Reviewer's comment	**Author's comment** *(if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)*
Compulsory REVISION comments	**Referee report below:** The problem of bound states in Quantum Field Theory is a very difficult unsolved problem. That's why any new look at this problem is useful. The authors discuss this problem on the example of two coupled oscillators. In such a rather short paper it is impossible to discuss allthe aspects of the problem. So the presentation depends on authors' preferences and different readers probably will have different preferences. At the same time, it seems to me, that the following point might be confusing. The authors write the Hamiltonian for oscillators as in nonrelativistic quantum mechanics. However, in Poincare invariant theory the Hamiltonian should be written	We agree with this referee on the point that the problem of bound states is very difficult to formulate in quantum field theory. This is the reason why we are not using field theory to deal with the physical problems discussed in this paper. We are using harmonic oscillators. Since this referee's comments are based on field theory, we are doing. We are not the first ones to use the harmonic oscillators. Feynman was the first one to suggest these oscillators for bound-state problems, instead of Feynman diagrams. He said that in his talk at the 1970 APS Washington meeting (published in Ref. 9). In spite of what we said above, we know how important QFT is in combining quantum mechanics and special relativity. We added an appendix to this paper to discuss where QFT and Feynman diagrams stand with respect to our oscillator program

	proceeding from irreducible representations or from representations describing local fields. In nonrelativistic quantum mechanics one can consider a particle in the harmonic oscillator potential. However, in QFT there is no harmonic oscillator potential. The authors justify their approach by referringto Dirac's SO(3,2) paper. "Remarkable representations" found in this paper (singletons) are some analogs of oscillator because, as shown later by Flato and Fronsdal, massless particles can be built from singletons. The authors refer to the Wigner little group.However, the singleton representation is special for SO(3,2) and there is no similar representation for the Poincare group.Probably the intention of the authors is to say that in the rest state one can take the wave function in the same form as in nonrelativisticquantum mechanics. This is true, for example in the theory of direct	

	relativistic interactions but not in QFT. So I believe that this pointshould be clarified. I would also like to make some additional comments on the presentation. To take into account those comments or not - this is fully optional for the authors.The authors consider the bound state problem in coordinate representation. They mention papers on irreducible representations: by Wigner on irreducible representations of the Poincare group and by Dirac on singletons (irreducible representations of the SO(3,2) group). In those papers an elementary particle is described in momentum representation and angular momentum representation, respectively. The authors do not mention how those representations are related to the coordinate representation and therefore it is not clear how those results can be used in the authors' formalism. Probably the intention of the authors was only to mention possible	

	approaches. Meanwhile, in the case of irreducible representations there is no problem with the probabilistic interpretation while it is well known that Poincare invariant local fields do have this problem. A problem of covariance in coordinate representation is difficult for several reasons. For example, on quantum level spacial coordinates and time are not on equal footing. This is clear even from the fact that the spacial position operator exists (at least in some approximations) while the time operator does not exist. That's why the wave function describes a distribution in spacial coordinates but it cannot describe a distribution in time. The absence of explicit covariance also follows from the fact that the relativistic wave function in coordinate representation is defined not on the whole Minkowski space but only on a hyperplane of this space. For example, the authors	

	mention Dirac's 1949 paper on the forms of relativistic dynamics. In QFT the momentum and angular momentum operators are given by integrals of the stress-energy and angular momentum tensors over a hyperplane. Then the Dirac instant form is obtained when the hyperplane is t=const, the front form is obtained when the hyperplane is the light cone and the choice of the hyperplane for the point form is a problem. In summary, the fact that the coordinate wave function is defined not in the whole Minkowski space but on a hyperplane breaks the explicit Lorentz covariance.	

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Minor REVISION comments		
Optional/General comments		