Review of: "Some Aspects of Quantum Fields in Curved Classical and Quantum Background Space-Time Using the Quantum Effective Action Formalism"

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Potential competing interests: No potential competing interests to declare.

I read the manuscript entitled above and find it good, but this version needs to improve before taking a publication rank, such that:

1. Some of the references are not addressed correctly in the body of the paper.
2. Some references are not addressed completely in the last section (list of references).
3. There is an essential problem with the meaning of the time evolution operator and technical application between the Schrödinger equation and the Wheeler-DeWitt equation. As we know, the time evolution operator is definite in the time-dependent Schrödinger equation but is indefinite in the Wheeler-DeWitt equation because of the entanglement of space with time in curved spacetimes and the absence of Lorentzian symmetry. However, in this paper, the author is studying the FRW background spacetime, which is conformally flat in four dimensions.
4. Furthermore, the author studied the interaction of quantum interacting matter fields with each other in the FRW background spacetime, while in the conclusion (not section 7 but after the appendixes), he mentioned that his study is dedicated to quantum gravity, which should be revised in the second version of the paper.

5. It is obvious to all experts in quantum gravity that the interaction of quantum matter fields with classical metric fields causes the creation of quantum particles/antiparticles called Hawking radiation (at scales higher than the Planck scale), the back-reaction of whose expectation values of the stress tensor operator generates a trace anomaly (after the renormalization), and so at least, some additional geometrical terms such as Gauss-Bonnet (higher-order metric derivatives) terms must be considered in the quantum aspects of the general theory of relativity action functional. According to this, I suggest that the author investigate in the next revisions of this paper the physical effects of the created Hawking particles on his proposal given in this paper.

6. Can we obtain a symmetry between the `quantum effective action` defined in the paper and Gauss-Bonnet terms?

7. Is there a relationship between the classical random Gaussian current field mentioned in the paper and the well-known Hawking radiation?

Sincerely yours,