Qeios

Peer Review

Review of: "Primary Hairs May Create Echoes"

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Looking at the conclusion, it is surprising that the modified terms in the Lagrangian and the scalar, vector, and Dirac fields from primary Proca-Gauss-Bonnet hair themselves, in the exterior region of any spherically static stars, can provide another barrier located near the horizon and enveloped by the usual potential barrier near the photon--sphere. This is due to certain choices of alpha and beta. I can see in Fig. 3 that the inner bump is small compared to the main outer bump, and the distance can be quite far from each other, hence producing a relatively small echo frequency.

I need to clarify some things as follows.

1. Because I see some choices of alphas, betas, and fields (scalar and Dirac), I cannot easily see the difference in their respective results. Can you explain concisely how different choices of alpha and beta impact the results and echo frequencies? At least in the conclusions, perhaps write it in a table for convenience.

2. There are some things that need to be addressed related to the frequency result. In Fig. 3, upper row on the right, what l (lowercase L) is used in the potential shown there? l=0, l=1, or else? Perhaps adding more plots for comparing potentials from different l values would be beneficial. Moreover, another table for results from l=1 may be needed just like Table 1 so that anyone can see the difference in numerical values between l=0 and l=1.

3. The eikonal parameter epsilon is a bit unclear in its relation to Eq. 15. Also, how exactly can the eikonal parameter correct the value of the frequency? I apologize if this question is a bit naive, but I think the clarity regarding the numerical steps needs improvement.

Declarations

Potential competing interests: No potential competing interests to declare.