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Echoes from braneworld wormhole

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We have studied the stability of wormhole geometries, under massless scalar, electromagnetic, and axial gravitational perturbations, in the context of higher dimensional spacetimes. Intriguingly, the construction of a wormhole spacetime in the presence of higher dimensions, known as braneworld wormholes, does not require the existence of exotic matter fields, unlike the scenario in four spacetime dimensions. Being a nonvacuum spacetime, the effective potential experienced by the axial gravitational perturbation differs considerably from the scenarios involving black holes. In particular, the present work provides one of the first attempts to study the gravitational perturbations of the wormhole spacetimes. Our analysis, involving both analytical and numerical techniques, demonstrates that there are echoes in the time domain signal of all the perturbations and the echo time delay is intimately related to the parameters originating from higher dimensions. Thereby combining the attempt to search for wormholes and extra dimensions, with the existence of gravitational wave echoes. Implications and future directions have also been discussed.

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