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Naked singularity in 4D Einstein-Gauss-Bonnet novel gravity: Echoes and instability

The stability of an asymptotically flat, static, spherically symmetric naked singularity spacetime in the novel four-dimensional Einstein-Gauss-Bonnet (EGB) gravity has been studied. Such a naked singularity is obtained from the four-dimensional EGB black

hole for large enough values of the coupling parameter. The stability and

the response of the spacetime are studied against the perturbations by test scalar, electromagnetic and Dirac fields, and the time evolution of these perturbations was observed numerically. Distinct echoes were seen in the time-domain profiles for l = 1 modes of scalar,

electromagnetic perturbation, and l = 0, 1 modes of Dirac perturbation. However, as the coupling constant increases, the echoes align, and the quasinormal

mode structure of the 4D-EGB naked singularity-spacetime becomes prominent. For higher values of the multipole number, the spacetime becomes unstable, thereby restricting the parameter space for the coupling parameter.

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