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Quasinormal modes of an accelerating black hole in the near-Nariai limit

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We investigated the quasinormal modes of massless scalar perturbation on a near-extreme accelerating black hole. The accelerating black hole spacetime is described by the Plebański-Demiański metric, which can be characterized by seven physical parameters. We showed that the conformally invariant Klein-Gordon equation can be separated through transformations that remove the conformal factor in the metric. Furthermore, we found that for a near-Nariai black hole, where its event horizon and cosmo-acceleration horizon are located extremely close, the effective potential of the radial perturbation equation is reduced to the Pöschl-Teller potential. This allows us to analytically obtain an exact solution, indicating that the decay rate of the quasinormal mode depends solely on the surface gravity of the black hole for each quantized mode.

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