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On the second order quasi-normal modes for an AdS black brane

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We study the second order gravitational perturbations in an AdS black brane background with Dirichlet condition on the AdS boundary and ingoing condition on the horizon. A second order quasi-normal mode is sourced by two first order quasi-normal modes. We obtain the equation of motion for the second order modes through a gauge invariant formalism and calculate numerically the ratio of amplitude between the second order mode and the product of the two linear modes in the source. The ratio of amplitude are found to be of order one in general. We also discuss about the implication of this non-linear effect on the dual field theory living on the boundary.

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