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Gauss-Bonnet AdS planar and spherical black hole thermodynamics and holography

In this work, we extend the study in \href{https://link.springer.com/article/10.1007/JHEP11(2022)013}{JHEP11(2022)013} incorporating the AdS/CFT duality to establish a relationship between the local temperatures (Tolman temperatures) of a large (AdS) spherical and a (AdS) planar Schwarzschild black hole near the AdS boundary considering Gauss-Bonnet curvature correction in the gravitational action. We have shown that the higher curvature corrections appear in the local temperature relationship due to the inclusion of Gauss-Bonnet term in the bulk. By transforming the metric into Fefferman-Graham form, we have calculated the energy density of the conformal fluid at the boundary. The obtained result contains finite coupling corrections which are holographically induced by the Gauss-Bonnet curvature correction in the bulk theory. Following the well known approach of fluid/gravity duality, the energy density of the conformal fluid at the boundary is then compared with the black body radiation energy density. This comparison shows that the energy density is proportional to the temperature of the conformal fluid. The temperature of the conformal fluid is then shown to be related to the Tolman temperature of the black hole which then eventually helps us to establish both the Hawking temperature and Tolman temperature relationship between large spherically symmetric and planar Schwarzschild black holes in Gauss-Bonnet gravity near the AdS boundary.

Field of contribution

Theory

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