Exact black-hole formation with a conformally coupled scalar field in three dimensions

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Abstract

We present an exact dynamical and inhomogeneous solution in three-dimensional AdS gravity with a conformally coupled scalar field [1], which is an analytic extension of the solution obtained by Xu [2]. Our solution represents: (i) an eternally shrinking dynamical black hole, (ii) a curious spacetime which admits an event horizon without any trapped surface, or (iii) gravitational collapse of a scalar field in an asymptotically AdS spacetime. In the last case, by attaching the solution regularly to the past massless BTZ spacetime with a vanishing scalar field, the whole spacetime represents the black-hole formation from regular initial data in an asymptotically AdS spacetime. Within a certain range of parameters, the resulting black hole is future asymptotically static.

References