

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

Hideki Maeda^a, Luis Avilés^{b,c}, and Cristián Martínez^b

^a Department of Electronics and Information Engineering, Hokkai-Gakuen University, Sapporo 062-8605, Japan.

^b Centro de Estudios Científicos (CECs), Av. Arturo Prat 514, Valdivia, Chile.

^c Departamento de Física, Universidad de Concepción, Casilla 160-C, Concepción, Chile.

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

- [1] L. Avilés, H. Maeda, and C. Martínez, *Class. Quant. Grav.* **35**, 245001 (2018).
- [2] W. Xu, *Phys. Lett. B* **738**, 472 (2014).