Adv. Theor. Math. Phys. **10** (2006) 503–523

On the nonlinear stability of higher dimensional triaxial Bianchi-IX black holes

Mihalis Dafermos[1] **and Gustav Holzegel**[2]

[1]Department of Pure Mathematics and Mathematical Statistics,
University of Cambridge, Wilberforce Road, Cambridge CB3 0WB, U.K.
m.dafermos@dpmms.cam.ac.uk

[2]Department of Applied Mathematics and Theoretical Physics,
University of Cambridge, Wilberforce Road, Cambridge CB3 0WA, U.K.
g.holzegel@damtp.cam.ac.uk

Abstract

In this paper, we prove that the five-dimensional Schwarzschild–Tangherlini solution of the Einstein vacuum equations is orbitally stable (in the fully non-linear theory) with respect to vacuum perturbations of initial data preserving triaxial Bianchi-IX symmetry. More generally, we prove that five-dimensional vacuum spacetimes developing from suitable asymptotically flat triaxial Bianchi-IX symmetric initial data and containing a trapped or marginally trapped homogeneous 3-surface necessarily possess a complete null infinity $\mathcal{I}^+$, whose past $J^-(\mathcal{I}^+)$ is bounded to the future by a regular event horizon $\mathcal{H}^+$, whose cross-sectional volume in turn satisfies a Penrose inequality, relating it to the final Bondi mass. In particular, the results of this paper give the first examples of vacuum black holes which are not stationary exact solutions.

e-print archive: http://lanl.arXiv.org/abs/gr-qc/0510051