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Rigidity of time-flat surfaces in the Minkowski spacetime. (English) Zbl 1316.83017

Summary: A time-flat condition on spacelike 2-surfaces in spacetime is considered here. This condition is analogous to the constant torsion condition for curves in a three-dimensional space and has been studied in (see e.g., [M.-T. Wang and S.-T. Yau, Commun. Math. Phys. 288, No. 3, 919–942 (2009; Zbl 1195.53039); P. Chen et al., ibid. 308, No. 3, 845–863 (2011; Zbl 1269.83024)]). In particular, any 2-surface in a static slice of a static spacetime is time-flat. In this paper, we address the question in the title and prove several local and global rigidity theorems for such surfaces in the Minkowski and Schwarzschild spacetimes. Higher-dimensional generalizations are also considered.

MSC:
83A05 Special relativity
53Z05 Applications of differential geometry to physics
83C57 Black holes
83E15 Kaluza-Klein and other higher-dimensional theories

Keywords:
rigidity; time-flat surfaces; Minkowski spacetime; torsion; Schwarzschild spacetimes; higher-dimensional generalizations

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