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Proper Weyl collineations in space-times(*)

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Summary. — A Lorentzian manifold M is said to admit a Weyl collineation (WC) if there exists a vector field X along which the Lie derivative of the Weyl tensor, $L_X C^a{}_{bcd}$, is zero. Historically the investigation of the WC symmetry is motivated for the role the Weyl tensor plays in algebraic classification of space-times according to their Petrov types. Recently some results have been published (see G. Shabbir, Ph.D. Thesis (2001) and G. S. Hall, *Grav. Cosmol.*, **2** (1996) 270) in which it is shown that proper WC can only be admitted when the Petrov type of the given space-time is either N or O. Studying proper Weyl symmetry in space-times, we show that proper Weyl collineation form an infinite-dimensional vector space.

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1. – Introduction

The aim of this paper is to study proper Weyl collineation in space-times by using the algebraic classification of Weyl tensor and direct integration techniques. Throughout M denotes a (4-dimensional connected, Hausdorff) smooth space-time manifold with Lorentz metric g of signature (−,+,+,+). The usual covariant, partial and Lie derivatives are denoted by a semicolon, a comma and the symbol L, respectively. The curvature tensor associated with g_{ab}, through the Levi-Civita connection, is denoted in component form where R_{abcd}, the Ricci tensor components are $R_{ab} = R^c{}_{acb}$, the Weyl tensor components are $C^a{}_{bcd}$, and the Ricci scalar is $R = g^{ab} R_{ab}$. Round and square brackets denote the usual symmetrization and skew-symmetrization.

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