Symmetry properties of a charged fluid in the general theory of relativity

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Abstract

The problem of specifying the symmetry properties of a charged fluid in space-time V4, which has a definite group of motions, is considered. It is shown that if nonempty spacetime V4 with an energy-momentum tensor for the charged fluid has symmetry (i.e., admits a group of motions), then the mass density, the pressure, and the four-velocity of the fluid inherits this symmetry, and for an electromagnetic field the relation Lξfij=7.*fij is satisfied. The necessary and sufficient conditions are found so that χ=0 in the case of a one-parameter group. Then additional relationships between κ and the structure constants are obtained in the case of an r-parameter group. It is shown that under certain conditions the symmetry properties obtained for charged matter are necessary and sufficient conditions for the symmetry of space-time V4. © 1979 Plenum Publishing Corporation.