Isometric motions of a perfect charged fluid

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Abstract

Space-times with perfect charged fluids as sources, that admit groups Gr of isometric motions, are investigated. It is assumed that the velocity vector of the fluid is collinear to the timelike Killing vector ξ^i of group Gr. It is shown that the macroscopic motion of a perfect charged fluid can occur only in the direction of such a Killing vector ξ^i that defines an operator in an invariant subgroup or, in particular, an operator of the center of the group. Parametric representations of the generalized equations of state for the pressure p, the energy density of the fluid, ρ, and the electric charge density σ are established. All these quantities are functions of the norm of the Killing vector ξ^i and the projection of the 4-potential of the electromagnetic field onto this vector ξ^i. In the approximation of the weak field in the coordinate system where $\xi^i = \delta^i_4$, these functional dependences imply that p, ρ, and σ are functions of Newtonian and electrostatic potentials. © 1988 Plenum Publishing Corporation.