

## Reduction of wave function associated with electromagnetic fields for imaginary mass system to standard helicity representation of Lorentz group

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MS received 6 March 1980; revised 13 June 1980

**Abstract.** Reduced expansions for electromagnetic fields associated with spin-1 particles of imaginary mass (tachyons) have been derived in terms of standard helicity representations of inhomogeneous Lorentz group. The effects of wave equation and reality condition on these reduced expansions to satisfy Maxwell's field equations have been derived. The reduced expansions of charge and current source densities associated with these fields have also been derived and it has been shown that these fields cannot satisfy the Maxwell's equations in the absence of both the current and charge source densities.

**Keywords.** Reduced expansion; imaginary mass; Poincaré group; superluminal frames; standard helicity representation.

### 1. Introduction

There has been growing interest in recent years in the study of possible existence of faster than light particles. Due to negative results given by experiments so far, it has become necessary to develop an appropriate quantum field theory of these particles so as to study their quantum mechanical properties. Feinberg (1967) and Dhar and Sudarshan (1968) restricted their theories to spin-zero tachyons only while Bandukwala and Shay (1974), Lemke (1976) and others (Shay 1975 and Schroer 1971) developed the theory for tachyons of spin- $\frac{1}{2}$  and arbitrary spin. There are yet many controversies in the formulation of a consistent quantum theory for these particles. Keeping these in view, we derived in an earlier paper (Rajput and Purohit 1979a) the reduced expansion for the wave-function which transforms as field associated with spin-zero tachyons in purely group theoretical manner using the general technique given by Lomont and Moses (1967). Study of invariance of Maxwell's field equations under real superluminal transformations of Antippa (1975) and imaginary superluminal transformations of Recami and Mignani (1973) was also undertaken (Rajput and Purohit 1979b).

In the present paper we extend our theory to tachyons of spin-1. The reduced expansion for the wave-function associated with spin-1 tachyons in terms of the standard helicity representation of proper, orthochronous, inhomogeneous Lorentz group has been derived. Wave-equation for imaginary mass and Lorentz condition has been used on the reduced expansion to eliminate some of the modes in the reduction of