

P R E F A C E

The title of the dissertation is "^{The} Studies On Charged Perfect Fluid In Null Electromagnetic Field". The aim of this work is to investigate the characteristic properties regarding the gravitational field and free gravitational field of the space time associated with the charged perfect fluid interacting with null electromagnetic field. We have used the well-known Newman-Penrose (N.P.) formalism based on complex null tetrad exploiting the respective spin coefficients and N.P. equations to simplify the basic field equations of the space time. We present below a broad spectrum of the work.

The first chapter is of introductory in nature, it deals with N.P. null congruence procedure. An elaborate account of the complex spin coefficients and N.P. equations followed by the simplified version of Bianchi identities, Ricci identities and Einstein field equations in terms of spin coefficients is given. The necessary kinematical conditions concomitants with geometrical symmetries necessary for particular type of fluid flow are given in terms of N.P. coefficients in the last section of this chapter. We claim no original results in this chapter.

The prime aim of Chapter II is to study the nature of gravitational field due to charged perfect fluid in null electromagnetic field following the N.P. formalism. The

salient features of this chapter are as follows :

Section 2 : The form of the stress energy tensor characterizing the charged perfect fluid in null electromagnetic field with the special choice of the time like flow vector as the linear combination of complex null tetrad vectors is designed. The decomposition of this stress energy tensor in terms of physically meaningful components is exposed.

Section 3 : Ricci tensor expression along with the respective Ricci scalars corresponding to the charged perfect fluid in null electromagnetic field are derived.

Section 4 : This section deals with Maxwell's equations for source free null electromagnetic field in N.P.version. The natural freedom condition directs here the property of conservation of electric current. The necessary and sufficient condition for Lorentz force to vanish are also derived. It is found that the value of the Lorentz force produced by charged perfect fluid in null electromagnetic field under the condition that the source term as null becomes zero.

Section 5 : Bianchi identities are written in simplified version by utilizing the N.P. procedure. The energy balance equation and continuity equation corresponding to the charged perfect fluid in null electromagnetic field are shown to be biproducts of these identities. Further we have derived Ricci identities generating 18 independent N.P. equations. These above identities are further examined under the natural freedom

conditions that the real null congruence is geodesic.

Section 6 : The conditions in terms of N.P. coefficients employed by the special choice of flow vectors are used to produce the N.P. equations in extremely simplified form.

Section 7 : In the space time of charged perfect fluid in null electromagnetic field, the Jacobi deviation equations explaining the relative velocity and relative acceleration of separation vector are obtained in N.P. version.

Section 8,9 : Electric type components and Magnetic type components are designed with the help of Weyl conformal tensor field describing the free gravitational field. The N.P. version of these components is also given. The electric type component is the mathematical description of physical entity known as gravitational tidal force. We have formulated here a theorem that speaks about the necessary conditions for the gravitational tidal force to be divergence free.

The appendix at the end includes the N.P. scalars for Einstein tensor associated with the charged perfect fluid in null electromagnetic field.