: PREFACE :

The presence of strong magnetic fields in the massive astronomical objects reveals the importance of the study of relativistic magnetohydrodynamics (RMHD). This has encouraged us to study the space-time of charged thermodynamical perfect fluid with infinite conductivity and constant magnetic permeability (magnetofluid). The vital role played by the null congruences in electromagnetic radiation theory is well known to physicists. Moreover the frequent usage of time-like congruences in cosmological model studies and the space-like congruences in the description of self-gravitating matter fields are in vogue. So an attempt of studying the space-time of the magnetofluid through the parameters associated with time-like congeuences is made here in this dissertation. Survey of important aspects investigated in this dissertation is displayed below.

Chapter O : MATHEMATICAL PRELIMINARIES -

1 : Brief introduction of the chapter

2 : Riemann Christoffel curvature tensor and its properties.

3 : Congruences and associated parameters viz. Kinematical parameters are described.

4 : Tetrad formalism, Ricci rotation coefficients and spin coefficients are explained.

5 : Some special types of flows of the magnetofluid namely geodesic flow, essentially expanding flow, Killing flow, Born rigid flow, harmonic flow, boost flow and steady state magnetofluid are stated. Further the defining conditions of the aforesaid flows are translated into the Ricci rotation coefficients.

Chapter I : CHARACTERIZATION OF THE MAGNETOFLUID SCHEME

1 : Importance of RMHD and brief survey of the chapter is given.

2 : Evolution of the stress energy tensor for the magnetofluid.

3 : Field equations for the magnetofluid space-time are stated and consequences of Maxwell's equations are investigated.

4 : Definitions of some important spaces are given.

Chapter II : SYSTEM OF STREAMLINES

1 : Introduction of the chapter is given.

2 : The equation of continuity and consequently the equation of streamlines are derived as the consequence of the local conservation law. It is shown that the magnetofluid obeying mass conservation law, the flow is adiabatic if and only if the quantity ($\frac{1}{2}\mu(1-\mu)h^2$) conserves along the flow vector. Further it is proved that the four accelaration is orthogonal to the magnetic field if and only if the term ($p + \frac{\mu}{2}(1-\mu)h^2$) is left invariant along the magnetic field vector.

3 : The consequences of the fluid flows with the help of Maxwell's equations and continuity equation for the magnetofluid are examined.

Chapter III : P-SPACE FOR THE MAGNETO-FLUID

1 : A brief survey of the chapter is presented.

2 : The space matter current tensor for the magnetofluid is developed. The necessary and sufficient condition for the transformation of p-space to c-space is found. It is found that for p-space, $(T-3\psi)$ is constant and the divergence of the space matter current tensor vanishes identically.

3 : For p-space of the magnetofluid the following results are derived. (1) The magnetic field is divergence free if and only if $(\frac{\mu h^2}{2} + 2\psi)$ conserves along the magnetic field. (2) The quantity $(\frac{\mu h^2}{2} + 2\psi)$ is invariant along the magnetic field if and only if the four accelaration is orthogonal to the magnetic field. (3) Streamlines are expansion free if and only if $(\psi = -\rho f + c)$, where C is any arbitrary constant.

4 : The consequences of the typical fluid flows of the magnetofluid with respect to p-space are examined.

Guide

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