

SOME PROBLEMS IN EINSTEIN'S UNIFIED
FIELD THEORY OF 1945SYNOPSIS

The thesis is concerned with the study of some problems of Einstein's unified field theory of 1945.

There are two parts, A and B, in chapter I. In part A we have dealt with a review of Einstein's Unified Field Theory of 1945 and its subsequent development by various authors. In course of this study we have described mainly some of the important work of other authors in relation to the outstanding mathematical problems of the theory such as the \mathcal{G} - T linear relation, the exact solutions of the theory, physical interpretation etc. We have also touched upon the derivation of the field equations of the theory based on the different orientations to the theory given by Einstein from time to time since 1945 to 1955. Only brief references to topics outside our subject of study like the philosophical background of the theory, the different types of interaction, the operational determination of the basic field variables, have been made. In Part B we have discussed some of the alternative approaches to the unified field problem such as the work of Schrödinger etc. There have been several other attempts besides these, viz. the well known one by Herman Weyl, etc.

We have not gone into these except for a brief mention of some that attracted our attention.

The original work starts from chapter II.

In chapter II we have discussed a special type of symmetry and coordinate system and derived the explicit form of field structure $g_{\mu\nu}$ that comes out as

$$\left\{ \begin{array}{cccc} 1 & 0 & 0 & I(x) \\ 0 & G(x) & \kappa(x) & 0 \\ 0 & -\kappa(x) & G(x) & 0 \\ -I(x) & 0 & 0 & H(x) \end{array} \right\},$$

where I, G, κ, H are functions of x . This is an analogue of the infinite plane of general relativity.

In chapter III we have obtained an exact solution (often termed as 'rigorous solution') corresponding to the above form. We have considered the 'weaker form' equations and have designated the solution as 'restricted weaker form' solution, because an arbitrary constant involved in the preliminary integration of one of the field equations is put equal to zero. The set of our solution contains the corresponding solution of 'stronger form' equations as a proper subset.

Chapter IV deals with some interrelations of our work in chapter III with the work of Ghosh and Bandyopadhyay, showing how one of the solutions obtained by Bandyopadhyay can be taken as a proper subset of our set of solutions and also how a proper subset of Ghosh's solution coincides with a proper subset of our solution.

In chapter V we have shown an alternative approach to obtain some earlier results of Bandyopadhyay by utilizing a technique developed recently by him in a different context.

Chapter VI gives a schematic representation of many of the solutions of Einstein's Unified Theory with the aid of 'Venn diagram', well known in elementary set algebra.

Chapter VII deals with the physical interpretation of our results obtained in chapter III in the light of the interpretation suggested by Einstein and that suggested by Hlavaty'. We have compared the two interpretations and discussed the results. The singularity in the solution may be interpreted as a single magnetic sheet or a series of sheets. Our study brings out that the vanishing of the same term implies absence of electric field in both the interpretations. Similar observation holds good for the magnetic field.

In chapter VIII we have followed the pattern of chapter VII for studying the physical implications of the results obtained by Bonnor.

Conformal spaces have occurred in general relativity. Hlavatý has introduced the idea for the non-symmetric theory as well. In chapter IX we have studied the consequences of 'conformal change', for our field structure as in chapter II and also for spherically symmetric fields. In both the cases we have studied the necessary and sufficient conditions for the vanishing of torsion vector by a 'conformal change'. Two possible meanings of the integrability conditions arising in this connection have been pointed out.