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Time Dependent Axially Symmetric Solutions of the Einstein-Maxwell-Yukawa Fields

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Abstract. Extending a technique developed for static fields by Janis *et al.* [10] to the nonstatic fields two exact solutions in the case of Einstein-Rosen metric for the interacting electromagnetic and zero mass scalar fields have been obtained.

1. Introduction

The need for exact solutions in the general theory of relativity is well known. In view of the highly nonlinear character of the field equations only a limited number of solutions are available in the theory. The object of this paper is to generate solutions for the interacting electromagnetic and meson fields which study is of considerable interest in the field of high energy particle physics.

The possibility of construction of new solutions out of existing solutions in some special cases has been established by the following authors. Datta Majumdar [1] has shown that for a static Einstein-Maxwell source free field the solutions could be generated from those of corresponding vacuum solutions. This investigation has further been extended by Misra and Radhakrishna [2] and later by Harrison [3] to the case of nonstatic Weyl fields. Formulating the idea of 'reciprocal solutions' Buchdahl [4], [5], [6], [7], has developed methods for generating new solutions from those of empty spacetime solutions. His work incidentally extends into Unified theories. It may be mentioned here that work relating to the generation of solutions of Unified theory has been done by Bandyopadhyay [8] and Rao and Tiwari [9].

Janis *et al.* [10] have developed results, for constructing solutions for the coupled fields from those of vacuum field equations in the case of a static metric. Observing that in the cylindrically symmetric metric we have considered, the results of Janis *et al.* [10] can be adapted to generate time dependent solutions from those of vacuum solutions, we have obtained two exact solutions. These solutions correspond to two of the solutions obtained by Rao *et al.* [11]. This technique is a powerful tool for obtaining new time dependent solutions and the work is being pursued separately.