

Electromagnetic Solutions of the Field Equations in Presence of Zeromass Mesons

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Abstract. The field equations of general relativity with electromagnetic stress tensor and zeromass scalar meson field are investigated. The metric coefficients are assumed to be functions of three variables only. It is then shown that, if one assumes a functional relation between some one of the metric coefficients and the electromagnetic potentials, that one can find a solution of the coupled Einstein-Maxwell equations in terms of a solution of the Einstein equations with zeromass scalar meson field as source.

1. Introduction

In this note we have investigated the nonempty field equations of general relativity where the stress-energy tensor of electrodynamics and zeromass meson field is taken as the source. Although the physical implications to be drawn from the study of zeromass meson fields suffer from the lack of any experimental support, nevertheless, it has been shown by Janis *et al.* [1] that a zeromass meson field interacting with a static, spherically symmetric and asymptotically flat gravitational field has some very interesting and surprising features. We have also investigated, elsewhere, the interaction of zeromass meson field with charged incoherent matter in a stationary axially symmetric gravitational field and have found that the spacetime is basically modified and leads to some interesting consequences [2]. Further, exact solutions of the field equations are scarce, and it is always worthwhile to obtain analytic solutions of a problem with more than one field coupled nonlinearly.

However, we shall not derive here any explicit solutions of the field equations corresponding to the problem stated above, rather, we shall discuss a procedure which will enable one to construct exact electromagnetic solutions from a given solution of the field equations with massless scalar meson field as source. It has been shown by Harrison [3] and others [4, 5] that one can generate a solution of the coupled Einstein-Maxwell equations with a nonvanishing electromagnetic field from a given vacuum solution of the field equations in which the metric coefficients are functions of not more than three variables. This result is a