PHOTONS IN EINSTEIN'S UNIVERSE

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ABSTRACT. Physically meaningful solutions of Maxwell equations on $S^3 \times R$ spacetime are derived, as linear superposition of the α- and β-polarized, left- and right-moving modes, of positive and negative frequencies. Using the orthonormal electric and magnetic fields intensities, we compute the components of the Umov–Poynting vector, of the effective momentum and the energy density. In the last section, non-trivial solutions for the 4-potential A^k, satisfying the $F^{ij} = 0$ property, are employed to analyze how the presence of the electromagnetic vacuum modes is affecting the solution of the Klein–Gordon equation, in comparison to its usual form on the Minkowskian background.

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1. INTRODUCTION

In the last decades, field theories on curved manifolds and the inclusion of gravity into gauge theories of elementary particles, in order to get the best possible unification picture, have been main topics of investigation.[1,14,19,21] In this respect, a special attention has been given to the Einstein's Universe since its maximal symmetry and compactness of space allow the formulation of field theories in a similar manner as on the Minkowskian background. Consequently, the Klein–Gordon, Weyl, Dirac and Rarita–Schwinger-type equations have been written down, by simply going from the momentum representation to the angular or total momentum one.[2,3,4,6,7,9] Going beyond the simplest version to a cosmologically interesting generalization, the spatially closed Friedmann–Robertson–Walker Universe, dominated by

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