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GEOMETRIC AND QUANTUM PROPERTIES OF CHARGED PARTICLES IN MONOCHROMATIC ELECTROMAGNETIC KNOT BACKGROUND

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Abstract. In this paper, we review recent results on the interaction of the topological electromagnetic fields with matter, in particular with spinless and spin half charged particles obtained earlier. The problems discussed here are the generalized Finsler geometries and their dualities in the Trautman-Rañada backgrounds, the classical dynamics of the charged particles in the single non-null knot mode background and the quantization in the same background in the strong field approximation.

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1. Introduction

The topological properties of the nonabelian field theories (with matter) play a crucial role in understanding their structure mainly in the nonperturbative regime. While topologically non-trivial fields are expected due to the non-abelian group structure, the existence of topologically non-trivial abelian fields is more surprising. These fields are described by knot solutions of Maxwell's equations and were discovered for the first time by Trautman and Rañada in [11, 12, 14]. Since then, the Trautman-Rañada fields have been investigated in many areas of applicability of the Classical Electrodynamics such as atmospheric physics, liquid crystals,