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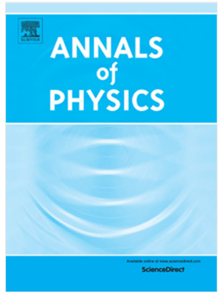

Faddeev-Jackiw quantization of topological invariants: Euler and Pontryagin classes

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Faddeev-Jackiw quantization of topological invariants: Euler and Pontryagin classes

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The symplectic analysis for the four dimensional Pontryagin and Euler invariants is performed within the Faddeev-Jackiw context. The Faddeev-Jackiw constraints and the generalized Faddeev-Jackiw brackets are reported; we show that in spite of the Pontryagin and Euler classes give rise the same equations of motion, its respective symplectic structures are different to each other. In addition, a quantum state that solves the Faddeev-Jackiw constraints is found, and we show that the quantum states for these invariants are different to each other. Finally, we present some remarks and conclusions.

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I. INTRODUCTION

Nowadays, the study of topological theories is an interesting topic to perform. In fact, the relevance for studying topological theories has been motived in several contexts of theoretical physics because of they provide an interesting relation between mathematics and physics, just like that existing between geometry and General Relativity [GR]. From the classical point of view, topological theories are devoid of physical degrees of freedom, background independent and diffeomorphisms covariant, because of these symmetries, the topological theories are considered as good laboratories for testing ideas about the construction of a background independent quantum theory, and these ideas could be applied for the construction of a desired quantum version of GR [1]. From a global point of view, topology and quantum mechanics has an interesting overlap just like that discovered by E. Witten in [2] and extended by M. Atiyah in [3], where concepts of geometry, supersymmetry and quantum field theory where unified, giving origin to the so-called topological quantum field theory [4]. Moreover, we find in the literature that the topological theories are also important in the canonical approach of GR; In fact, when GR is considered with the addition of topological terms, namely the Pontryagin, Euler and Nieh Yan invariants, it is well-known that these topological invariants have no effect on the equations of motion of gravity, however, they give an important contribution in the symplectic structure of the theory [5]. Within the classical field theory context, either the Euler or Pontryagin classes are fundamental blocks for constructing the noncommutative form of topolog-

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