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MODERN APPROACHES TO THE QUANTIZATION OF GAUGE THEORIES

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Abstract. In the Batalin–Vilkovisky field-antifield formalism a classical mechanical system is described by a solution of the classical master equation. The quantization of this general gauge theory in the Lagrangian approach can be accomplished in closed form. The AKSZ-formalism is a geometrical construction of such a solution as a QP-manifold. This can be extended and applied to topological quantum field theories.

1. Introduction

In physics the fundamental interactions are governed by gauge theories. One usually does not want to eliminate the gauge degrees of freedom, because they ensure manifest covariance, the locality of the interactions and they are convenient for calculational purposes. The quantization is not always straightforward. In general it involves the introduction of ghost fields. It is useful to introduce these ghosts at the classical level, then one is able to quantize the theory in a canonical way, since all necessary parameters are involved from the beginning. These so-called **pseudo-classical theories** are formulated by the use of fermionic degrees of freedom, which lead to Grassmann algebras and "supersymmetric theories".

Ghosts appeared in physics for the first time in the Faddeev–Popov quantization procedure [8]. This relies on the path integral quantization; the ghosts are introduced by dividing out the volume of gauge transformations in function space, which leads to a finite path integral measure. One is left with a summation over the equivalence classes of gauge fields, bearing in mind the gauge