Second International Conference on
Geometry, Integrability and Quantization
June 7–15, 2000, Varna, Bulgaria
Ivaïlo M. Mladenov and Gregory L. Naber, Editors
Coral Press, Sofia 2001, pp 99-109

SYMPLECTIC LEAVES OF W-ALGEBRAS FROM THE REDUCED KAC–MOODY POINT OF VIEW

Z. BAJNOK and D. NÓGRÁDI

Institute for Theoretical Physics, Roland Eötvös University,
Pázmány sétány 1/A, H-1117 Budapest, Hungary

Abstract. The symplectic leaves of W-algebras are the intersections of the symplectic leaves of the Kac–Moody algebras and the hypersurface of the second class constraints, which define the W-algebra. This viewpoint enables us to classify the symplectic leaves and also to give a representative for each of them. The case of the W_2 (Virasoro) algebra is investigated in detail, where the positivity of the energy functional is also analyzed.

1. Introduction

W-algebras have attracted a great interest since their first appearance [1] thanks to the fact that their quantized versions [2], (the extensions of the Virasoro algebra with higher spin currents), are relevant not only in the classification of two dimensional conformal field theories but also in describing various statistical physical models. For a review on W-algebras and their application see [3] and references therein. Later it was shown in [4] that the Toda models (which carry the W-algebras as symmetry algebras) are Hamiltonian reductions of the **Wess-Zumino-Witten** (WZW) **models**. Under the reduction procedure, which can be implemented by second class constraints, the symmetry algebra of the WZW model, namely the **Kac–Moody** (KM) **algebra**, reduces to the symmetry algebra of the Toda models, the W-algebra.

The quantization of W-algebras started by a free field construction [2], and then the BRST method [5] was adopted to produce their quantum counterparts. None of the approaches mentioned however, are relied on the classical geometry of W-algebras and loose useful information in this way. The aim of this paper is to reveal the classical geometry of W-algebras, more precisely to analyze