Spectra of Wess–Zumino–Witten Models with Arbitrary Simple Groups*

G. Felder[1], K. Gawędzki[2] and A. Kupiainen[3]

1 Theoretische Physik, ETH-Hönggerberg, CH-8093 Zürich, Switzerland
2 C.N.R.S., I.H.E.S., F-91440 Bures-sur-Yvette, France
3 Research Institute for Theoretical Physics, University of Helsinki, SF-00170 Helsinki 17, Finland

Abstract. We consider the Wess–Zumino–Witten two-dimensional sigma models with fields taking values in an arbitrary connected (but not necessarily simply connected) simple Lie group G. The quantum states of the theory are realized geometrically as sections of a line bundle over the loop group LG. The action of the current algebra of the theory is decomposed into highest weight representations by explicit construction of the highest weight states. This solves for the spectrum of the models. As a by-product, we obtain modular invariant partition functions of the theory on tori. The present paper extends the results of [7] where the cases $G = SU(2)$ and $SO(3)$ were treated.

1. Introduction

The Wess–Zumino–Witten (WZW) models [27, 15] of two-dimensional quantum fields with values in group manifolds have attracted considerable attention in recent years. There are multiple reasons for that:

1. In special cases, the WZW models provide a non-abelian extension of bosonization rules [27] whose abelian version had been one of the main tools in the analysis of two-dimensional field theories.
2. Because of extremely rich symmetry combining non-abelian current algebra and conformal invariance, they provide generally non-trivial examples of field theories solvable not only for spectrum but for Green functions as well [15].
3. As models of conformal field theory, the WZW systems are possible building blocks of perturbative string theory vacua [11].
4. Models with rank two groups play an important role in the classification of the so-called minimal conformal field theories [4, 6, 10].