Commun. Math. Phys. 114, 317–343 (1988)

Communications in Mathematical Physics

A Phase Cell Approach to Yang-Mills Theory

IV. The Choice of Variables*

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Abstract. Variables are chosen to describe the continuum Yang-Mills fields, a discrete set of group valued variables. These are group elements associated to the sequence of lattice field theory configurations realizing the continuum field. The field is "laid down" inductively. At each inductive step one of three types of "field excitations" makes its contribution to the total field. These are either "pure modes", "averaging correction modes", or "chunks". The pure modes are small field excitations, as studied in previous papers in this series [2, 3]. The averaging correction modes are small excitations added to make sure the block spin transformation is satisfied at each edge. The chunks, encompassing most of our difficulties, are large field excitations. Topological obstructions in $\pi_3(G)$ must be dealt with in defining a gauge choice for each chunk. The laying down process is complex, but fiendishly clever, ensuring a principle of "gauge invariant coupling". Each group valued variable is either the "amplitude" of a pure mode or an "internal variable" in a chunk. The amplitude of an averaging correction mode is a dependent variable, a function of the (independent) variables used to describe the field. The (independent) variables herein defined are those whose mutual interaction will later be inductively decoupled in defining the phase cell cluster expansion (of course treating the variables of each chunk as a unit).

0. Introduction

Loosely speaking one may separate the work of controlling a cluster expansion into two tasks. The first, the "non-linear" aspect, is controlling the functional integrals using positivity properties of the action. The second, the "linear" aspect, is

* This work was supported in part by the National Science Foundation under Grant No. PHY-85-02074