Commun. math. Phys. 56, 115—123 (1977)

Communications in Mathematical Physics



# A Classification of $SU_3$ Magnetic Monopoles

J. Madore*

Centre de Physique Théorique, CNRS, F-13274 Marseille Cedex 2, France

**Abstract.** A classification scheme is proposed for $SU_3$ magnetic monopoles when the Higgs fields lie in the adjoint representation. The scheme is based on a study of the second homotopy groups of the orbit spaces.

## I. Introduction

Consider an octet of self-interacting scalar fields transforming according to the adjoint representation of $SU_3$, minimally coupled to a set of Yang-Mills fields. Suppose that the scalar self-interaction potential is generic—that it depends explicitly on both invariants of the adjoint representation. Then at infinity the little group is $U_2$. See, for example [1, 2]. Spontaneous symmetry breaking leaves massless the Yang-Mills fields corresponding to $U_2$, that is, those that commute with the octet of scalar fields. If we wish to discuss the electromagnetic properties of a solution to the field equations, one of these must be chosen as the electromagnetic field. That is, we must choose a $U_1$ subgroup of $U_2$. $U_2$ contains also $SU_2$ as a subgroup. There are three ways to choose $U_1$ according to how it intersects $SU_2$:

(i) $U_1 \cap SU_2 = \{1\}$,

(ii) $U_1 \cap SU_2 = \mathbb{Z}_2$,

(iii) $U_1 \subset SU_2$.

We are interested in everywhere regular, finite energy, static solutions to the field equations and we wish to show that they may be classified by two integers $s$ and $t$ which satisfy the following conditions, according to the three possible choices of $U_1$:

(i) $s$ is even or odd, $t=0$,

(ii) $s$ is even, $t=0$,

(iii) $s=0$, $t$ is even or odd.

* Permanent address: Laboratoire de Physique Théorique, Institut Henri Poincaré, 11, rue Pierre et Marie Curie, F-75231 Paris Cedex 5, France