

A General Relation Between Kink-Exchange and Kink-Rotation

Rafael D. Sorkin*

Physics Department, Syracuse University, Syracuse, NY 13244-1130, USA and
The Institute for Advanced Study, Princeton, NJ 08540, USA

Abstract. The normal correlation between spin and statistics is shown to be valid for arbitrary kinks, among them the $SU(n)$ Skyrmions for $n \geq 3$. It is assumed in the proof that no gauge-ambiguity attaches to the values of the underlying scalar field, and that conversely each configuration of this field is represented quantum mechanically by a Hilbert subspace of dimension precisely one.

I. Introduction

As has been known for several years, objects bearing fermionic *statistics* can occur in theories whose “elementary particles” are all bosons, for example, in field theories which impose only CCR’s (Canonical Commutation Relations) but never CAR’s (Canonical Anti-Commutation Relations) on their fundamental field operators. In the same way *spinorial* states – ones of angular momentum $1/2, 3/2$, etc. – can occur in theories whose elementary particles are all tensorial (i.e. of integer spin), for example, field theories in which all the fundamental fields are scalars or vectors.

Such “emergent” fermionicity and spinoriality occurs in a large number of situations, the oldest example being a system of non-relativistic electrically *and* magnetically charged particles, interacting via the associated inverse-square forces (together with any short-range attractive forces that may be included in order to provide for the formation of bound states). In such a situation a bound state can be a spinorial fermion even if its elementary constituents are all (for example) bosons of spin zero [1]. Specifically, a “Saha dyon” formed from an electric monopole e and a magnetic monopole g will have “anomalous” spin *and* statistics whenever the product eg is an odd multiple of Planck’s constant h .

Dyons with emergent spin and statistics can also occur in Lorentz invariant quantum field theories in flat space. This can occur, for example, in a theory

* Supported in part by NSF Grant No. PHY 83-18350