

**Nolasco, Margherita; Tarantello, Gabriella**

**Vortex condensates for the SU(3) Chern-Simons theory.** (English) Zbl 0998.81047  
*Commun. Math. Phys.* 213, No. 3, 599-639 (2000).

The  $(2+1)$ -dimensional relativistic Chern-Simons equations form a nonlinear system of partial differential equations for a gauge field  $A_\mu$  and a Higgs field  $\phi$  defined on  $\mathbb{R}^3$  with standard Lorentzian metric. The self-dual static solutions are defined on  $\mathbb{R}^2$  and absolutely minimize the energy. They are also called 'vortices'. In the Abelian case, solutions have been shown to exist in a variety of circumstances but in the non-Abelian case, i.e. when  $A_\mu$  and  $\phi$  takes values in a non-Abelian semisimple Lie algebra, much less is known. To make progress in this case, one can assume the fields to be of a special form. Specifically, the authors suppose that  $A_\mu$  takes values in a Cartan subalgebra and  $\phi$  takes values in the corresponding raising operators. The  $\mathfrak{su}(2)$  case then reduces to the Abelian case, so  $\mathfrak{su}(3)$  is the simplest non-Abelian case. The authors look for doubly-periodic vortices in this case. They show the existence, for sufficiently small values of the coupling constant, of such vortices with specified zeroes of the Higgs field in the fundamental domain and other good properties. There are solutions at the first admissible non-zero energy level  $E = 2\pi$  and gauge distinct solutions at higher energy levels.

Reviewer: [M.G.Eastwood \(Adelaide\)](#)

**MSC:**

- [81T13](#) Yang-Mills and other gauge theories in quantum field theory
- [58E15](#) Variational problems concerning extremal problems in several variables; Yang-Mills functionals
- [35Q35](#) PDEs in connection with fluid mechanics
- [22E46](#) Semisimple Lie groups and their representations

Cited in **3** Reviews  
Cited in **61** Documents

**Keywords:**

Chern-Simons; self-dual; Higgs field; vortex; nonlinear system of partial differential equations; gauge field; self-dual static solutions; Abelian case; non-Abelian case; Cartan subalgebra

**Full Text:** [DOI](#)