

RCNP SEMINAR

Research Center for Nuclear Physics, Osaka University

Speaker	Dr. Shigehiro Yasui (KEK)
Title	Non-Abelian vortices and non-Abelian statistics in CFL color superconductivity
Date	May 2 nd , 2012, 14:00-
Place	Lecture room, 4th floor, RCNP, Osaka University

Abstract

Color-Flavor-Locked (CFL) phase in color superconductivity including u, d, s quarks is an interesting QCD phase which can be studied in observation of compact stars and in experiments in relativistic heavy ion collisions.

As recent studies, it is discussed that there exist quantized vortices in the rotating CFL superconductor.

Those vortices possess $SU(2) \times U(1)$ symmetry, and hence are called "non-Abelian vortices."

In this talk, we discuss the new physics included in the non-Abelian vortices, and propose some possible applications to other fields such as particle physics, condensed matter physics and so on.

We focus on the following two subjects:

1. Zero-mode Majorana fermions/Dirac fermions in non-Abelian vortices.

We analyze the Bogoliubov-de Gennes equation which gives the hamiltonian for fermions in vortices, and find zero-mode solutions.

We show that there exist triplet zero-mode Majorana fermions in M1 type vortices, and doublet zero-mode Dirac fermions in M2 type vortices.

The existence of those zero-modes is also induced from the index theorem as the topological nature of vortices.

2. "Non-Abelian statistics" as a novel quantum statistics in exchange of non-Abelian vortices.

The exchange of vortices do not obey the normal quantum statistics, such as the Bose-Einstein statistics, nor the Fermi-Dirac statistics.

It obeys "the non-Abelian statistics" which exhibits the non-commutativity of exchange of two different vortices, which has been known for the case of Abelian vortices.

We show that the non-Abelian statistics of non-Abelian vortices have a new structure, "Coxeter x Ivanov", which is not seen in the non-Abelian statistics in the Abelian vortices.

We give first an introduction to non-specialists which are not familiar to this field, and discuss the above topics by giving some demonstrations.