



**Conference on Frustration, Disorder and Localization:
Statics and Dynamics**

**28 September - 2 October 2015
Trieste, Italy**

BOSE CONDENSATION IN CATEGORY THEORY

Titus NEUPERT

**Princeton Center for Theoretical Science, Princeton University
NJ-08544 Princeton, U.S.A.**

Abstract:

The condensation of bosons can induce transitions between topological quantum field theories (TQFTs). This has been previously investigated through the formalism of Frobenius algebras and with the use of Vertex lifting coefficients. I will discuss an alternative, algebraic approach to boson condensation in TQFTs that is physically motivated and computationally efficient. With a minimal set of assumptions, such as commutativity of the condensation with the fusion of anyons, we can prove a number of theorems linking boson condensation in TQFTs with algebra extensions in conformal field theories and with the problem of factorization of completely positive matrices over the positive integers. I will present an algorithm for obtaining a condensed theory fusion algebra and its modular matrices. In addition, I will discuss how this formalism can be used to build multi-layer TQFTs which could be a starting point to build three-dimensional topologically ordered phases. Using this formalism, I will also give examples of bosons that cannot undergo a condensation transition due to topological obstructions.