

2-DIMENSIONAL TOPOLOGICAL QUANTUM FIELD THEORIES

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1. INTRODUCTION

A topological quantum field theory, abbreviated TQFT, is a mathematical structure which captures some of the properties found in the physical notion of a quantum field theory. While TQFTs are very much simpler than general quantum field theories, and so from a physics standpoint can be regarded as toy models, they have the advantage of being rigorously defined as mathematical objects. They provide insights into questions in various parts of topology, knot theory, representation theory and algebraic geometry.

Each TQFT has a certain dimension, which in the analogy with physics plays the role of the dimension of spacetime. When this dimension is smaller than 3, the theory can be defined by concrete algebraic data. In the particular case of a 2-dimensional TQFT, the data defining a TQFT is known to be equivalent to the data of a fairly simple algebraic object called a “commutative Frobenius algebra”. The goal for this project will be to learn enough about TQFTs and Frobenius algebras to be able to explain this statement and its proof.

2. WHAT GOES INTO THIS

Before doing this project you should understand abstract algebra at the level of *MAT2200 – Groups, Rings and Fields*. You will learn some algebra, topology and category theory. You don’t need to know any physics.

A good place to learn this story is the book *Frobenius algebras and 2D topological quantum field theories* by Joachim Kock.