STRING DIAGRAMS!

You are probably most familiar with proofs that look like paragraphs, but there are other options - sometimes pictures can even be proofs! The kind of pictures I use are called **string diagrams** and they can be used to prove the linear algebra fact that

$$\mathrm{tr}(AB) = \mathrm{tr}(BA)$$

for matrices A and B.

We are going to divide visualization into two projects:

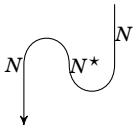
- The flat string diagram board game.
- How do we make cylindrical string diagrams?

1. The flat string diagram board game

There are certain allowable moves for string diagrams and this makes proving things a game with allowable moves as the rules. With this project we want to:

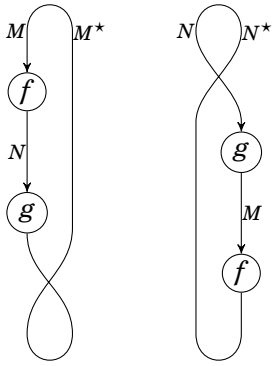
- write down the rules so anyone can play,
- write down a bunch of things to prove, and
- make game pieces.

For examples, one of the rules is that anytime you see



you can replace it with

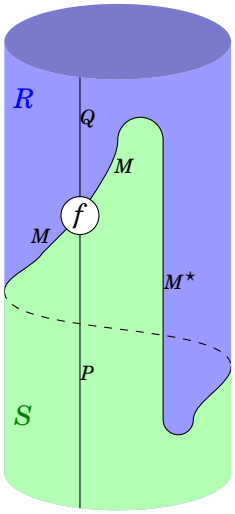
One of the things to show is that we can replace the diagram on the left below by the one on the right using the allowable moves.



We also need to figure out what game pieces we need and what they should look like!

2. How do we make cylindrical string diagrams?

For the math I do, I need to put these string diagrams on cylinders. This makes it harder to explain what is going on to other people - so to make this easier, we'd like to figure out how to make useful 3 dimensional models of these diagrams. The starting point for this project is this diagram



but there are many more...