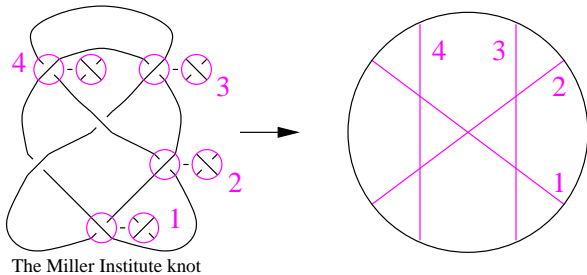


# Knotted Trivalent Graphs, Tetrahedra and Associators

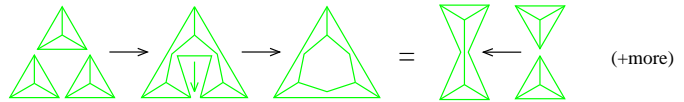
HUJI Topology and Geometry Seminar, November 16, 2000

Dror Bar-Natan

Goal:  $Z: \{\text{knots}\} \rightarrow \{\text{chord diagrams}\} / 4T$  so that

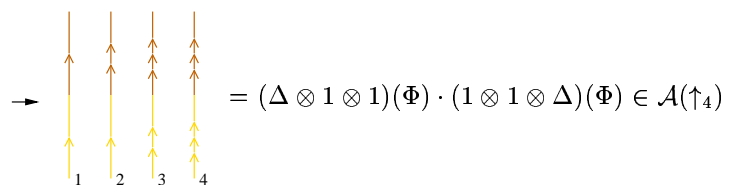
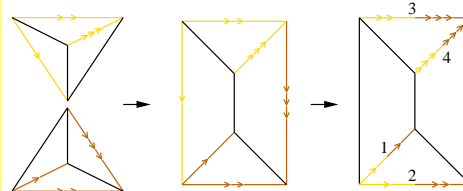
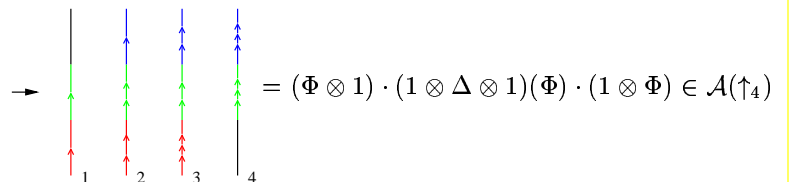
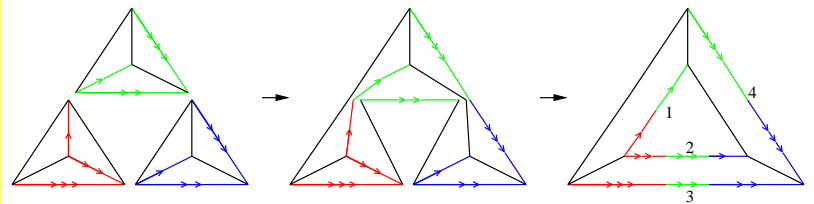
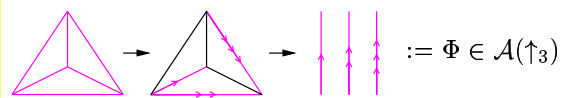


Modulo the relation(s):  $\left( \begin{array}{c} \text{tetrahedron} \\ = \\ \text{tetrahedron} \end{array} \right)$

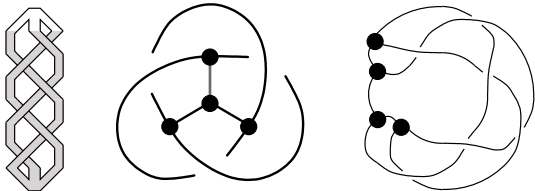


**Claim.** With  $\Phi := Z(\Delta)$ , the above relation becomes equivalent to the Drinfel'd's pentagon of the theory of quasi Hopf algebras.

**Proof.**

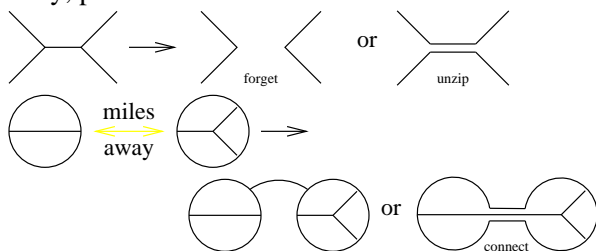


Extend to Knotted Trivalent Graphs (KTG's):

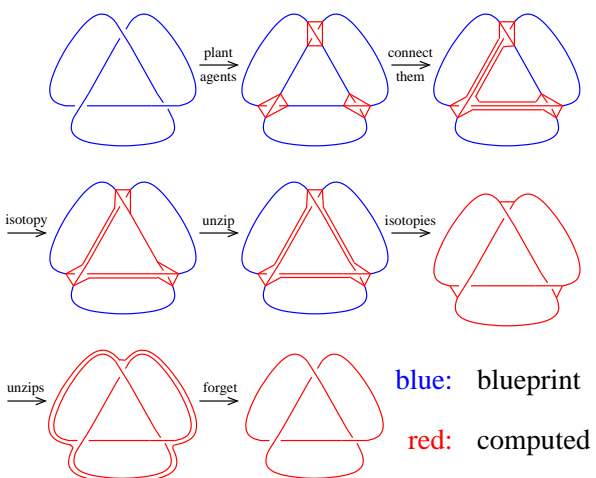


Need a new relation:  $\text{trivalent vertex} + \text{trivalent vertex} + \text{trivalent vertex} = 0$

Easy, powerful moves:



Using moves, KTG is generated by ribbon twists and the tetrahedron  $\Delta$ :



Further directions:

1. Relations with perturbative Chern-Simons theory.
2. Relations with the theory of 6j symbols
3. Relations with the Turaev-Viro invariants.
4. Can this be used to prove the Witten asymptotics conjecture?
5. Does this extend/improve Drinfel'd's theory of associators?

This handout is at <http://www.ma.huji.ac.il/~drorbn/Talks/HUJI-001116>