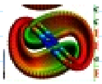
Vienna-1402 Handout on February 1, 2014

February-01-14 11:32 AM

To do. * A word about axial gauge.

* decker set examples:  ✓

— Some example with triple points

Dror Bar-Natan: Talks: Vienna-1402:
ω :=http://www.math.toronto.edu/~drorbn/Talks/Vienna-1402

A Partial Reduction of BF Theory to Combinatorics

Abstract. I will describe a semi-rigorous reduction to computable combinatorics of perturbative BF theory (Cattaneo-Rossi [CR]), in the case of ribbon 2-links. Also, I will explain how and why my approach may or may not work in the non-ribbon case. Weak this result is, and at least partially already known (Watanabe [Wa]). Yet in the ribbon case, the resulting invariant is a universal finite type invariant, a gadget that significantly generalizes and clarifies the Alexander polynomial and that is closely related to the Kashiwara-Vergne problem. I cannot rule out the possibility that the corresponding gadget in the non-ribbon case will be as interesting.

(good news highlighted)

BF Following [CR]. $A \in \Omega^1(M = \mathbb{R}^4, \mathfrak{g})$, $B \in \Omega^2(M, \mathfrak{g}^*)$,

$$S(A,B) := \int_M \langle B, F_A \rangle.$$

With $f\colon (S = \mathbb{R}^2) \to M$, $\xi \in \Omega^0(S, \mathfrak{g})$, $\beta \in \Omega^1(S, \mathfrak{g}^*)$, set

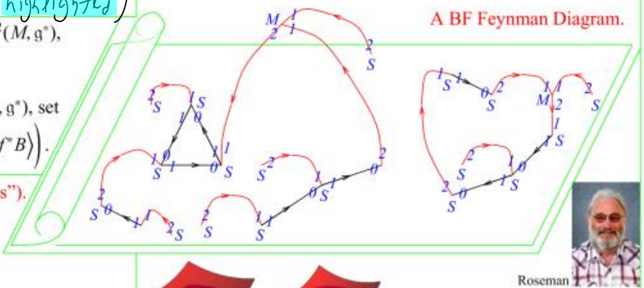
$$O(A,B,f) := \int \mathcal{D}\xi\mathcal{D}\beta \exp\left(\frac{i}{\hbar}\int_S \langle \xi, d_{f^*A}\beta + f^*B \rangle\right).$$

The BF Feynman Rules.

Put words here!

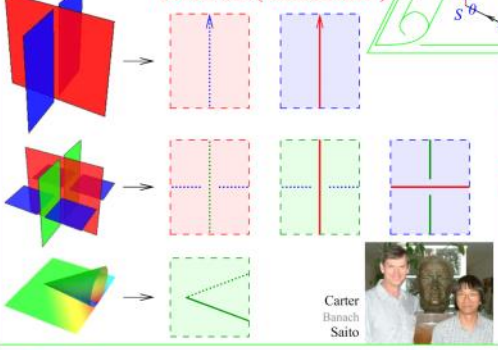
Cattaneo Rossi

A BF Feynman Diagram.



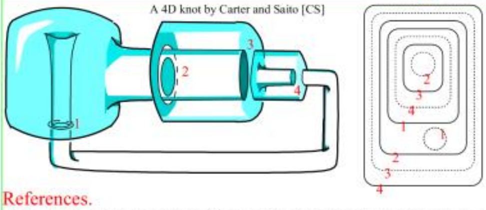
Roseman

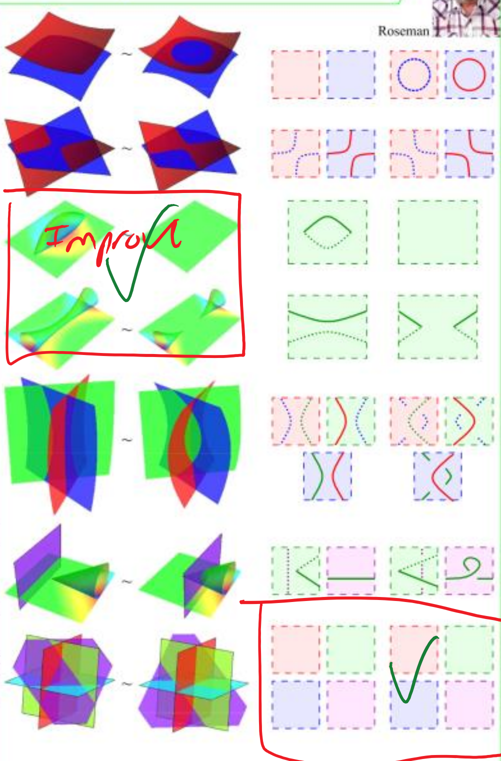
Decker Sets ("Gauss Codes").



Carter Banach Saito

A 4D knot by Carter and Saito [CS]





Improve

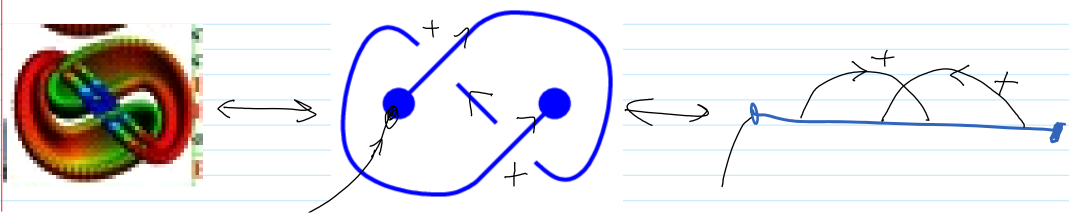
finish

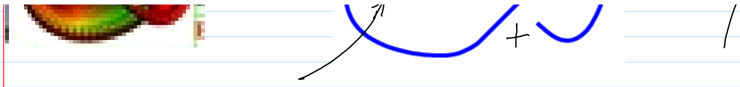
References.

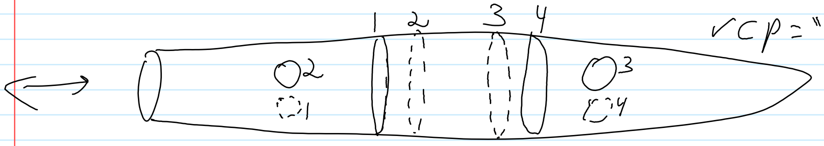
[CS] J. S. Carter and M. Saito, *Knotted surfaces and their diagrams,* Mathematical Surveys and Monographs **55**, American Mathematical Society, Providence 1998.

[CR] A. S. Cattaneo and C. A. Rossi, *Wilson Surfaces and Higher Dimensional Knot Invariants,* Commun. in Math. Phys. **256-3** (2005) 513–537, arXiv:math-ph/0210037.

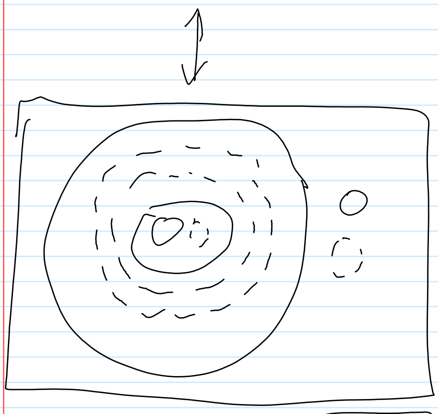
[Wa] T. Watanabe, *Configuration Space Integrals for Long n-Knots, the Alexander Polynomial and Knot Space Cohomology,* Alg. and Geom. Top. **7** (2007) 47-92, arXiv:math/0609742.





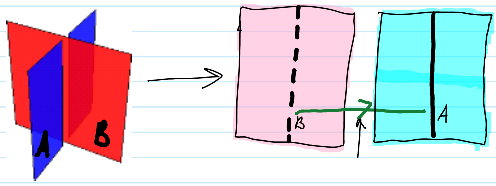


rcp = "ribbed cigar presentation"



Axial gauge / ribbon knots:

1. "drop down" red propagators:



2. No M-trivalent vertices
3. No need for "black cycles"

2nd example: