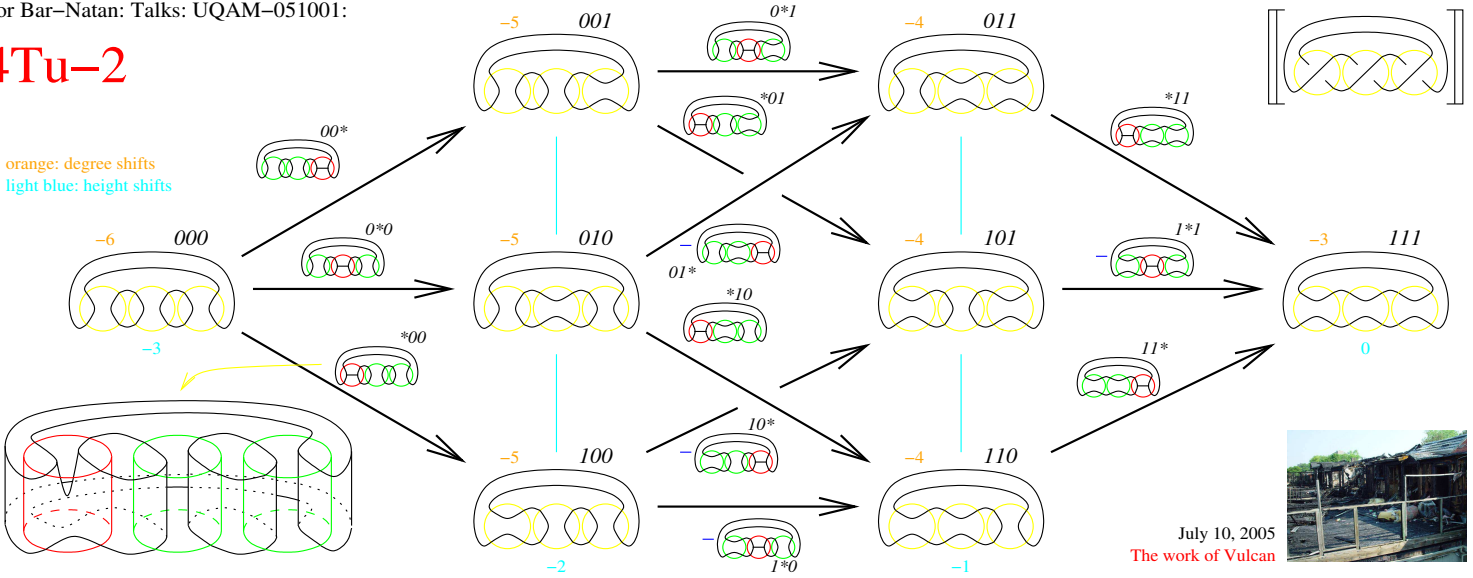


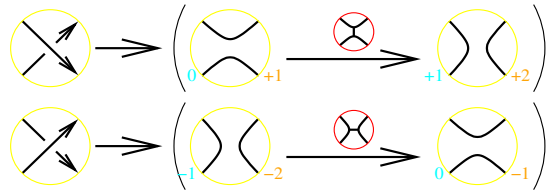
# 4Tu-2

orange: degree shifts  
light blue: height shifts

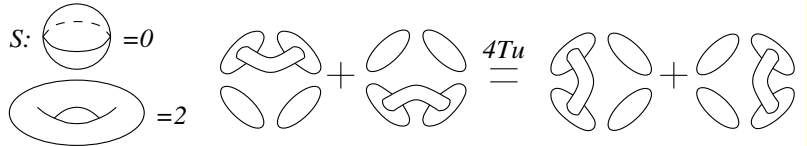


July 10, 2005  
The work of Vulcan

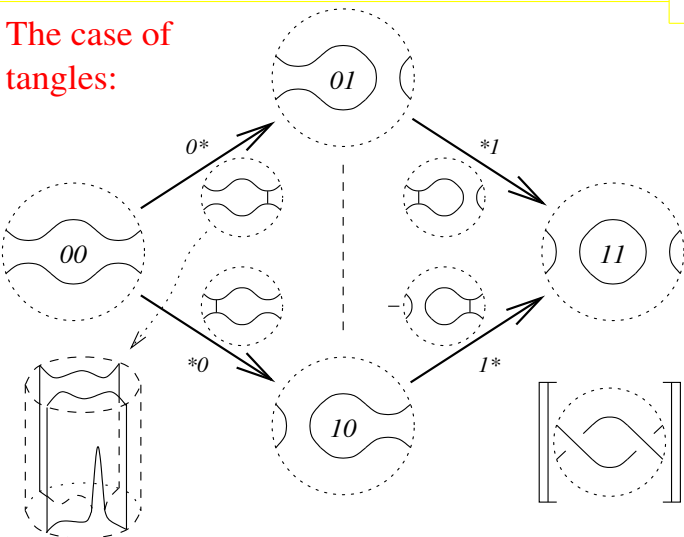
## General Crossings



Where does it live? In  $Kom(Mat(\langle Cob \rangle / \{S, T, 4Tu\}) / \text{homotopy})$   
 Kom: Complexes Mat: Matrices Cob: Cobordisms  $\langle \dots \rangle$ : Formal lin. comb.



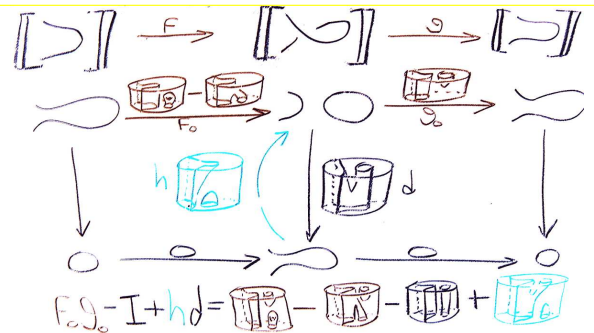
## The case of tangles:



## Invariant!



Kurt Reidemeister



The Reduction Lemma. If  $\phi$  is an isomorphism then the complex

$$[C] \xrightarrow{\begin{pmatrix} \alpha \\ \beta \end{pmatrix}} \begin{bmatrix} b_1 \\ D \end{bmatrix} \xrightarrow{\begin{pmatrix} \phi & \delta \\ \gamma & \epsilon \end{pmatrix}} \begin{bmatrix} b_2 \\ E \end{bmatrix} \xrightarrow{(\mu \ \nu)} [F]$$

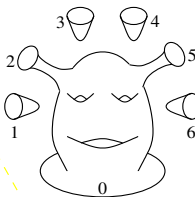
is isomorphic to the (direct sum) complex

$$[C] \xrightarrow{\begin{pmatrix} 0 \\ \beta \end{pmatrix}} \begin{bmatrix} b_1 \\ D \end{bmatrix} \xrightarrow{\begin{pmatrix} \phi & 0 \\ 0 & \epsilon - \gamma\phi^{-1}\delta \end{pmatrix}} \begin{bmatrix} b_2 \\ E \end{bmatrix} \xrightarrow{(0 \ \nu)} [F]$$

## The work of Naot.

$\langle \text{surfaces} \rangle / 4Tu$  is freely generated by Shrek surfaces

A Shrek surface with 7 boundaries (one distinguished), 3 handles and 2 tubes



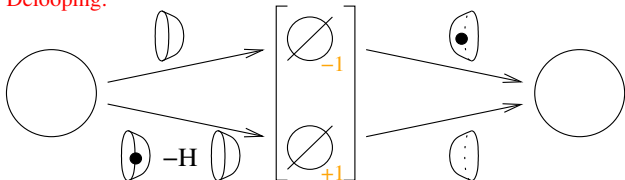
Gad Naot



שרעק

Let  $\bullet$  denote a tube to the distinguished component (the curtain), and let  $H$  denote a handle on the curtain. Then

### Delooping:



... so the invariant is valued in complexes over a category with just one object and morphisms in  $\mathbb{Z}[H]$ ; all is graded and  $\text{deg}H = -2$ .

## The work of Green.

standard data:

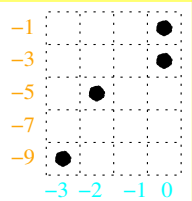


Jeremy Green

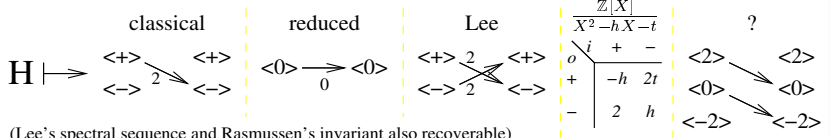
The universal invariant of the left-handed trefoil is

$$-3 \mid \frac{\square}{H} \mid -2 \mid -6 \mid -1 \mid 0 \mid -2$$

(and the invariant of the 48 crossing  $T(8,7)$  is computable in minutes...)



## Some functors.



(Lee's spectral sequence and Rasmussen's invariant also recoverable)

<http://www.math.toronto.edu/~drorbn/Talks/UQAM-051001/>