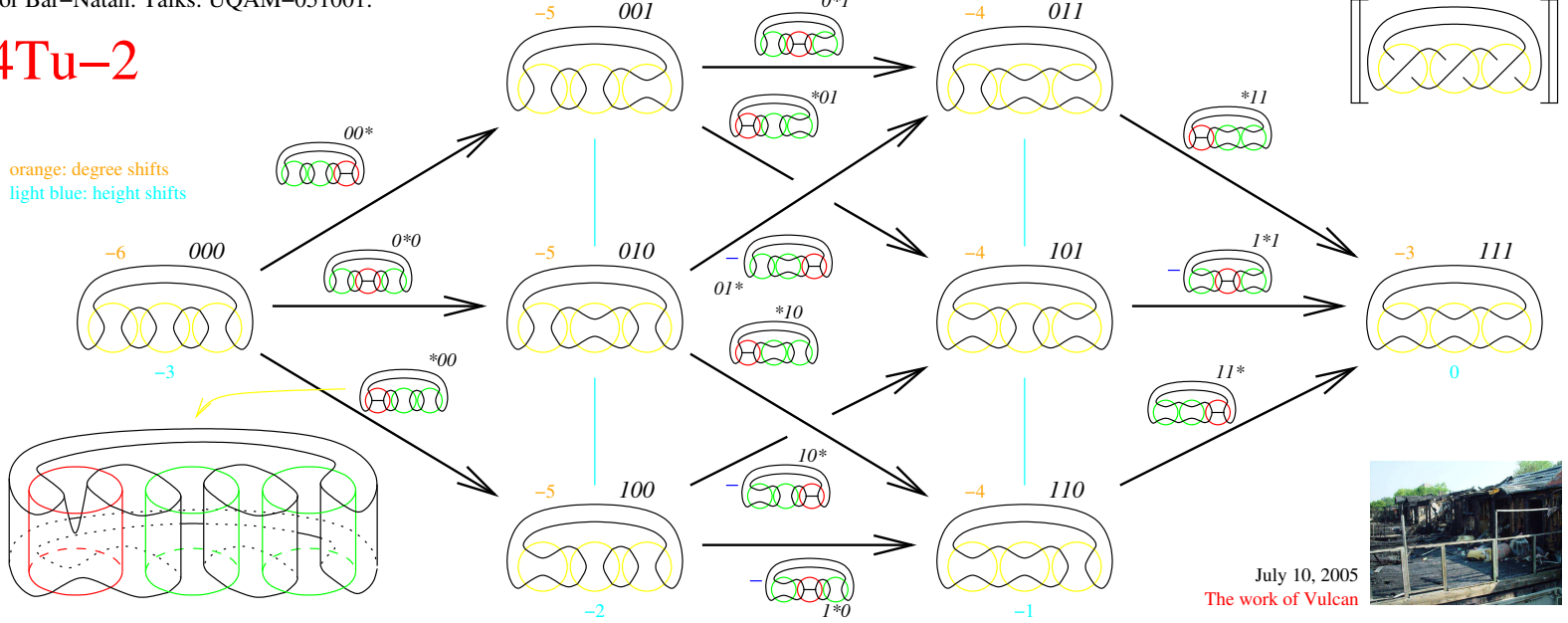
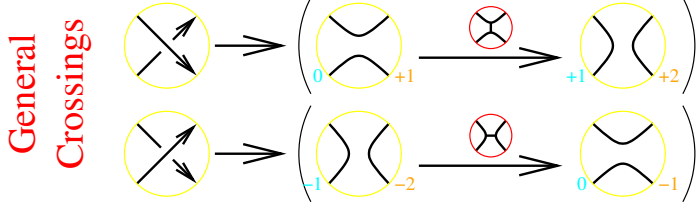


4Tu-2

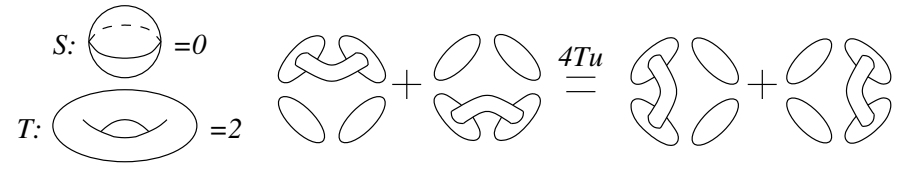
orange: degree shifts
light blue: height shifts



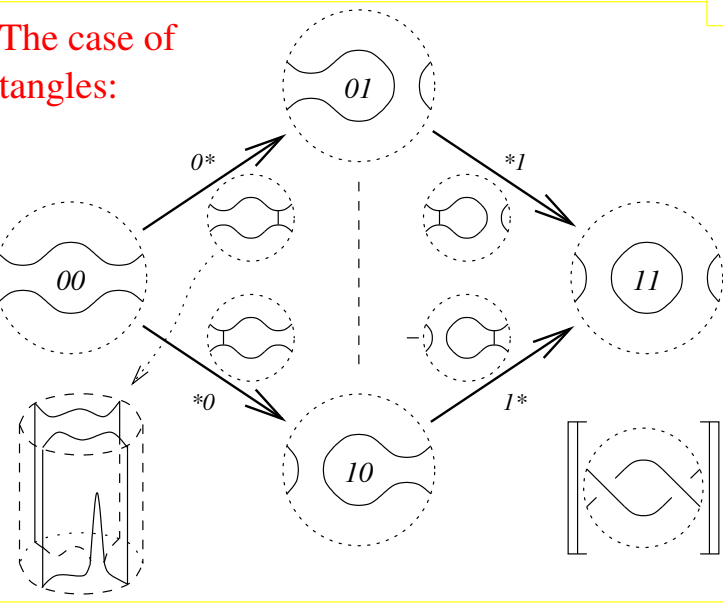
July 10, 2005
The work of Vulcan



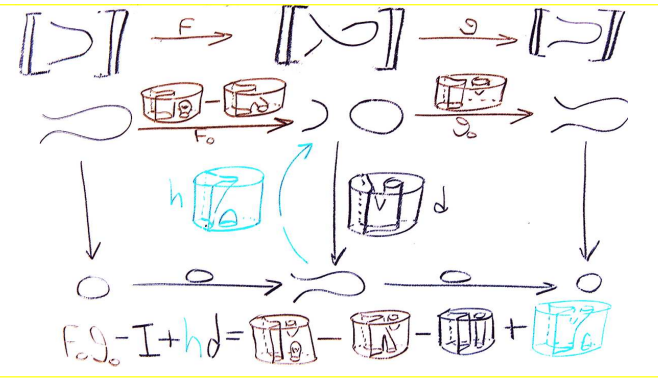
Where does it live? In $Kom(Mat(\langle Cob \rangle / \{S, T, 4Tu\})) / \text{homotopy}$
 Kom: Complexes Mat: Matrices Cob: Cobordisms $\langle \dots \rangle$: Formal lin. comb.



The case of tangles:



Invariant!



The Reduction Lemma. If ϕ is an isomorphism then the complex

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

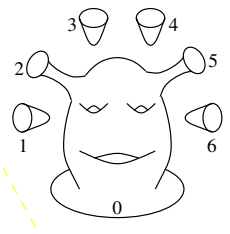
is isomorphic to the (direct sum) complex

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

The work of Naot.

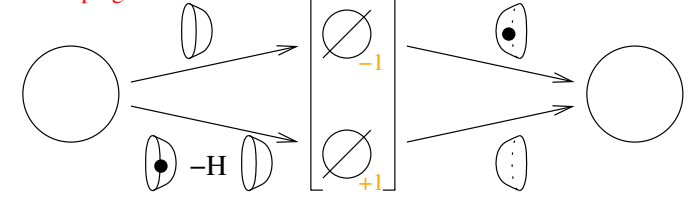
$\langle \text{surfaces} \rangle / 4Tu$ is freely generated by Shrek surfaces

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



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 $Z[H]$; all is graded and $\text{deg}H = -2$.

The work of Green.

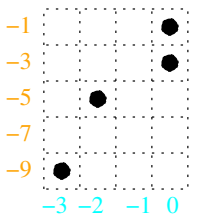
standard data:



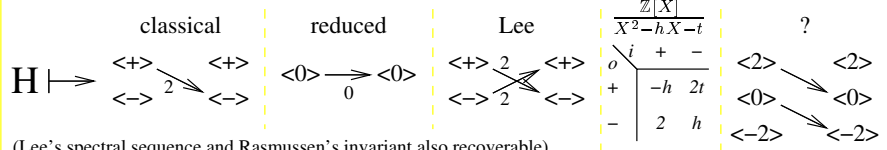
The universal invariant of the left-handed trefoil is

$$\begin{array}{c} \begin{array}{c} \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \end{array} \\ \begin{array}{c} \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \end{array} \end{array} \xrightarrow{H} \begin{array}{c} \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \end{array} \xrightarrow{0} \begin{array}{c} \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \end{array} \xrightarrow{0} \begin{array}{c} \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \end{array}$$

(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)