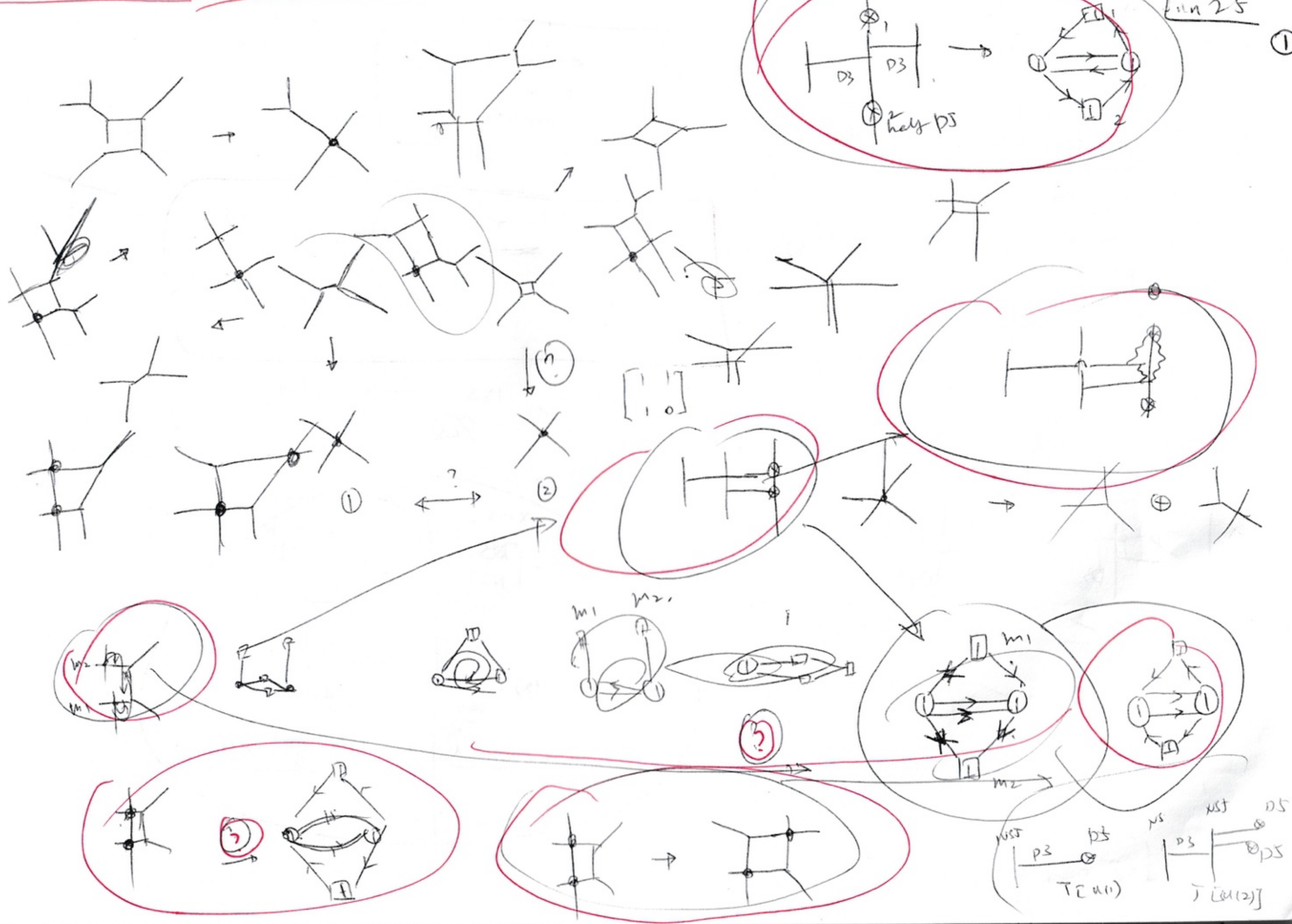
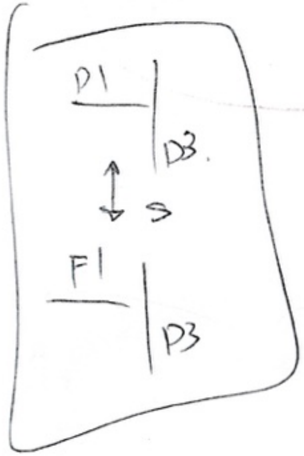
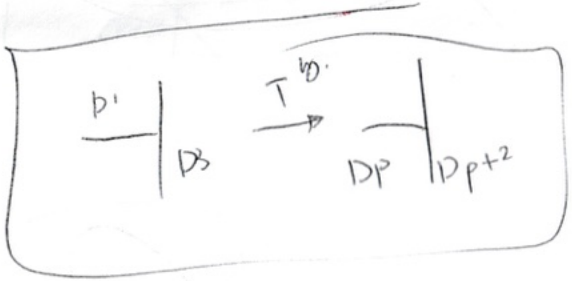
Sishii 2023 | + ~~little~~ some Shanghai



Jun 28

$F1 \overset{S}{\leftrightarrow} D1$

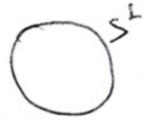




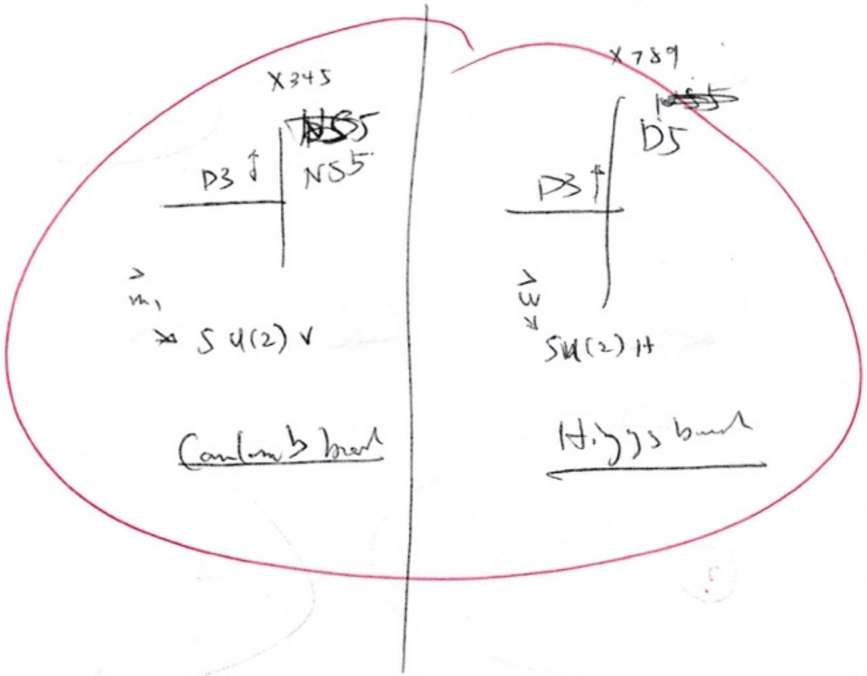
$D(p-1) \longleftrightarrow Dp$

wrap on S^2.

Dp on S^2 $\xrightarrow{T}$ D(p-1) un wrapped

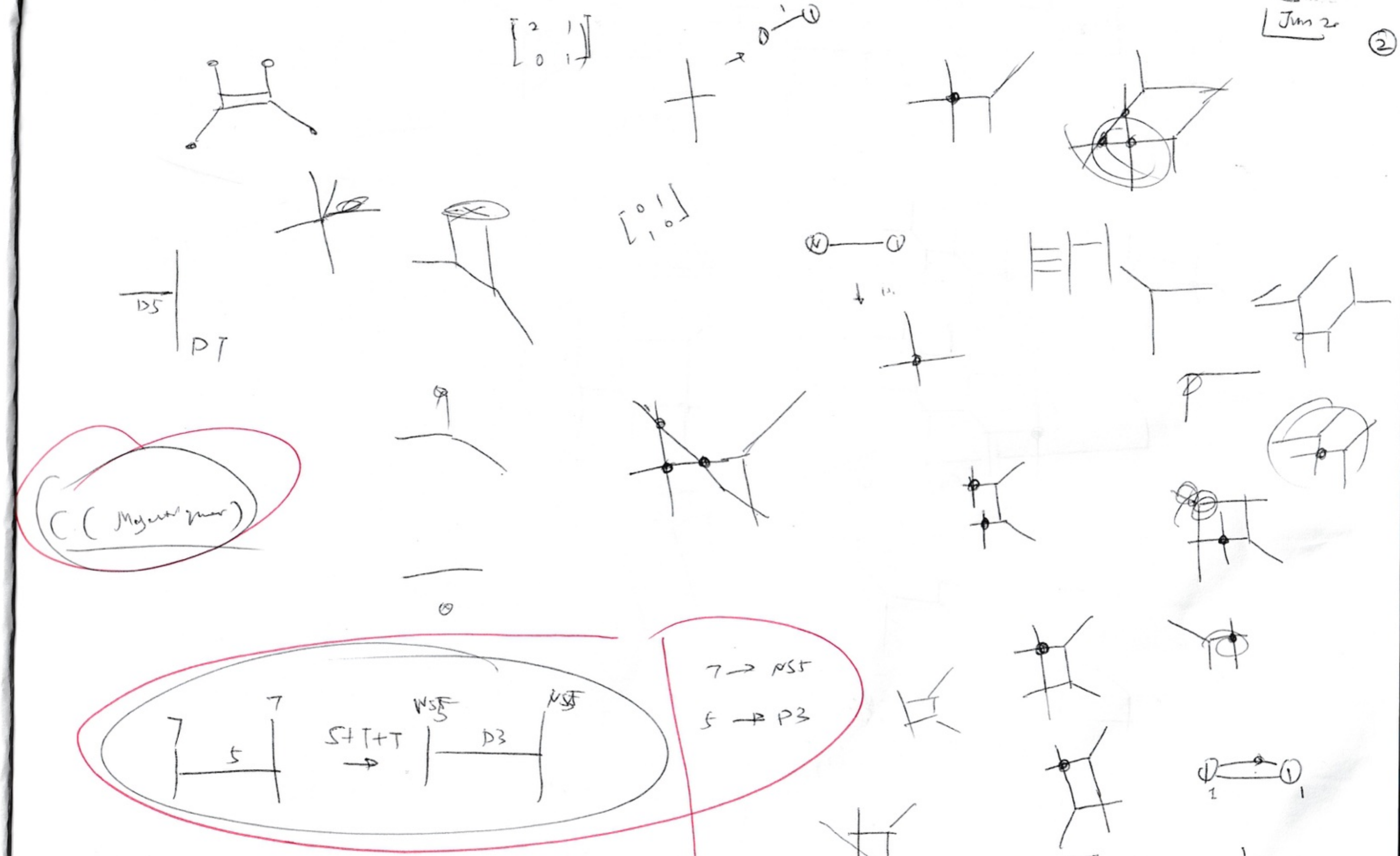


for ex: $D5 \xrightarrow[T]{/S^2} D4$.



Jun 2

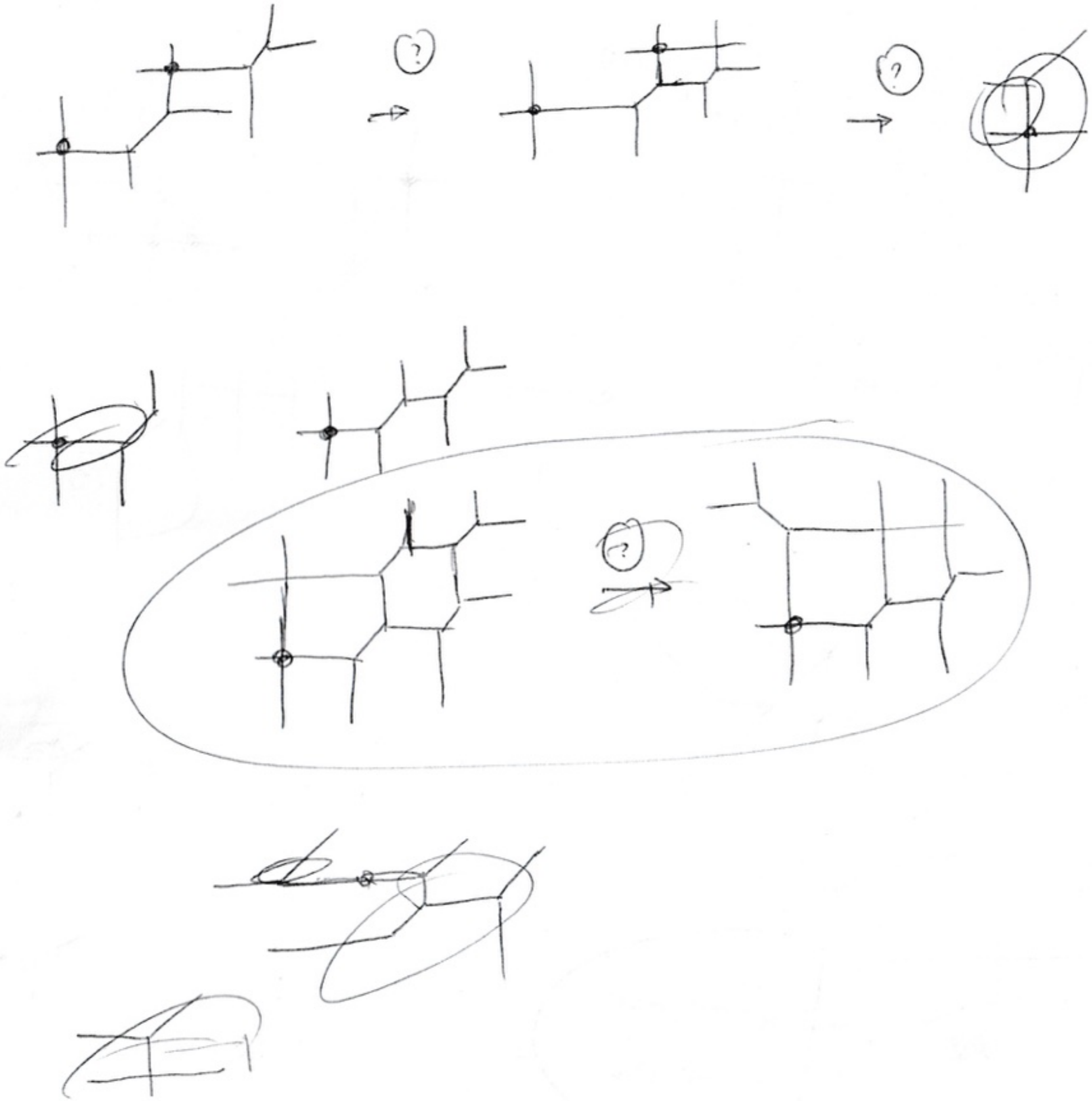
②



$k_{eff} = \boxed{1} = k + 2 \times \frac{1}{2} = 1$

$\boxed{k = 0}$

Jun 2



Jun 28

Codim 2 defect K on M.

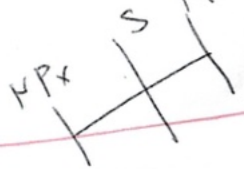
Φ_{adj} ⟳ (N_2) k=1 ⟷ ϕ_i $i = 1, \dots, N_c - 1$

SU(N) (N−1)

~~U(1)$_{N_c}$ − N_c) − k~~

SU(2) + 1 Φ_{adj} ⟷ 1 Φ

T[S^3]

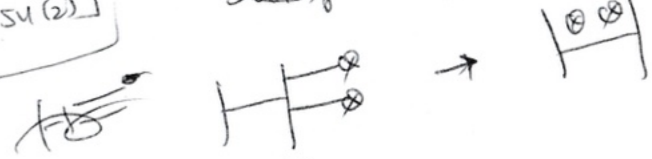


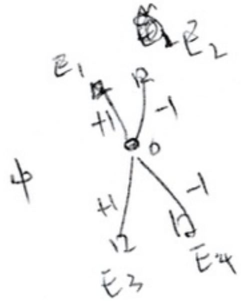
Z∅

Jun 27

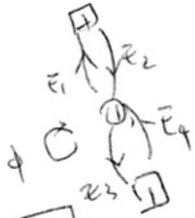
T[SU(2)]

$U(1)_0 + 2\,H$



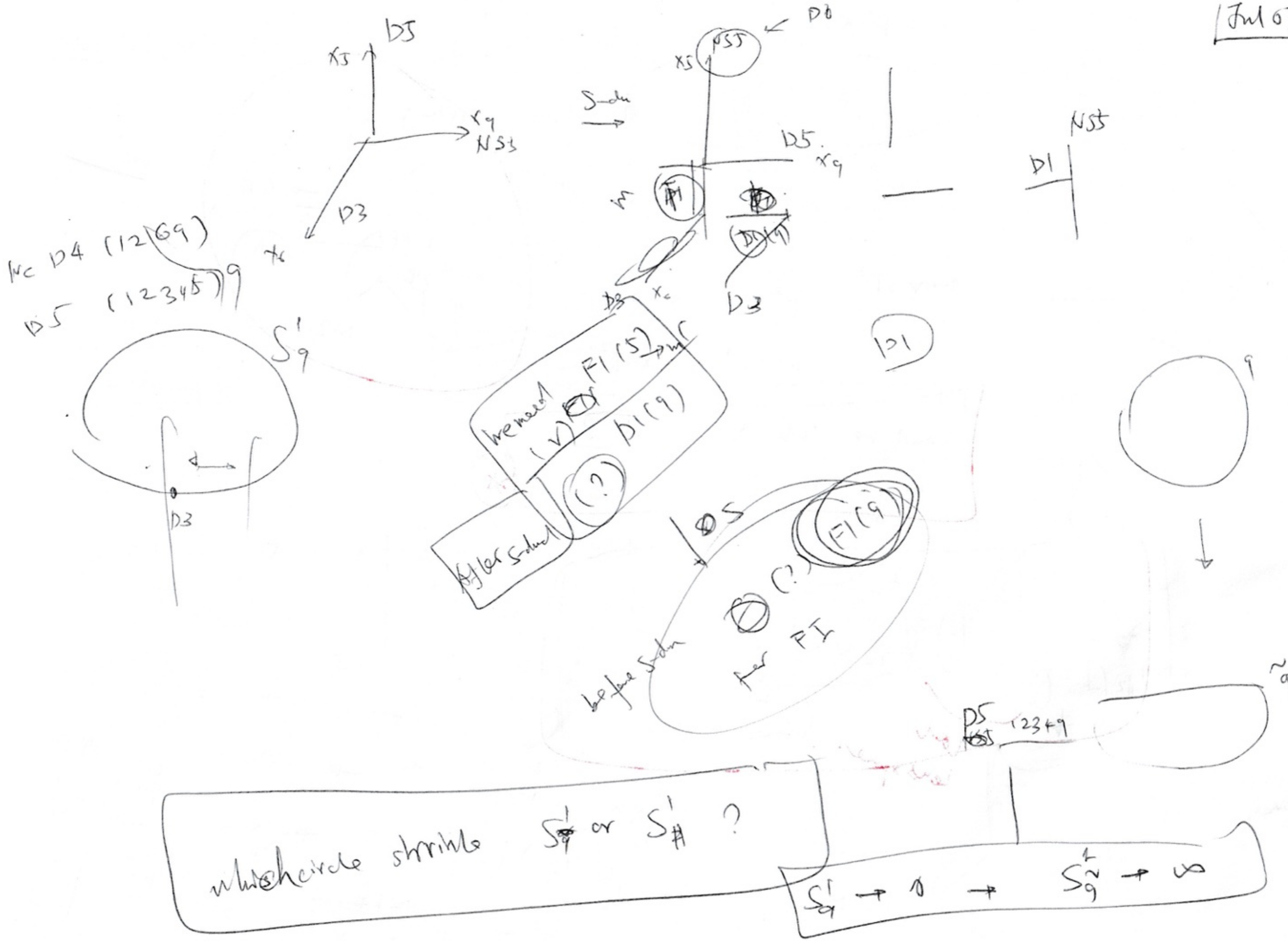


$W = \phi E_1 E_2 + \phi E_3 E_4$

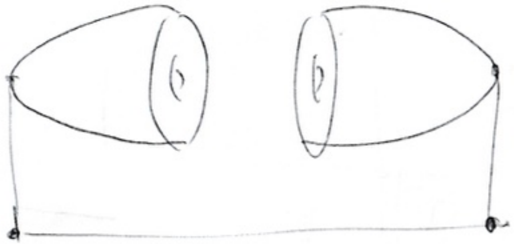


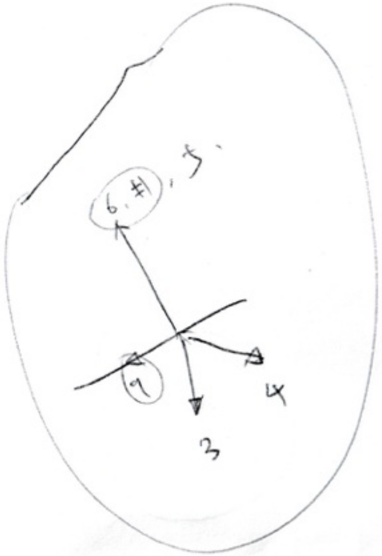
$Z_{T[S^3]} = \frac{1}{\sqrt{N}} \prod_{j=2}^{N} S_b(j\epsilon)$

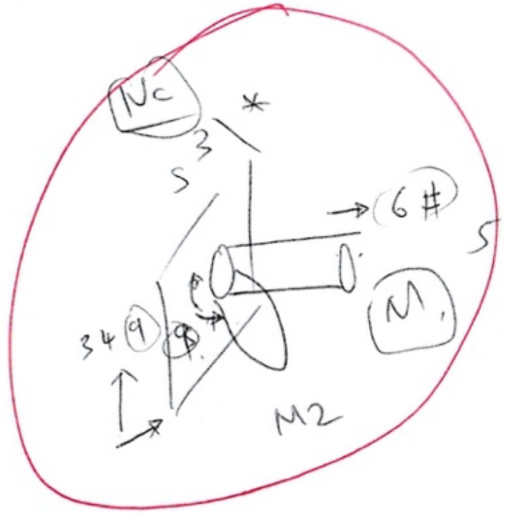
→ $T(\rho\epsilon)^2$


D5
X5
X9
NS3
D3
X6
S-du
D8
NS5
D5
X9
m
F1
D1(9)
D3
X6
D1
NS5
NC D4 (1269)
D5 (12345) 9
S^1_9
D3
we need F1(5) → m
(V)
D1(9)
(?)
After S-dual
D1
9
D5
F1(9)
(?)
for F1
before S-du
~9
D5
NS5
12349
which circle shrink S^1_9 or S^1_A ?
S^1_9 → 0 → $S^1_{\tilde 9}$ → ∞

$D^2 \times S^1$







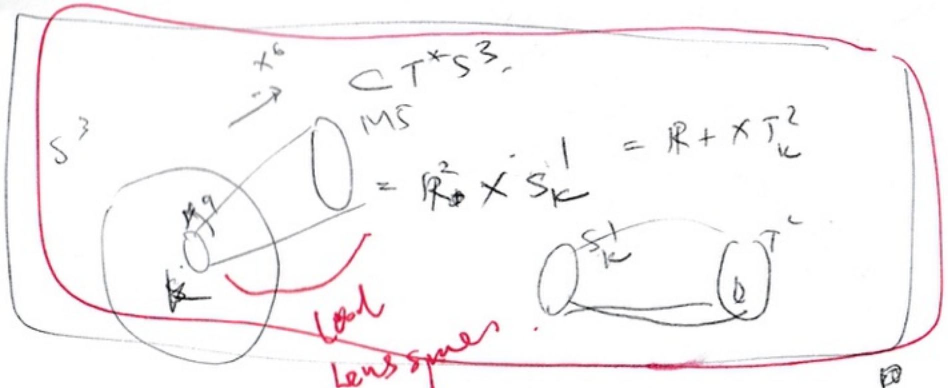
~~R+×~~ T^2

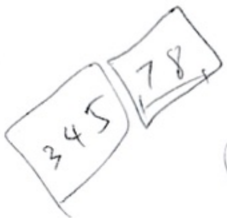
$D^2 = I \times S^1$

$D^2 \times S^1 = I \times T^2$

Could we make S^1_q small?

by deforming $L(k,1)$? ✱





MM5 P 12 | 6 9 # → MD3

N MM5(S^3) 12 | 3 4 9, → $N^{\times}_k$ S5.

~~D6~~ D0(#) → D6 → D5.

S-M → MD3 → N D5 → L M

$\begin{bmatrix} -S^1_q \\ S^1_\# \end{bmatrix}$ $\quad \partial(\mathring{M} \setminus k) = T^2$

NSS $\quad \tilde{S}^1_\#$

def ↓

NSS $\quad \tilde{S}^1_\# = k S^1_q + S^1_\#$

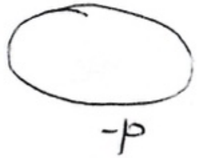
$S^1_\# \cdot S^1_\# = k S^1_q \cdot S^1_\# = k$

k → framing #

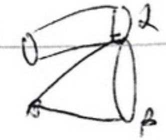
consistent (✓)

$L(k,1) = S^3/\mathbb{Z}_k$

$\pi_1(S^3/\mathbb{Z}_k) = \mathbb{Z}_k$



$L(k,1)$



$\begin{bmatrix} -1 & 0 \\ k & 1 \end{bmatrix}$

5n1 08

$L(2,1) = \mathbb{R}P^3 = S^3/\mathbb{Z}_2$

2n1 09

$L(1,q) = S^3$

$L(0,1) \sim S^2 \times S^1$ → $k = 0$

$L(2,1) \sim \mathbb{R}P^3$

$L(1,0) = S^3$

$L(1,0) = L(1, 0 + q \cdot 1)$

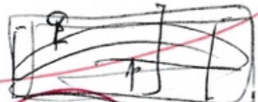
$= L(1, q)$

$L(-1,1)$

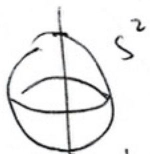
$L(1,1) = S^3/\mathbb{Z}_1$

S^3

$k = \pm 1$

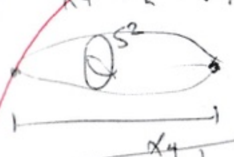


S^3



$= I \times S^1$

$x_4 : [-r, r]$ } S^3



$gen(S^3) = 0$

$x_1^2 + x_2^2 + x_3^2 + x_4^2 = r^2$

$x_4 = 0 \quad x_1^2 + x_2^2 + x_3^2 = r^2 \; : S^2$

$x_1^2 + x_2^2 + x_3^2 = r^2 - x_4^2 \; : S^2(x_4)$

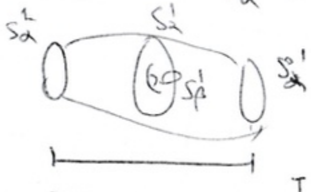
$L(1,q) = L(-1,1) = L(1,1) = S^3$

$k = 1/q = \pm 1 \; (q = 1)$ $\quad \pm \frac{1}{2} \; (q=2)$

$\begin{bmatrix} -1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} S^1_q \\ S^1_\# \end{bmatrix} = \begin{bmatrix} -S^1_q \\ S^1_q + S^1_\# \end{bmatrix}$

$L(0,1) = S^1 \times S^2$

$= S^1_\alpha \times [I \times S^1_\beta]$

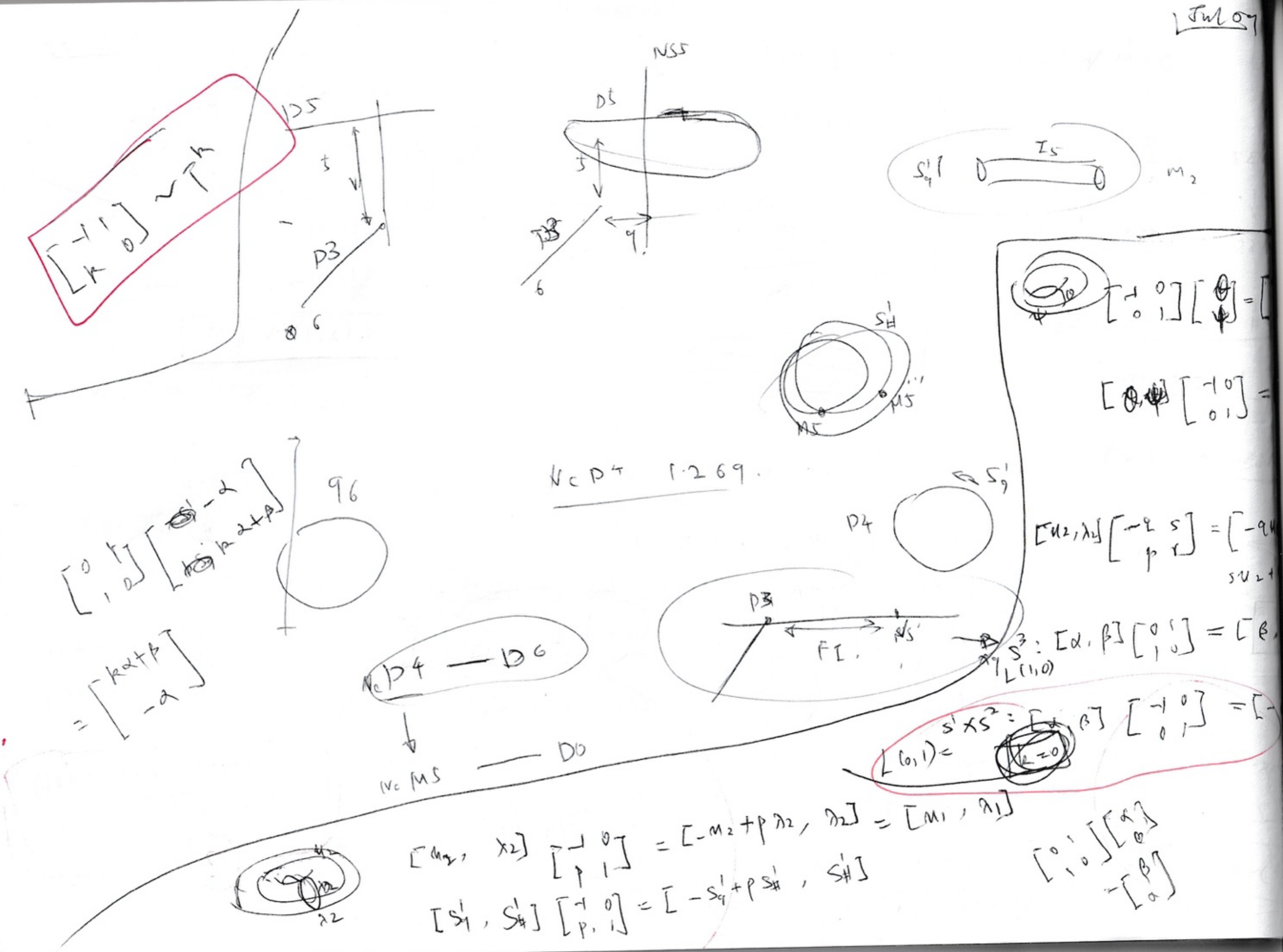


$gen(S^1 \times S^2) = 1$

$L(p,q) = L(p, q + kp)$

$= L(-p, q)$

?


Jul 07
D5
t
V
D3
6
NS5
D5
5
D3
9
6
S^1_q
I_5
M_2
$\begin{bmatrix} -1 & 1 \\ k & 0 \end{bmatrix} \sim T^k$
$\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$
$\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$
S^1_H
M5
M5
96
Nc D4 1.269.
S^1_q
D4
$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$
$= \begin{bmatrix} k\alpha+\beta \\ -\alpha \end{bmatrix}$
$[M_2, \lambda_2] \begin{bmatrix} -q & s \\ p & r \end{bmatrix} =$
D3
FI.
NS
S^3 : $[\alpha, \beta] \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} = [\beta,$
L(1,0)
Nc D4 — D6
Nc M5 — D0
$S^1 \times S^2$: $[\alpha, \beta] \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} =$
L(0,1) =
k=0
$[M_2, \lambda_2] \begin{bmatrix} -1 & 0 \\ p & 1 \end{bmatrix} = [-M_2 + p\lambda_2, \lambda_2] = [M_1, \lambda_1]$
$[S^1_q, S^1_H] \begin{bmatrix} -1 & 0 \\ p & 1 \end{bmatrix} = [-S^1_q + pS^1_H, S^1_H]$
λ_2
$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} \alpha \\ \beta \end{bmatrix} = \begin{bmatrix} \beta \\ \alpha \end{bmatrix}$

$k_{eff} = 0 + \frac{1}{2} + \frac{1}{2}$

$= 0 + \frac{\mathrm{sign}(m_F)}{2} + \frac{1}{2}\,\mathrm{sign}(m_{AF})$

$k_{eff} = 0 + \frac{1}{2} + \frac{1}{2} = 1$ $\begin{cases} m_F > 0 \\ m_{AF} < 0. \end{cases}$

$k_{eff} = 0$ $\begin{cases} m_F > 0 \\ m_{AF} > 0 \end{cases}$

$k_{eff} = 0 = k - \frac{1}{2}$

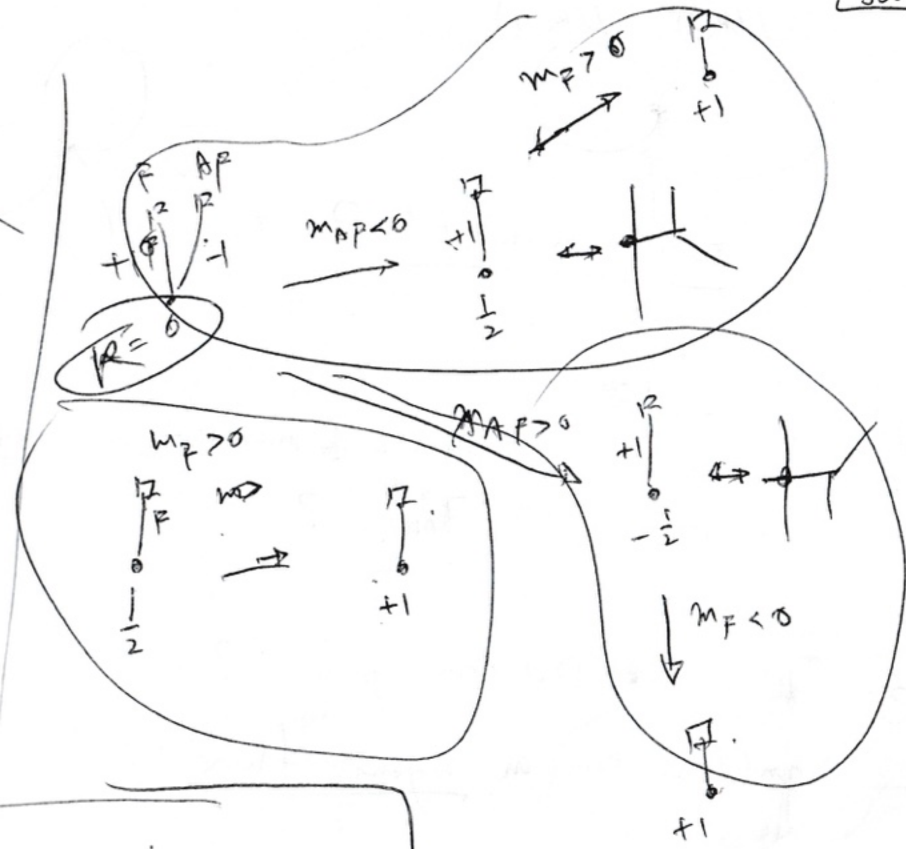
$k = \frac{1}{2}$

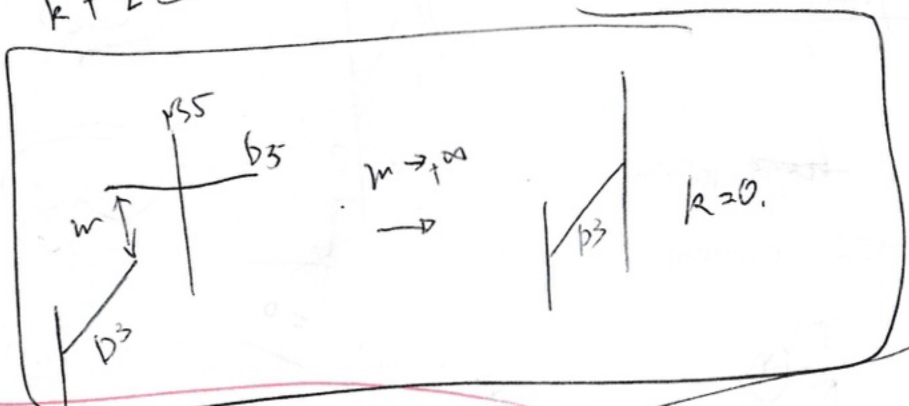
$k + \frac{1}{2} + \frac{1}{2} = 1$

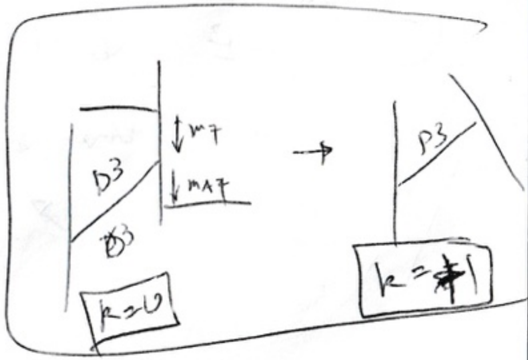
$k_{eff} = +1$

$= k + \frac{1}{2} = 1$

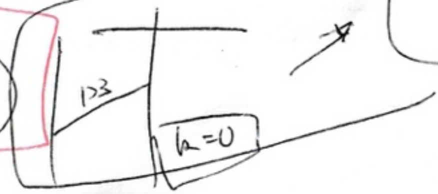
$k = \frac{1}{2}$



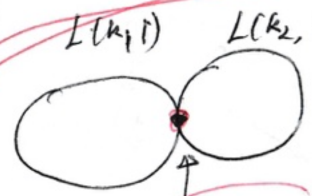




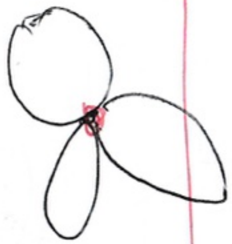
What is the decoupling of defect D5 in terms of terms space in M-theory (?)



1



Is this bifurcated?



2

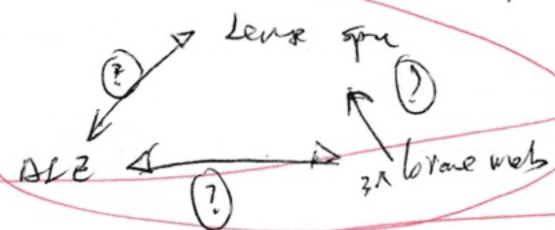
Is there a ~~for~~ micro ... brane web in T^2_{AH} ?

3 Where the D0 come from, ?

Should we turn on magnetic flux ?

4 3d ALE D^2/Γ_{ADE}, ~~have~~ non-Abelian has matter ?
3d N=2 4

what is the ~~relation~~ correspondence between



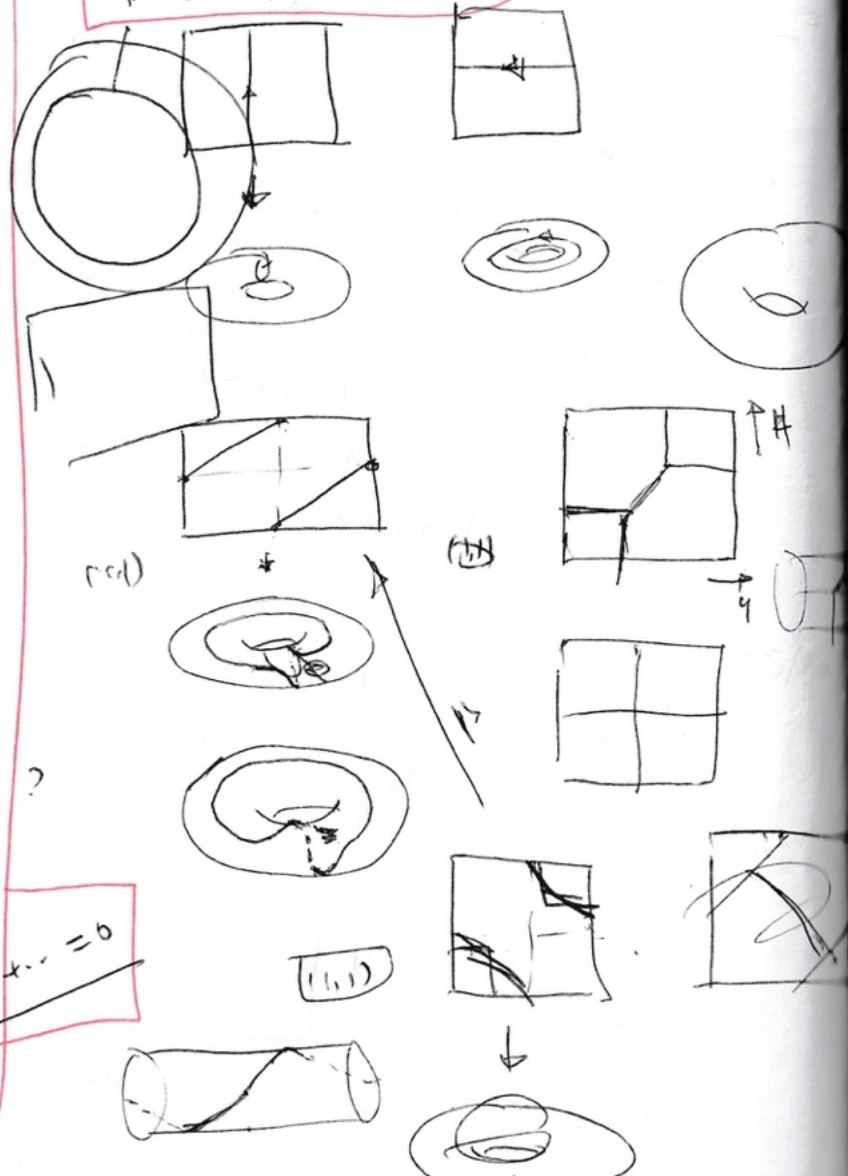
$x^k P_n(\cdots) + \cdots = 0$

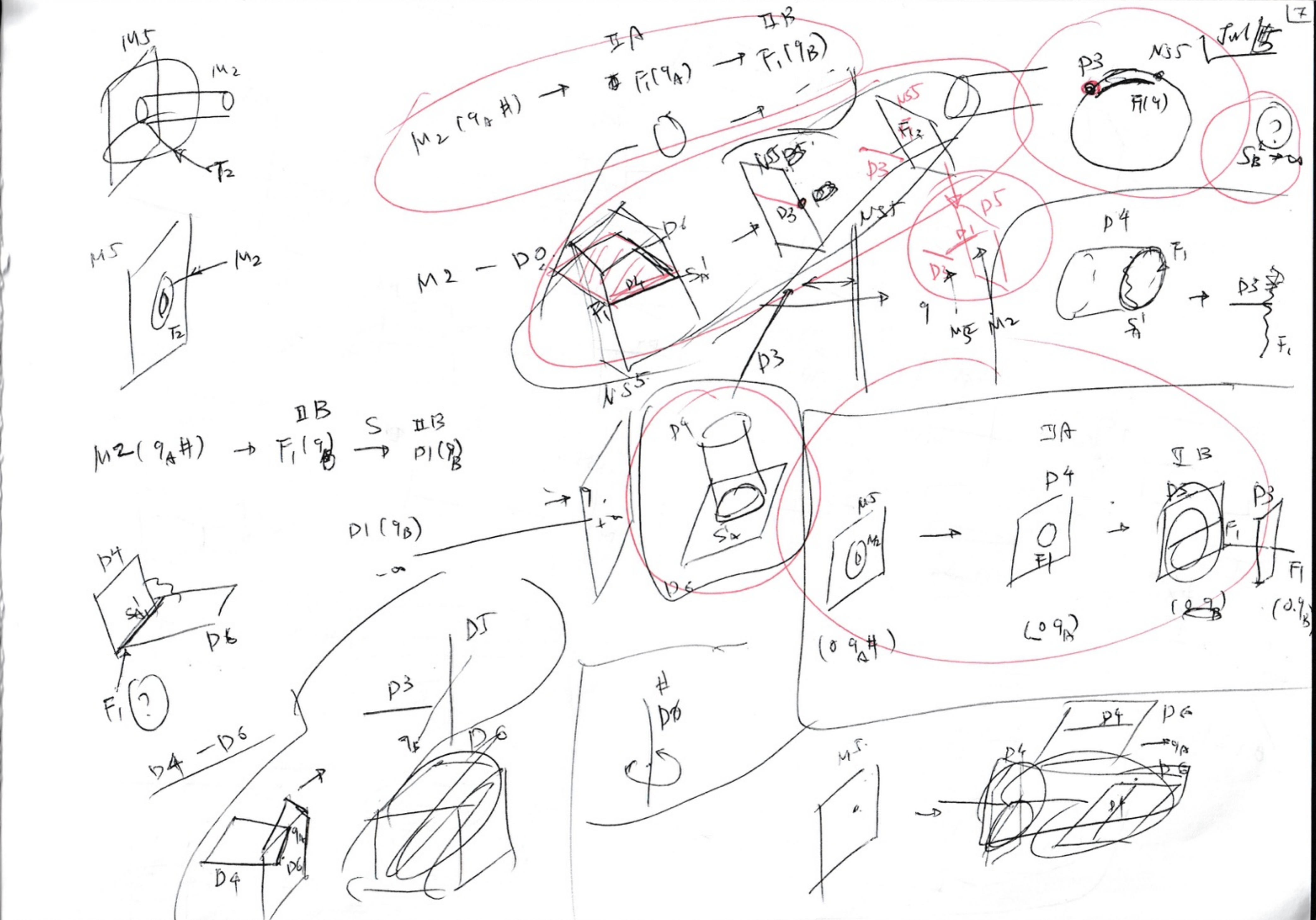
K3

D1 (9) $\xrightarrow{S}$ F1 (9).

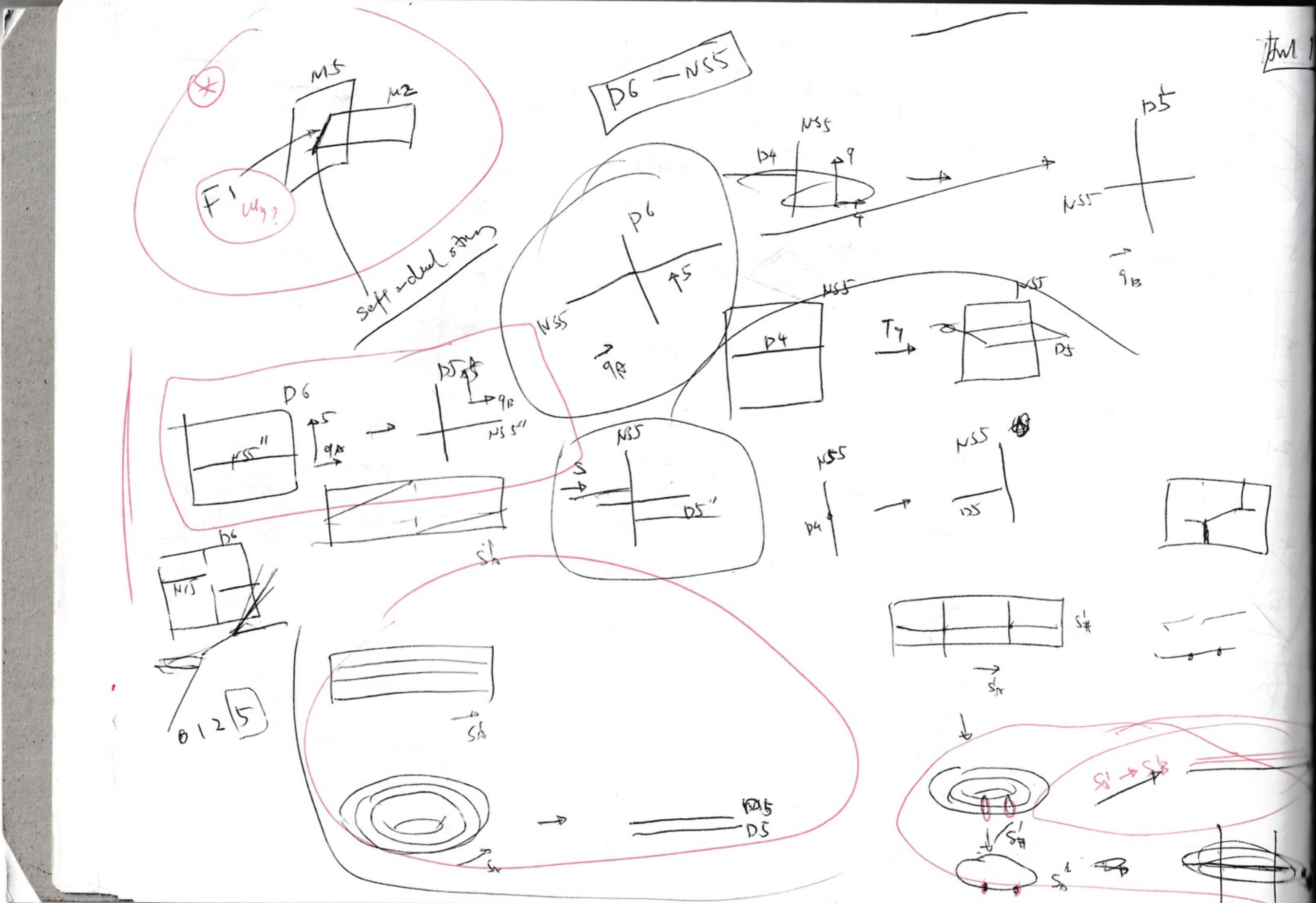
D4 − D6 F1 9 D3 NS5

M2 (9 H) → F1 (9)



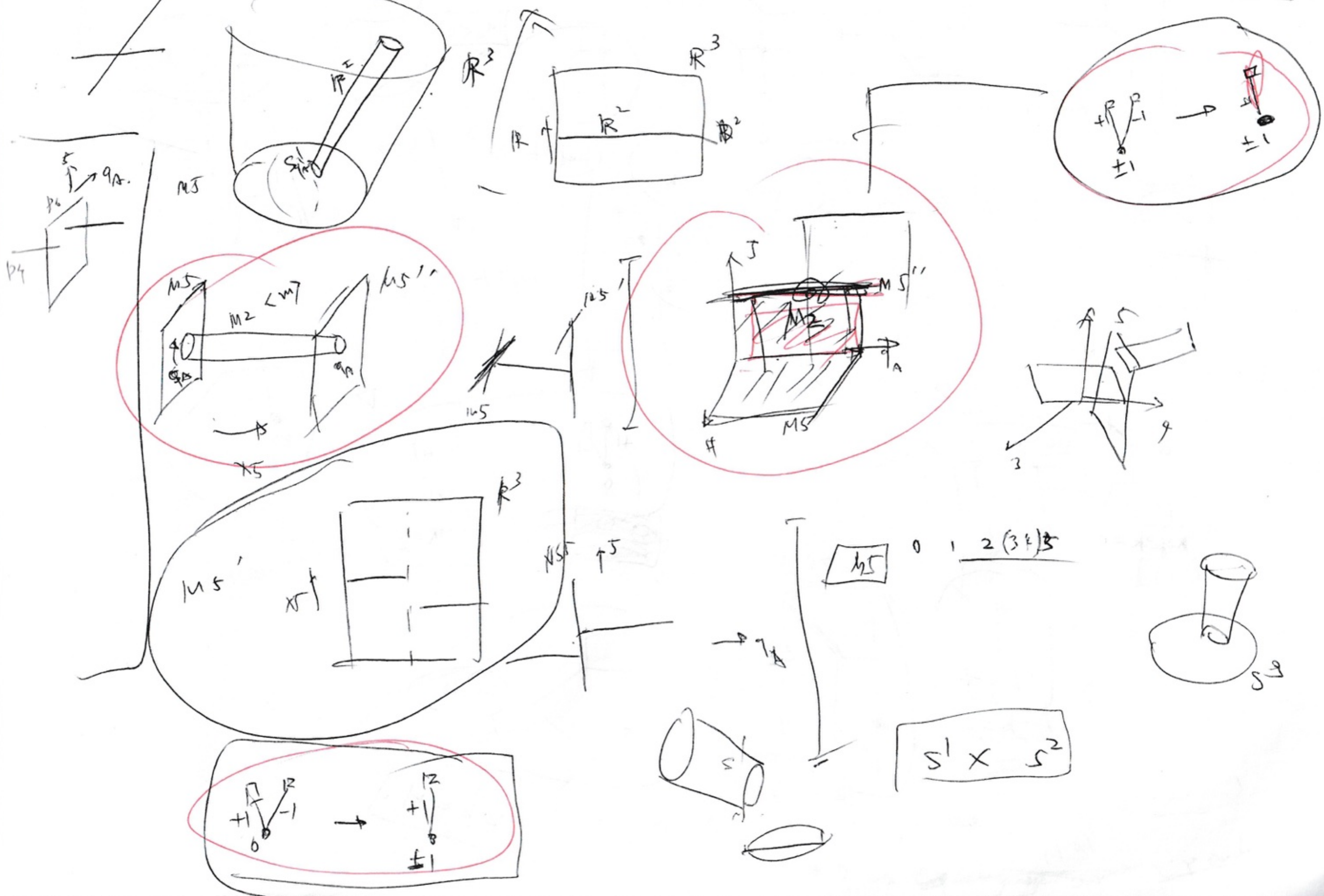


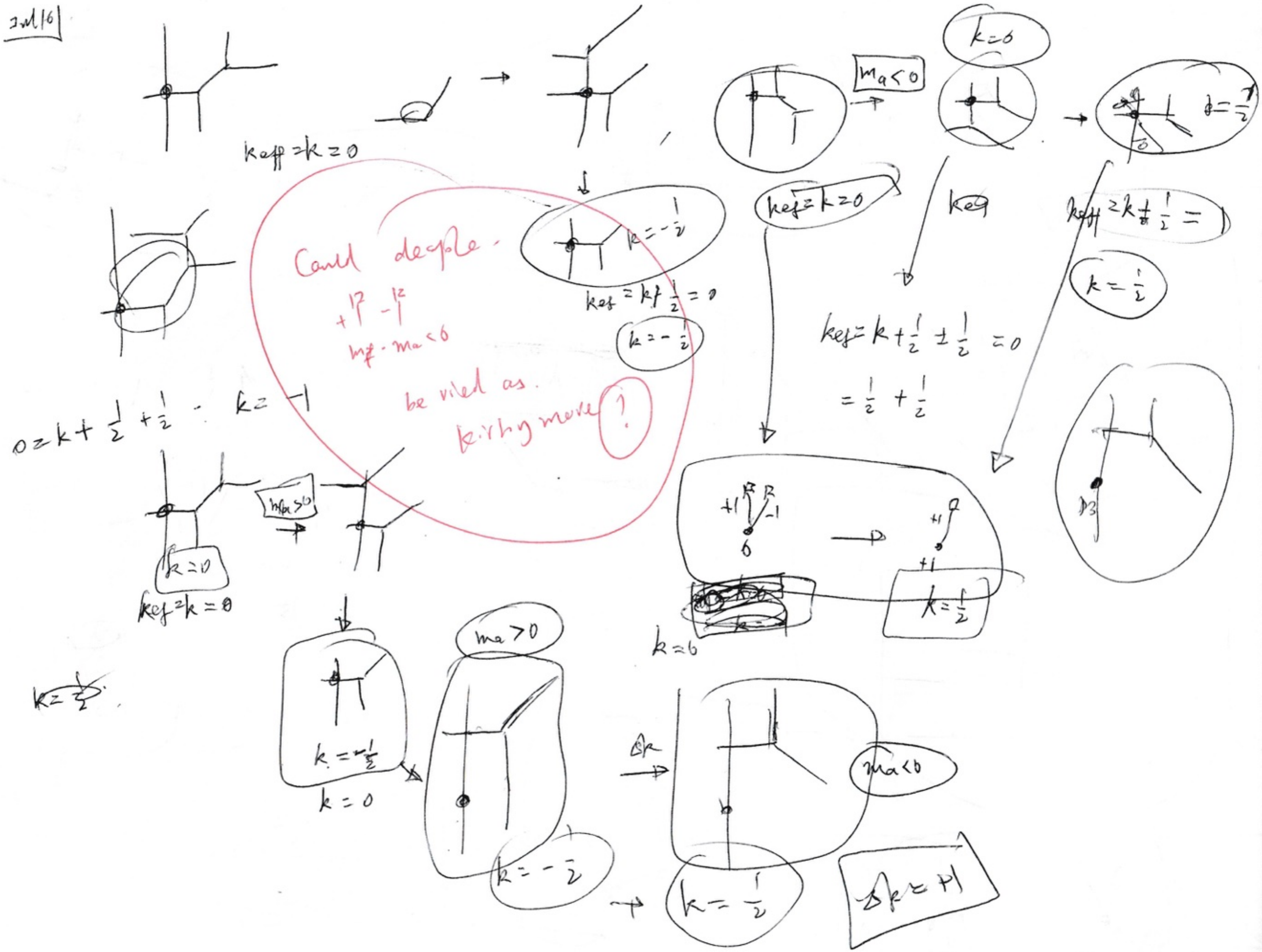
M5
M2
T2
IIA
IIB
M2 (9A #) → F1(9A) → F1(9B)
NS5
P3
F1(9)
M2 — D2
D6
D4
S'A
F1
D3
M2 (9A #) → F1(9B) S→ D1(9B)
D1 (9B)
−∞
D4 — D6
D5
D6
IA
IB
P4
P3
(0 9A #)
(0 9A)
(0 9B)



D6 — NS5
M5
M2
F1
self-dual string
D4
NS5
D5
D6
NS5''
D5''
T4
0 1 2 5

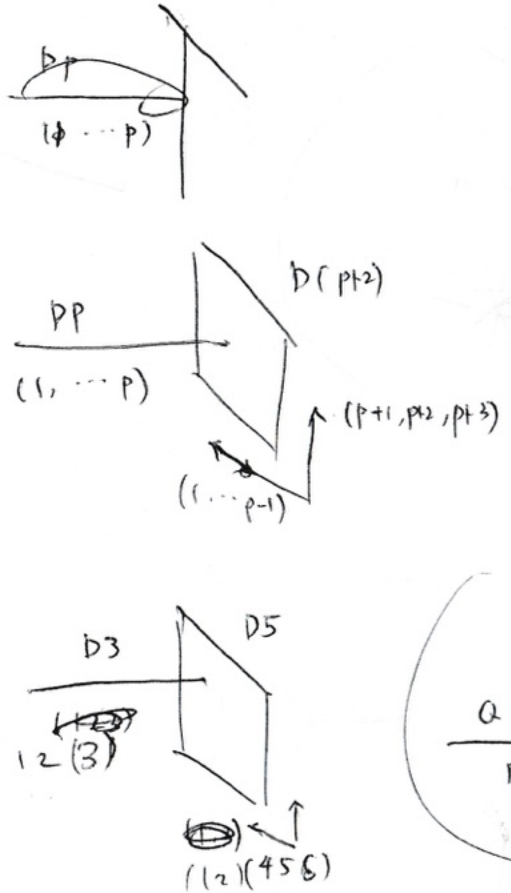
Jul 16.

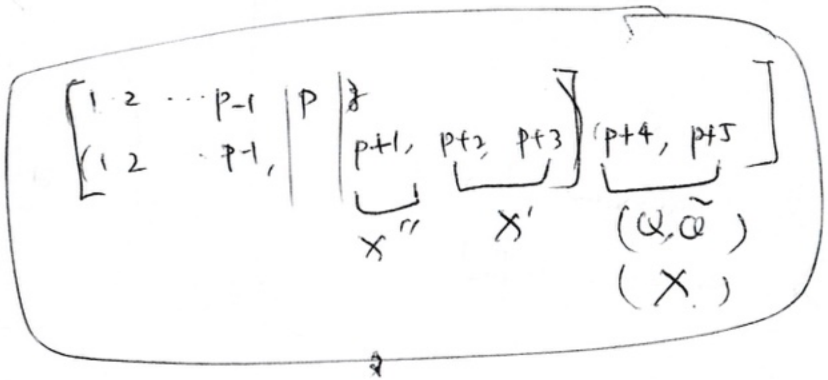


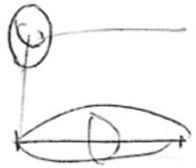


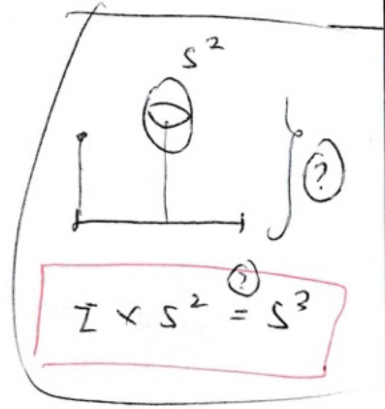
keff = k = 0
Could decple.
mf · ma < 0
be viewed as
Kirby move ?
k = -1/2
keff = k + 1/2 = 0
ma < 0
k = 0
keff = k = 0
keff = k + 1/2 ± 1/2 = 0
= 1/2 + 1/2
k = 1/2
D3
0 = k + 1/2 + 1/2 . k = -1
ma > 0
k = 0
keff = k = 0
k = -1/2
Δk
ma < 0
Δk = +1

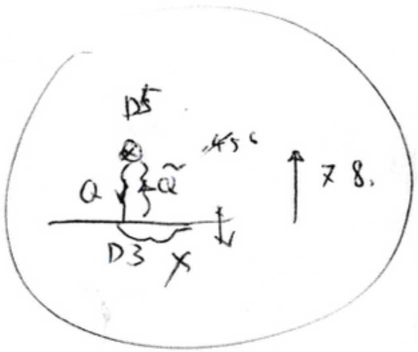
Jul 17

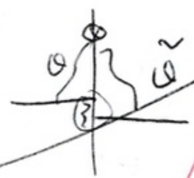






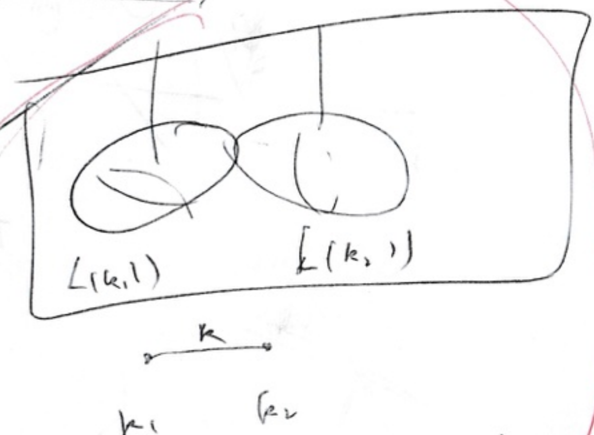




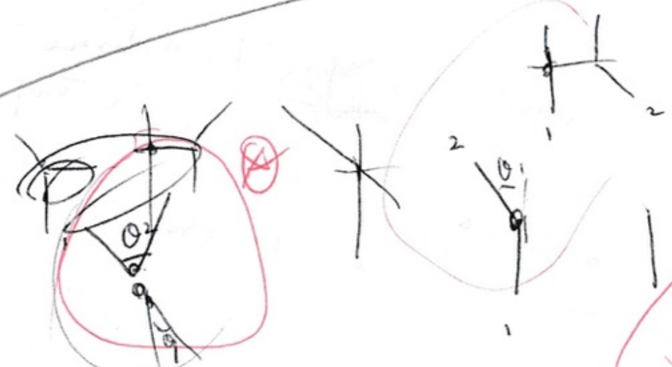


Jul 18

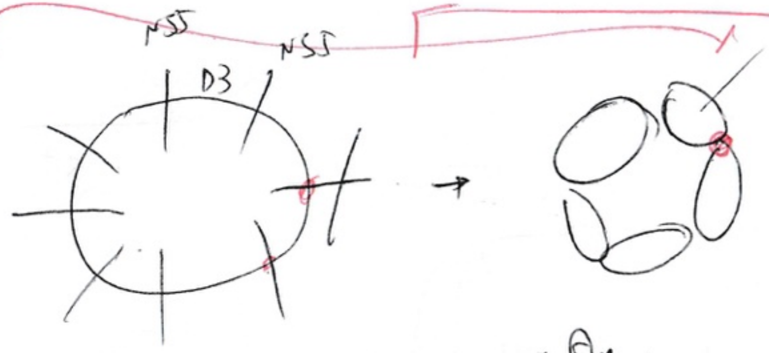
$p = 9 - 5 = 4$

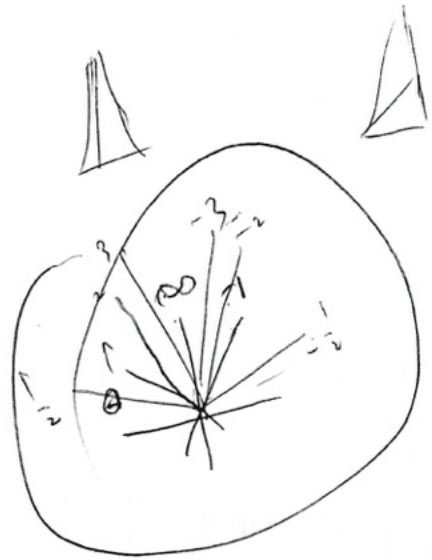


(7, 8)



- How to ~~put~~ embed $L(k_1,1) \# L(k_2,1)$ in in the same spacetime?
- Does ~~changing~~ (11d) ~~cond~~ CY conditions influence?

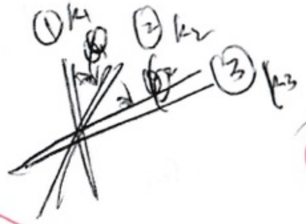




θ_n

How to clearly understand this ?

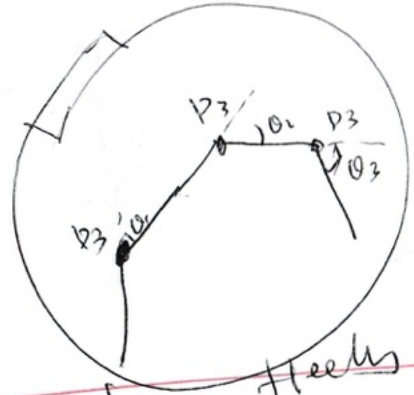
and what X encodes bifund ?



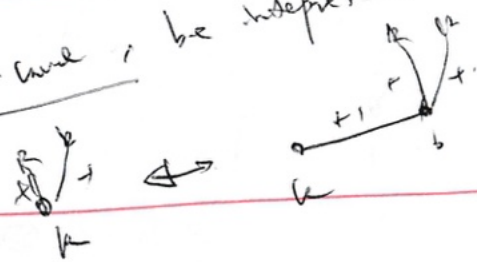
Is this θ_1 and $k_i = \tan \theta_i$

same θ_i and φ_i on the

the same plane ?

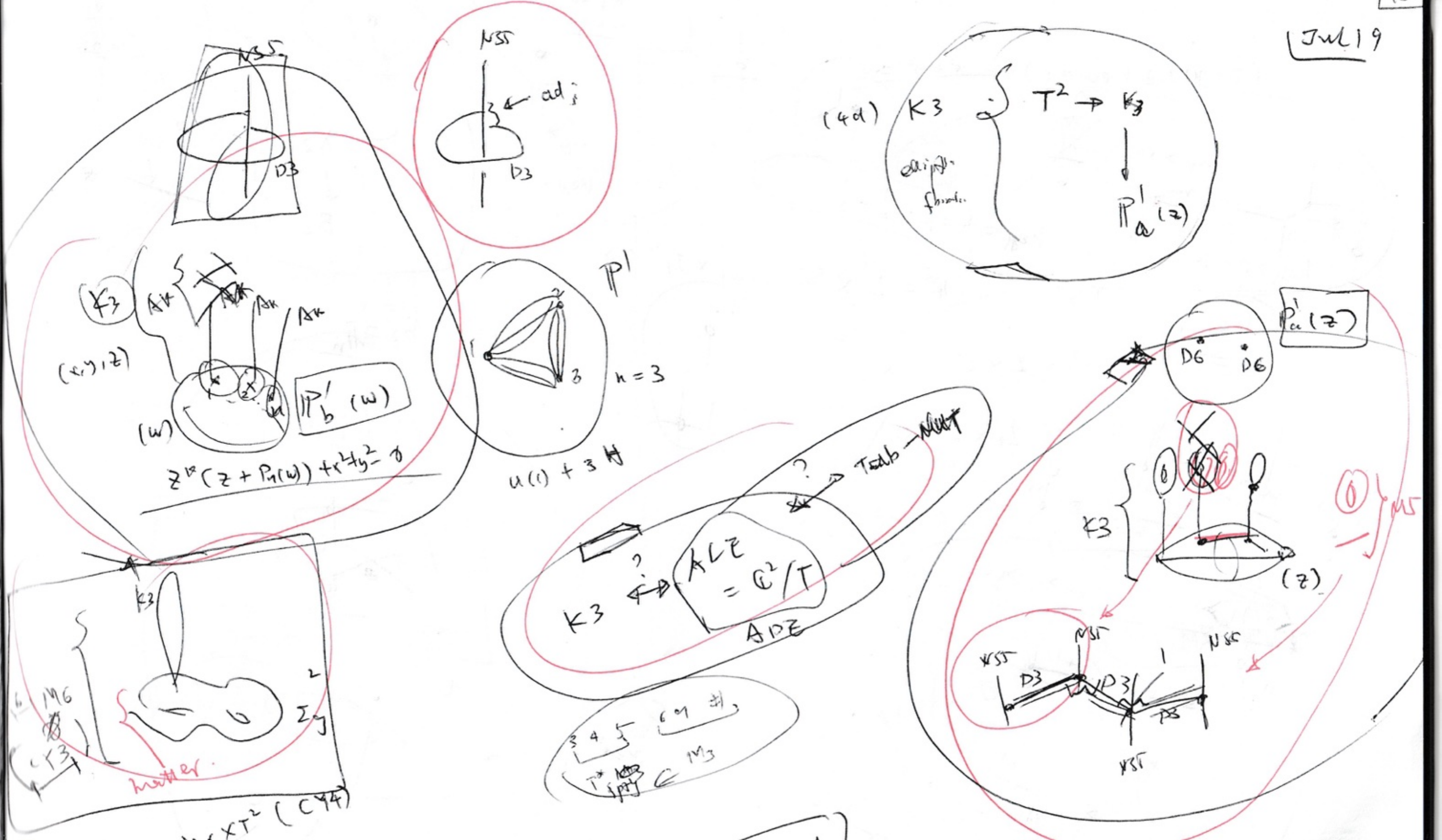


Is the ST-move ; be interpreted as D5-flavo brane crossing, S-duality and Hecke ?



$\xrightarrow{e_1}$ T[U(1)]

How about charge q-defect MS ?

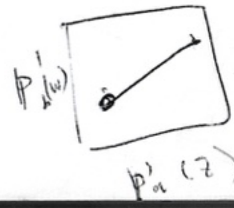


$6 + \boxed{5} = 11$

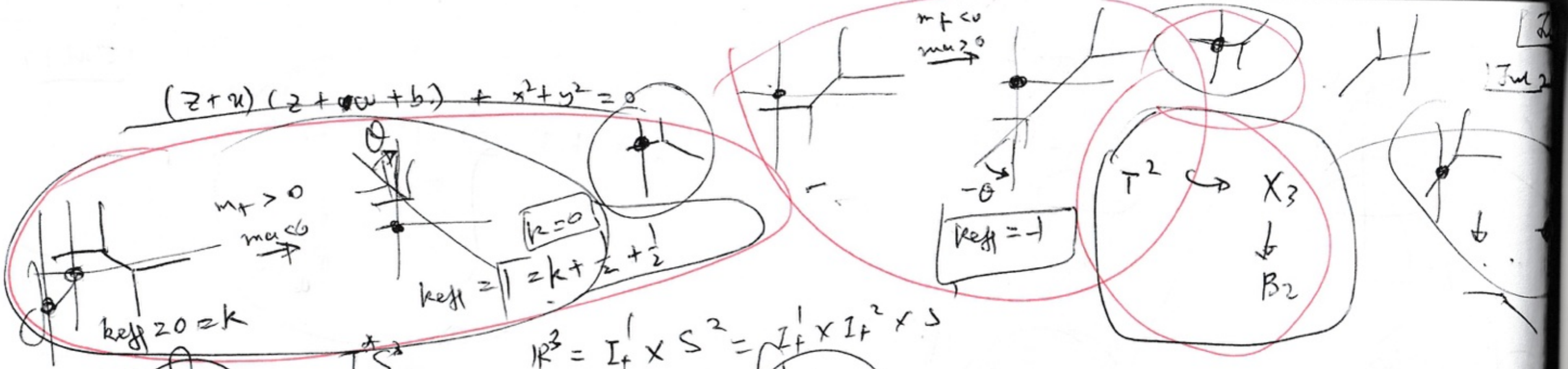
$5 - 3 = \boxed{2}$

CY4 8

$11d / CY_4 = 3d$



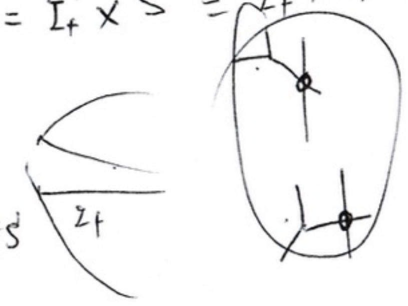
$(z+u)(z+u+b)+x^2+y^2=0$



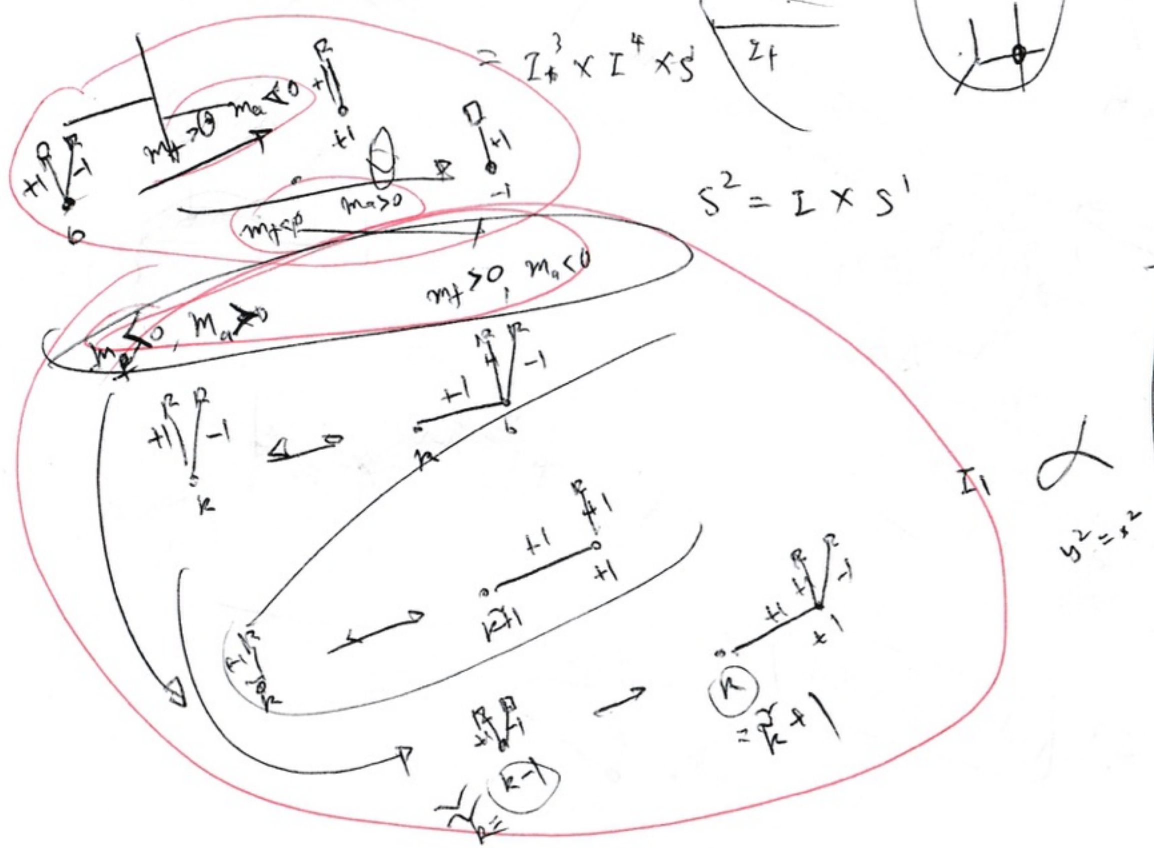
$\mathbb{R}^3 = I_+^1 \times S^2 = I_+^1 \times I_+^2 \times S$

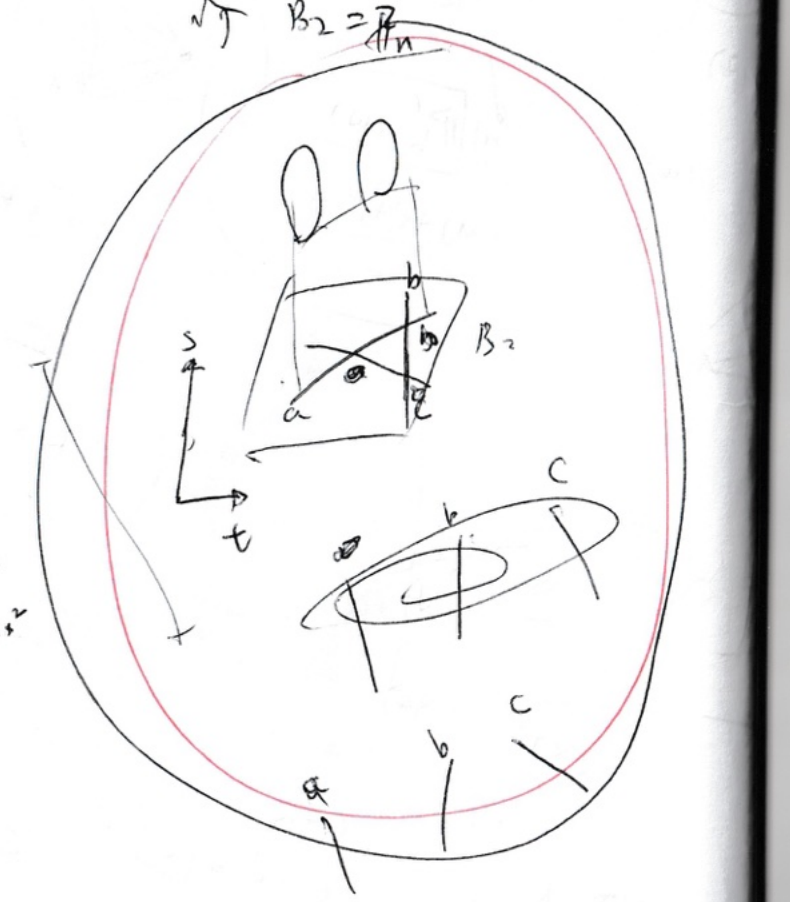
$S^3 = I \times S^2$

$= I_+^3 \times I^4 \times S^1$



$S^2 = I \times S^1$



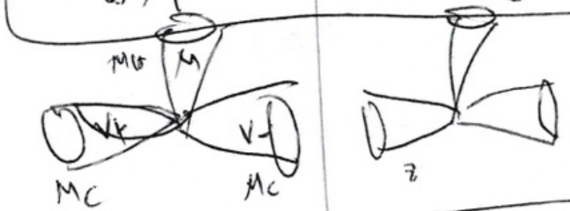


$U(1) + \Phi$
$+ \{Q, \tilde{Q}\}$ SQED $\leftrightarrow$ XYZ

$\{M, V_+, V_-\} \leftrightarrow$

monopole

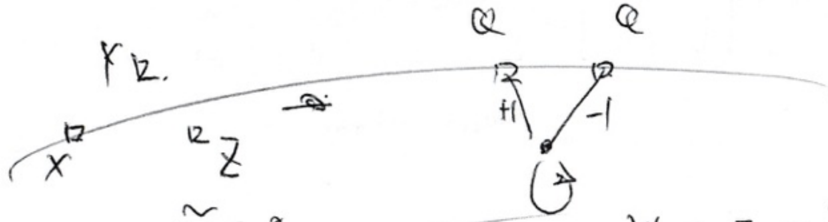
$\{Q, \tilde{Q}\}$, $\{M, V_+, V_-\}$ $\leftrightarrow$ $\{X, Y, Z\}$



$W = \Phi Q \tilde{Q}$ $\{X, Y, Z\}$
$\tilde{W} = 0$

$\Phi Q \tilde{Q}$ $\tilde{W} \overset{0+}{=} XYZ$
$W = \Phi Q \tilde{Q}$
$+ M V_+ V_-$

$W = 0$ | $\tilde{W} = XYZ$



$\tilde{W} = 0$ $W = \Phi Q \tilde{Q}$

$\tilde{W} = XYZ$.

$\tilde{W} = X Y, Z$,

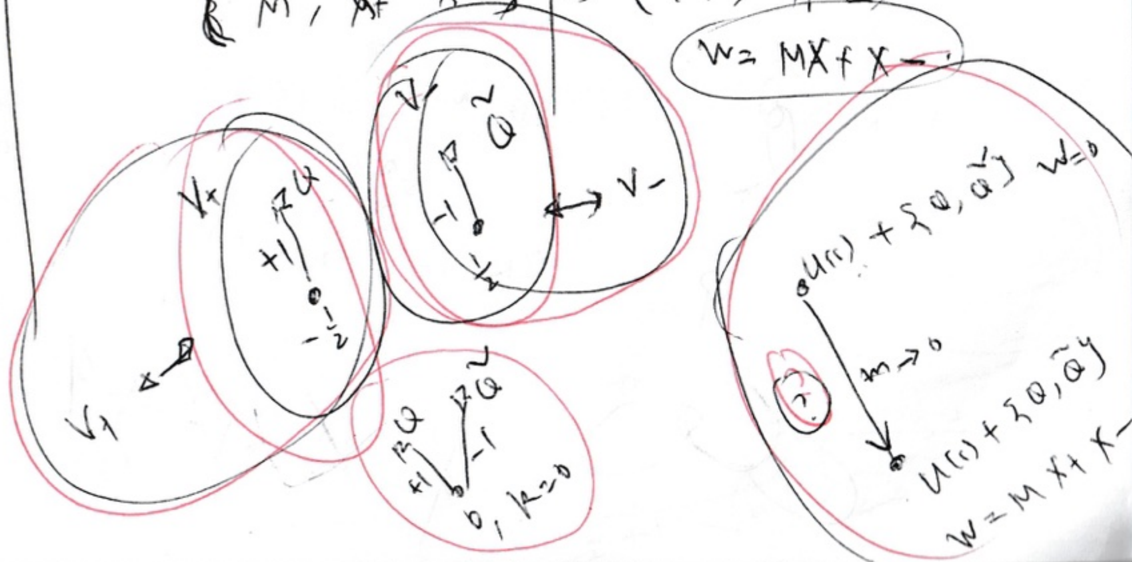
$W = M V_+ V_-$

$U(1)_0 + \{Q, \tilde{Q}\}$ $\leftrightarrow$ $\{M, X_+ X_-\}$ SCFT

$W = 0$

$\{M, X_+ X_-\} \leftrightarrow (X, Y, Z)$

$W = M X_+ X_-$



$$\begin{bmatrix}-a_1 & 1\\ 1 & 0\end{bmatrix}\begin{bmatrix}-a_2 & 1\\ 1 & 0\end{bmatrix} = \begin{bmatrix}a_1a_2+1 & -a_1\\ -a_2 & 1\end{bmatrix}\begin{bmatrix}-a_3 & -1\\ -1 & 0\end{bmatrix}$$

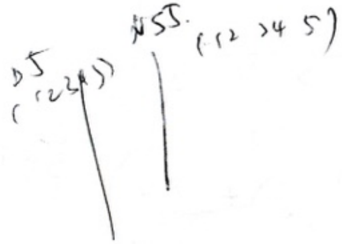
$$= \Big[\, -a_3(a_1a_2+1)+a_1$$

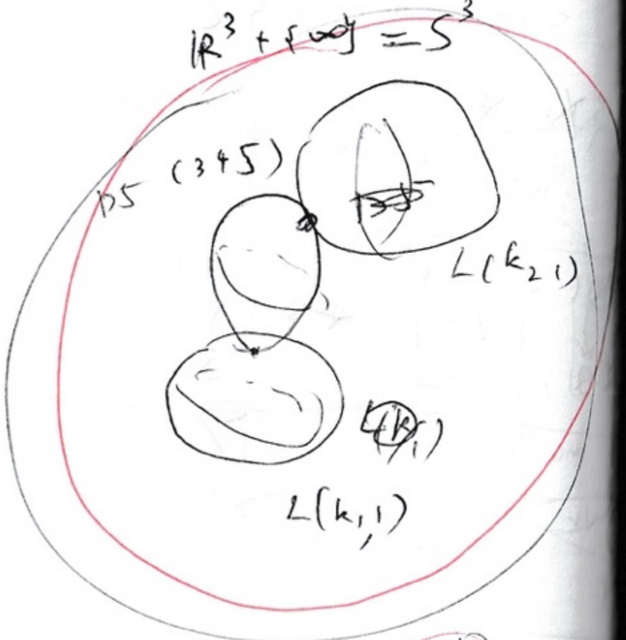
$L(1, q)$

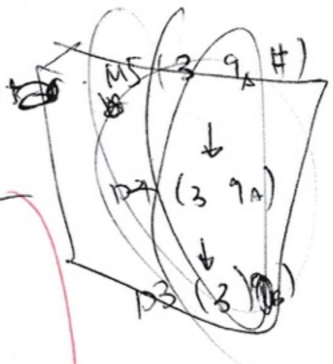
$= -1\ 1, 1+\varepsilon$

$\cos 2n = -1$

$\sin 2n = 0$







M5 (12345)

↓

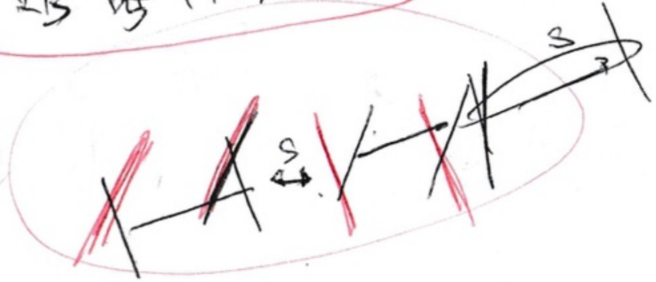
IIA NS5 (12 345)

↓

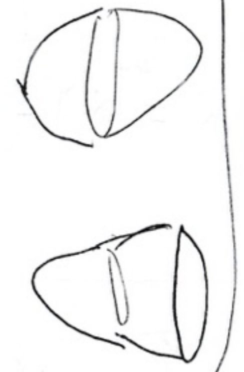
IIB NS5 (12 345).

S ↕

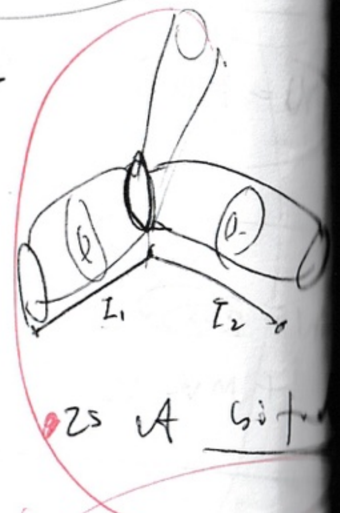
IIB D5 (12345)



S^2:

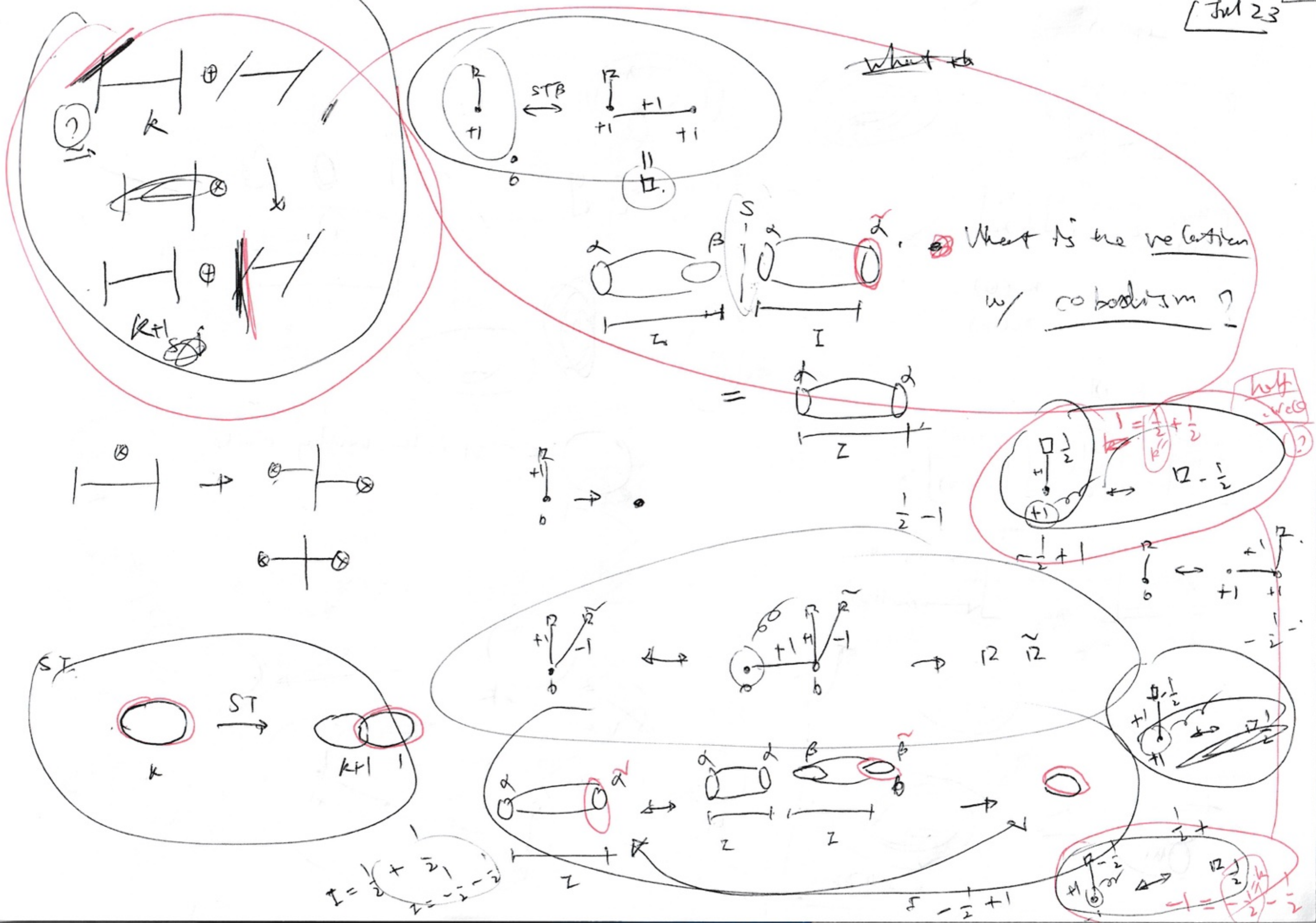


$S^1 \times S^2$



2S IIA

Could $L(k,1)$ be glued



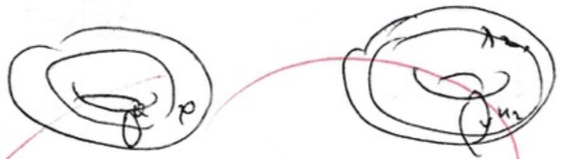
What is the relation w/ cobordism ?

$L(p, q)$

$T^2 \xrightarrow{f} T^2$

$\begin{bmatrix} \mu_1 \\ \lambda_1 \end{bmatrix} \to \begin{bmatrix} \mu_2 \\ \lambda_2 \end{bmatrix}$

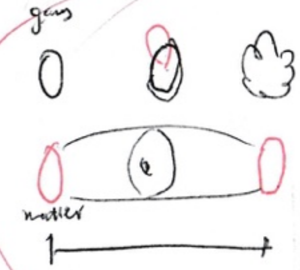
$$\begin{bmatrix} \mu_1 \\ \lambda_1 \end{bmatrix} = \begin{bmatrix} -q & p \\ s & r \end{bmatrix} \begin{bmatrix} \mu_2 \\ \lambda_2 \end{bmatrix}$$



$$\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} \theta \\ \psi \end{bmatrix} \to \begin{bmatrix} -\theta \\ \psi \end{bmatrix}$$

$\mu_2(\theta)$

$\lambda_2(\psi)$



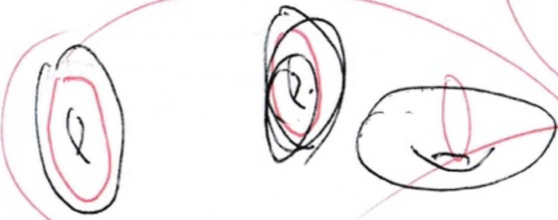
for $L(k, 1)$

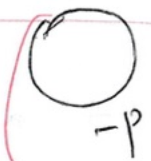
$$\begin{bmatrix} \mu_1 \\ \lambda_1 \end{bmatrix} = \begin{bmatrix} -1 & k \\ 0 & 1 \end{bmatrix} \begin{bmatrix} \mu_2(\theta) \\ \lambda_2(\psi) \end{bmatrix}$$

$$= \begin{bmatrix} -\mu_2 + k\lambda_2 \\ \lambda_2 \end{bmatrix}$$

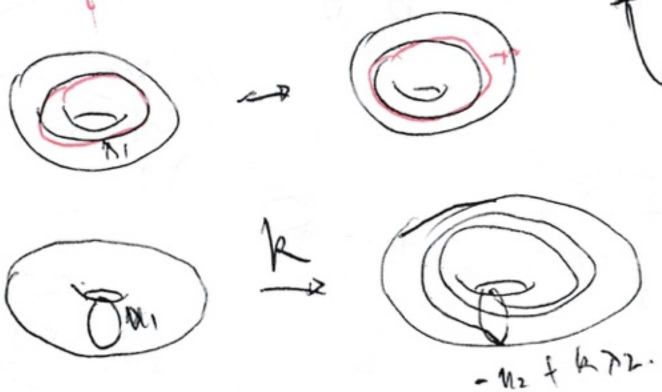
← gauge

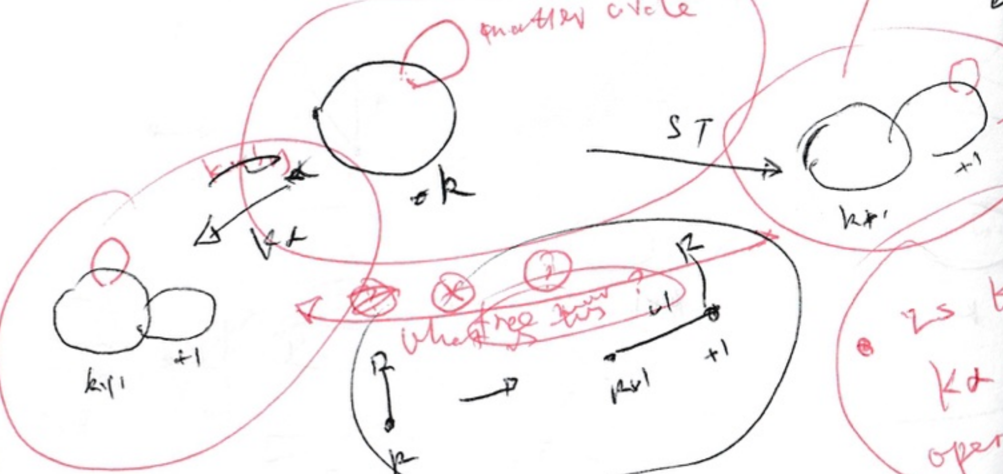
← matter





← it is the vanishing circle.



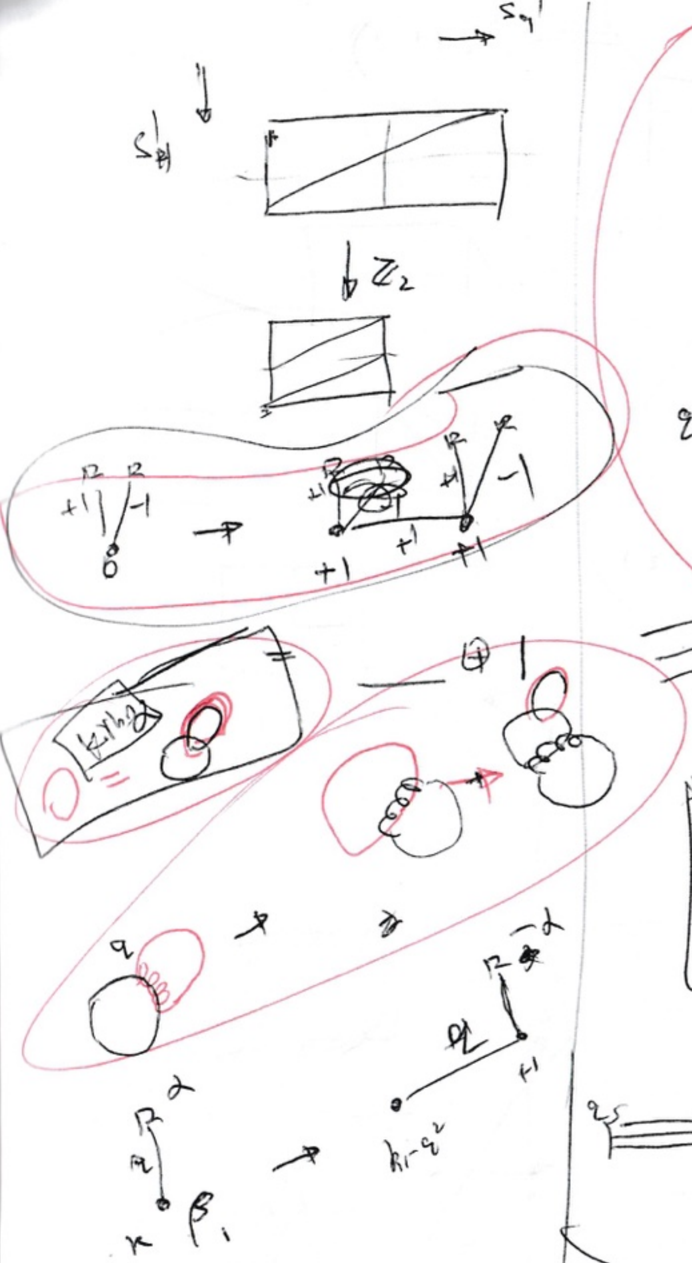


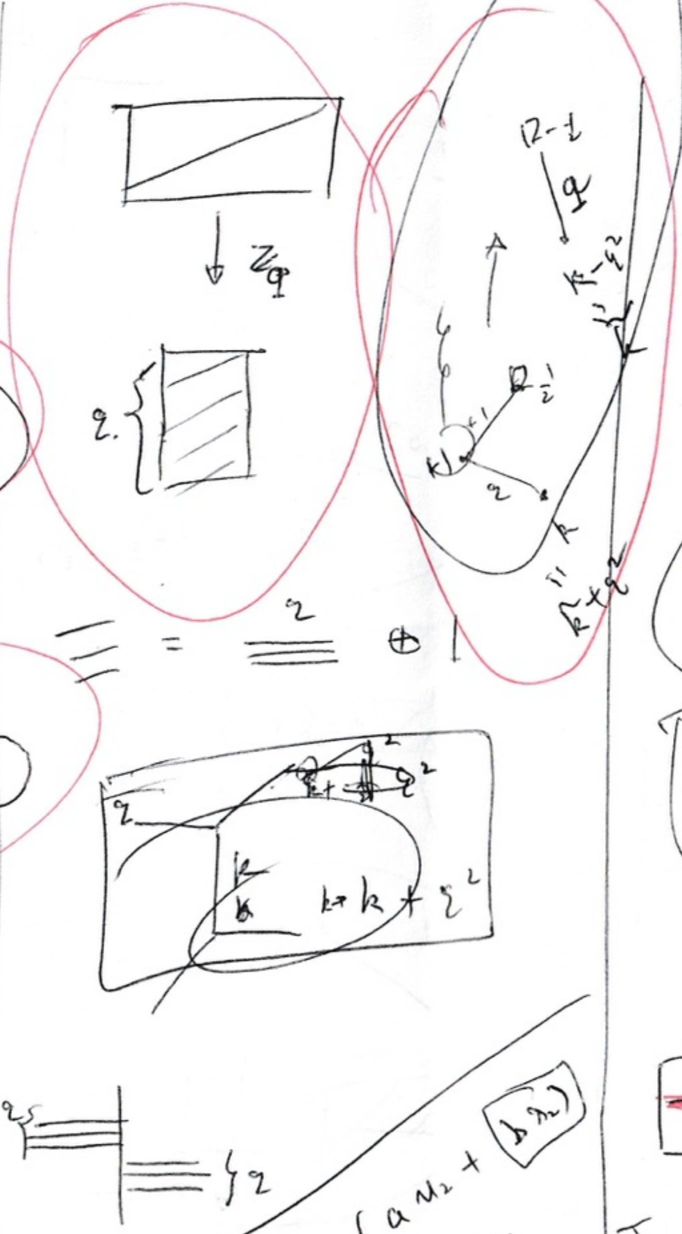
Is Kirby

K a

operation

Jul 24





$(-u_2 + k x_2)(a u_2 + b x_2)$

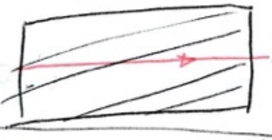
$= a k\, x_2 \cdot u_2 - b\, u_2 x_2$

$= (ak - b)$

$a = 1,\ b = -q$

$\tilde\alpha = -\alpha$

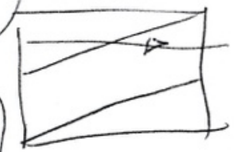
$\tilde\beta = k\alpha + \beta$



$\tilde\beta \cdot \tilde\beta = k\alpha \cdot \beta = k$

$\tilde\alpha \cdot \tilde\beta = -k\alpha^2 - \alpha \cdot \beta$

$= -1$



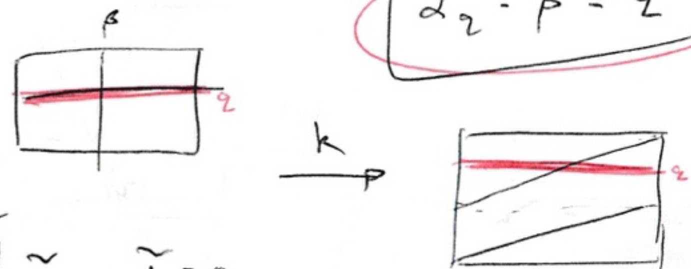
$\tilde\beta^2 = k^2\alpha^2 + \beta^2 + k\alpha\cdot\beta$

$= k$

$\tilde\alpha_q = q\alpha,$

$\tilde\alpha_q \cdot \alpha = 0$

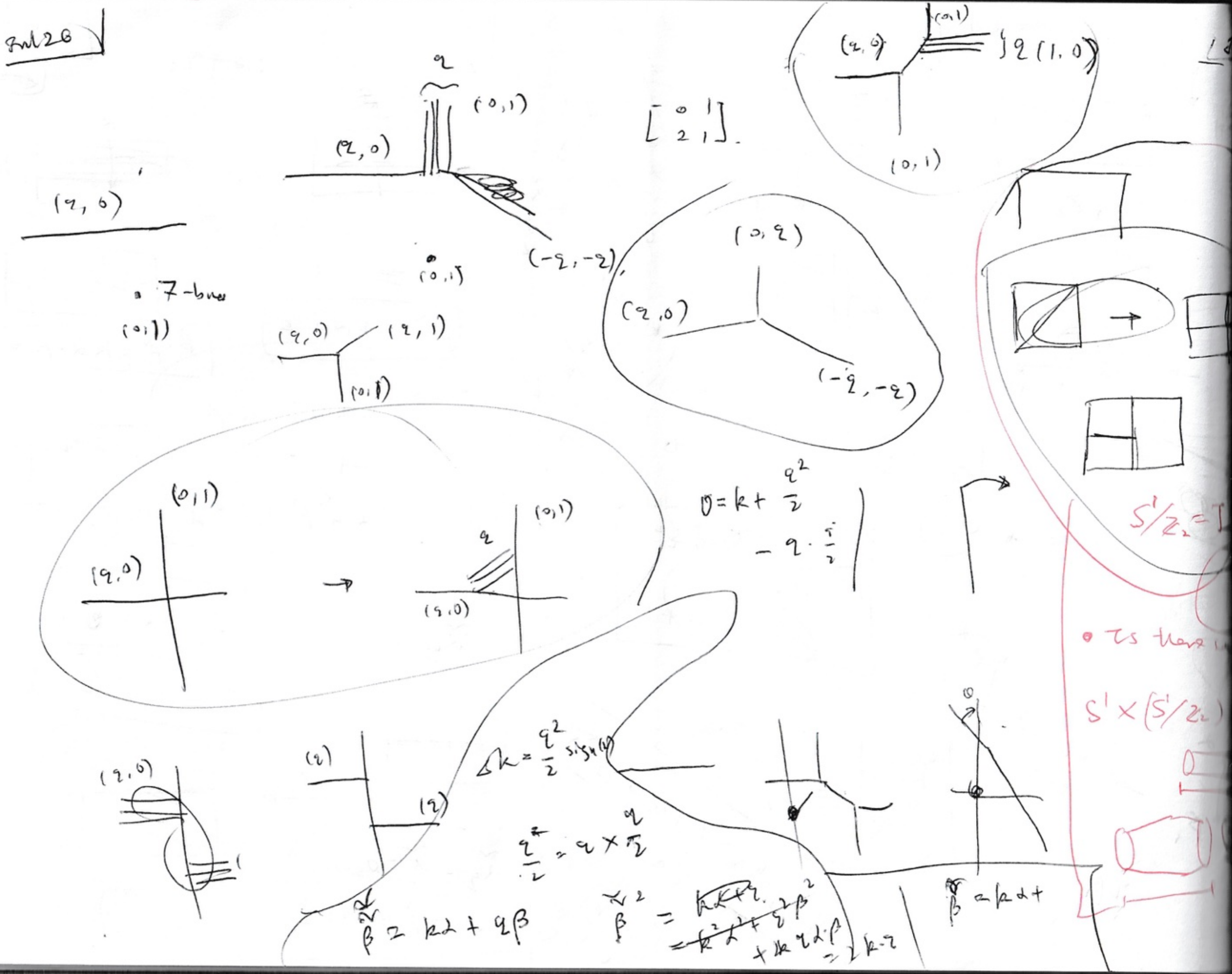
$\tilde\alpha_q \cdot \beta = q$



$\tilde\alpha_q \cdot \tilde\alpha = 0$

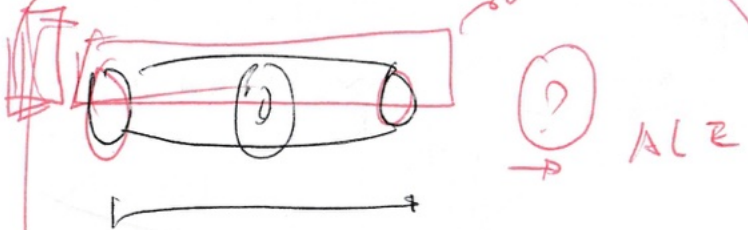
$\tilde\alpha_q \cdot \tilde\beta = q\alpha \cdot \beta = q.$

3/26

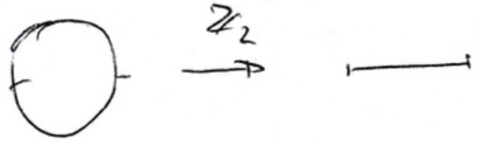


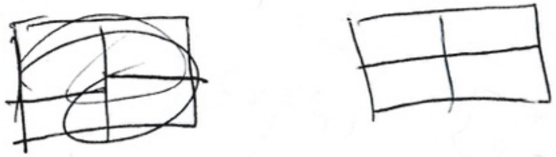
q
(0,1)
(q,0)
(−q,−q)
(q,0)
(0,1)
• 7-brane
(0,1)
(q,0)
(q,1)
(0,1)
[0 1; 2 1].
(q,0)
(0,1)
q(1,0)
(0,1)
(0,q)
(q,0)
(−q,−q)
(0,1)
(q,0)
(0,1)
q
(q,0)
0 = k + q²/2 − q · 1/2
S¹/Z₂ = T
• Is there
S¹ × (S¹/Z₂)
(q,0)
(q)
(q)
Δk = q²/2 sign(q)
q²/2 = q × q/2
β̃ = kα + qβ
β̃² = k²α² + q²β² + k q α β
β̃ = kα +

Jul 24



• Is this large radius limit make sense ?

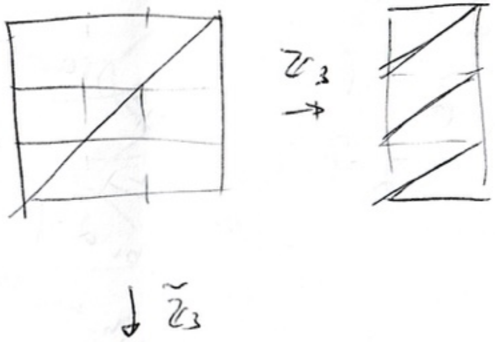


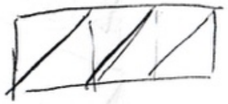


$L(1,1) = S^3/Z_1 = S^3$

$L(k,1) = S^3/Z_k$

$(z_1, z_2) \mapsto (e^{\frac{2\pi i}{k}} z_1, e^{\frac{2\pi i}{k}} z_2)$

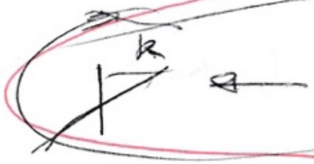




$\tilde{\beta} = k\beta + \alpha$

$\beta \to$ straight

~~$\alpha + k\beta$~~



$\beta + k\alpha \to$ slow

$k\beta + \alpha \xrightarrow{\text{dep}} (k \pm 1)\beta + \alpha$?

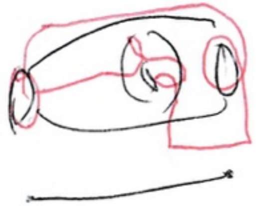
$k\beta + \alpha \xrightarrow{\text{dep}} (k \pm q^2)\beta + \alpha$?

$\alpha \cdot \tilde{\beta} = \alpha \cdot (k\alpha + \beta) = \alpha \cdot \beta = 1$

$= k + q$

$q\alpha$

- How to insert a knot into Lens space?



- What is the matter content for the knot?

$\tilde{\beta} = k\alpha \pm \beta$

$L_\beta \cdot L_{\tilde{\beta}}$

$= \beta(L_\beta + q L_\alpha) \cdot (L_{\tilde{\beta}} + q L_{\tilde{\alpha}})$

$= L_\beta \cdot L_{\tilde{\beta}} + q L_\alpha \cdot L_{\tilde{\beta}} + q L_\beta L_{\tilde{\alpha}} + q^2 L_\alpha \cdot L_{\tilde{\alpha}}$

$2\tilde{\alpha} = 2\alpha + \beta$

$4\tilde{\beta} = 4\beta - 2\alpha$

$2\tilde{\alpha} + \; = 5\beta$

$\alpha \cdot \alpha = 0$

$\beta \cdot \beta = 0$

$\alpha \cdot \beta = 1$

$\Rightarrow \begin{cases} \tilde{\alpha} = \alpha + \frac{1}{2}\beta \\ \tilde{\beta} = \beta - \frac{1}{2}\alpha \end{cases} \Rightarrow (\tilde{\alpha}^2 = 1, \tilde{\beta}^2 = -1, \tilde{\alpha} \cdot \tilde{\beta} = 0)$

$\tilde{\alpha} \cdot \tilde{\beta} = (a_1\alpha + b_1\beta)(a_2\alpha + b_2\beta)$

$= a_1 a_2 \alpha^2 + a_2 b_1 \alpha \cdot \beta + a_1 b_2 \alpha \cdot \beta$

$= (a_1 b_2 + a_2 b_1) = 0$

$\tilde{\beta} + q\tilde{\alpha}$

$= \beta - \frac{\alpha}{2} + q\alpha + \frac{q}{2}\beta = \frac{q+1}{2}\beta$

$a_1 = 1 \quad b_1 = \frac{1}{2}$

$a_2 = 1 \quad b_2 = \frac{1}{2}$

$(\tilde{\beta} + q\tilde{\alpha})^2 =$

$2\tilde{\alpha} = 2\alpha + \beta$

$2\tilde{\beta} = 2\beta - \alpha$

$\tilde{\alpha} = a\alpha + b_1\beta$

$\tilde{\alpha}^2 = (a\alpha + b\beta)^2$

$= a^2\alpha^2 + b^2\beta^2 + 2ab\,\beta \cdot \alpha$

$= 2ab\,\beta \cdot \alpha = 2ab = 1$

$a b_1 = \frac{1}{2}$

$a_2 b_2 = \frac{1}{2}$

$\tilde{\beta} = a_2\alpha + b_2\beta$

$a_1 b_2 + a_2 b_1 = 0$

$\beta \cdot \tilde{\beta} = \beta \cdot k\beta = k$

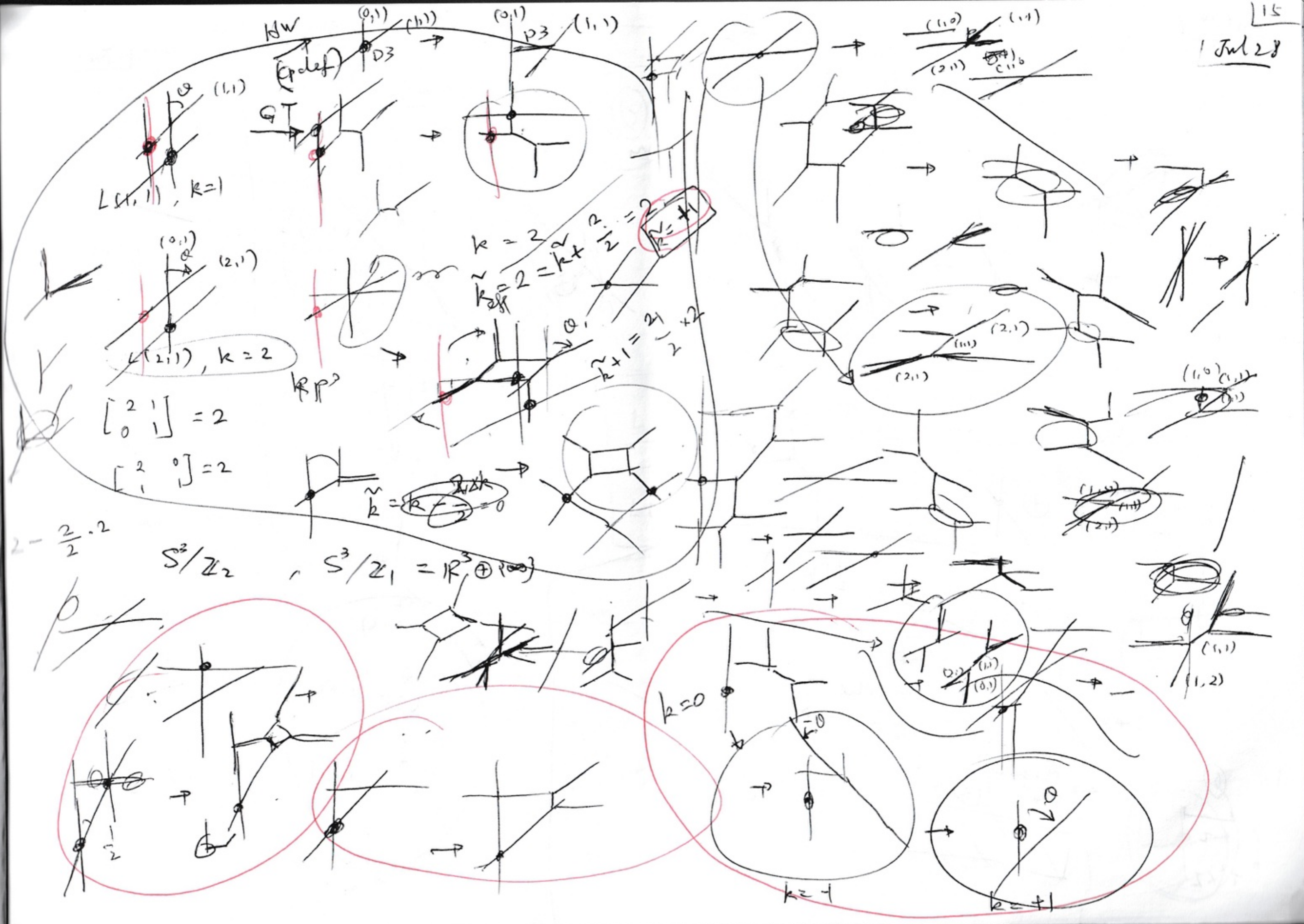
$\beta = \tilde{\beta} + \frac{\alpha}{2} - \frac{\beta}{4}$

$= \tilde{\beta} + \frac{\tilde{\alpha}}{2}$

$q^2 \alpha \cdot \tilde{\alpha} + 2q\tilde{\beta} \cdot \alpha$

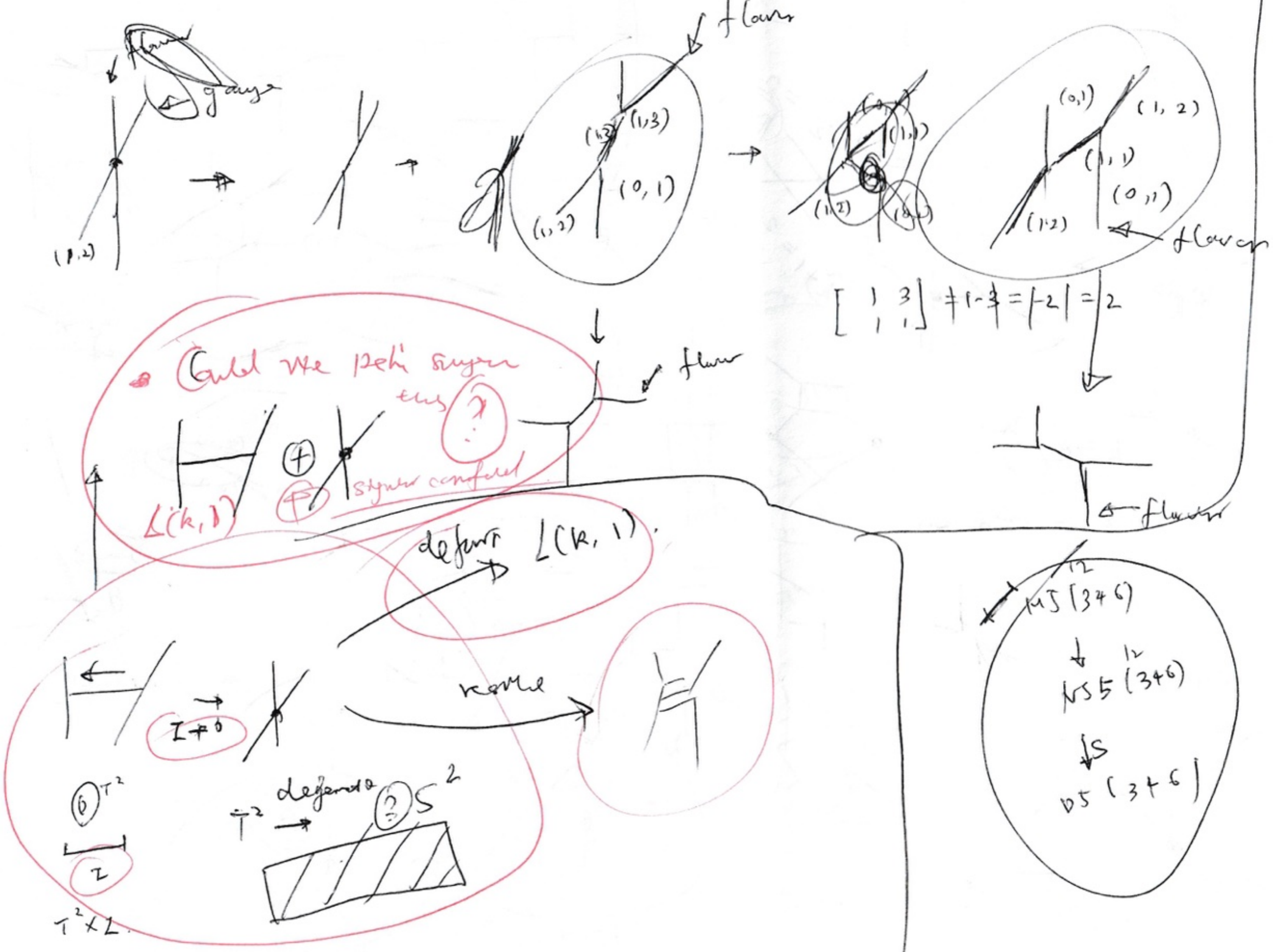
$\alpha \cdot \tilde{\beta} = (k\alpha + \beta)\alpha$

Jul 28



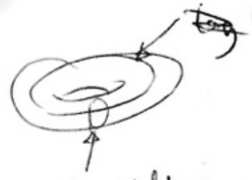
NW
(0,1)
(1,1)
D3
(p,q def)
P3
GT
L(1,1), k=1
(2,1)
L(2,1), k = 2
k = 2
$\tilde{k}_{eff} = 2 = \tilde{k} + \frac{2}{2} = 2$
$\tilde{k} = +1$
$\tilde{k} + 1 = \frac{2}{2} \cdot 2$
$\begin{bmatrix} 2 & 1 \\ 0 & 1 \end{bmatrix} = 2$
$\begin{bmatrix} 2 & 0 \\ 1 & 1 \end{bmatrix} = 2$
$\tilde{k} = k - \frac{2}{2} = 0$
$2 - \frac{2}{2} \cdot 2$
$S^3/\mathbb{Z}_2$, $S^3/\mathbb{Z}_1 = \mathbb{R}^3 \oplus \{\infty\}$
(1,0)
(2,1)
(1,2)
k=0
k = -1
k = +1

Jul 20



gauge
flavor
(1,2)
(1,3)
(0,1)
(1,1)
(0,1)
(1, 2)
flavor
[1 3; 1 1] = |1-3| = |-2| = 2
flavor
flavor
Could we ... this ?
L(k,1)
signs confused
deform L(k, 1)
I ≠ 0
T²
deform
S²
T² × I
MS (3+6)
MS5 (3+6)
S
D5 (3+6)

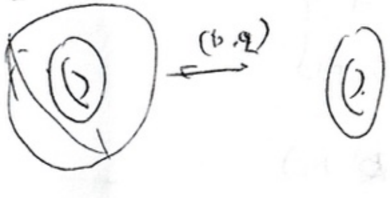
Jul 29

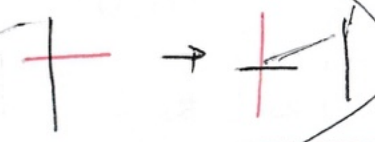


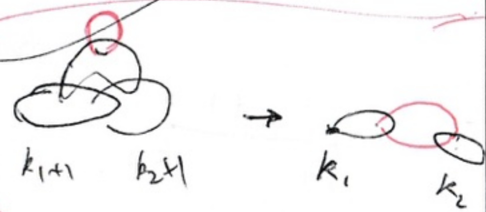
$p\mu + q\lambda$

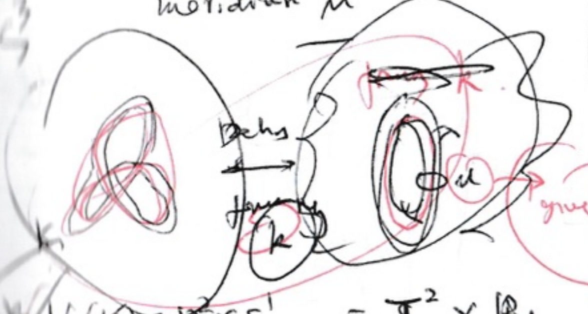
p/q surgery

$L(p,q)$









give framing k

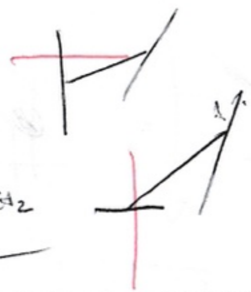
What is $1/n$ surgery?

What is n the charge q?

$N(K) = D^2 \times S^1_{Hmm} = T^2 \times \mathbb{R}_+$

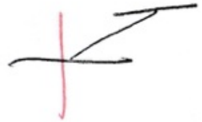
$D^2 =$  $= S^1 \times \mathbb{R}_+$

$\mathbb{R}_+$ ↑ gauge



$L(k,1) = L(k, 1 \pm nk)$

$L(p', q) = L(p,q)$. $q' = q \pmod p$

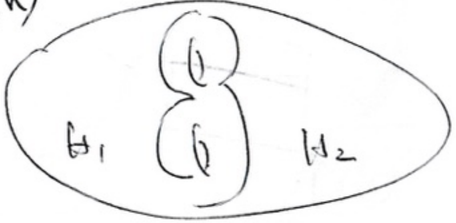


Heegaard splitting $M = H_1 \cup H_2$

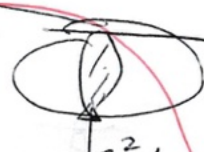
In QV, matter circle is a knot?

Heegaard splitting

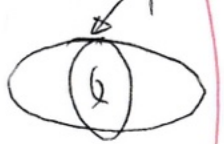
(H_1, H_2, h)

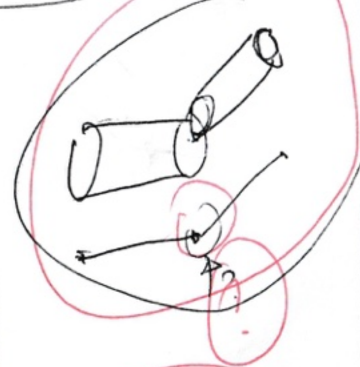


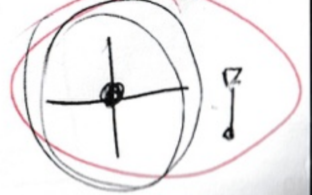
$h \left\{ \begin{array}{l} \partial H_1 = \Sigma_g \\ \partial H_2 = \Sigma_g \end{array} \right\} h$

S^3 :  S^2,

$\begin{bmatrix} -1 & r \\ k & s \end{bmatrix}$

$S^2 \times S^1$  T^2





$L(1,1)$

$$\begin{bmatrix} -1 & 0 \\ k_1 & 1 \end{bmatrix}\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}\begin{bmatrix} -1 & 0 \\ k_2 & 1 \end{bmatrix} = \begin{bmatrix} -k_2 & -1 \\ k_1k_2-1, & k_1 \end{bmatrix}$$

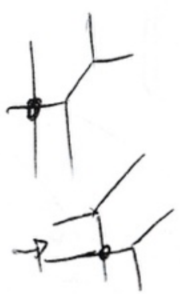
$L(k_1k_2-1, k_2)$

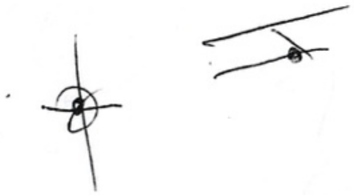
若 $k_2=1$ $L(k_1-1, 1)$

$$\begin{bmatrix} -1 & -1 \\ k_1-1 & k_1 \end{bmatrix}\begin{bmatrix} \alpha \\ \beta \end{bmatrix}$$

$$= \begin{bmatrix} -\alpha-\beta \\ k_1-1 \end{bmatrix}$$

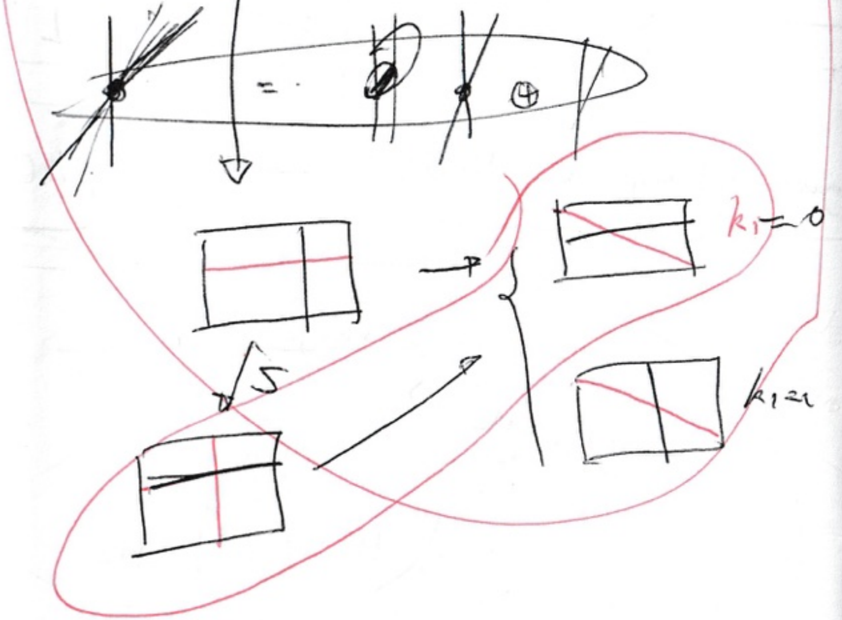
$(\alpha+\beta)^2 = \alpha^2+\beta^2+2\alpha\beta = 2$



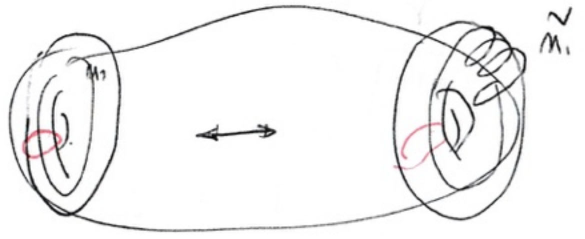


$$\begin{bmatrix} 0 & k \\ 1 & p \end{bmatrix}$$

$$\begin{bmatrix} \alpha \\ \beta \end{bmatrix} \to \begin{bmatrix} -\alpha-\beta \\ (k_1-1)\alpha+k_1\beta \end{bmatrix} = \begin{cases} \begin{bmatrix} -\alpha-\beta \\ -\alpha \end{bmatrix} & k_1=0 \\ \begin{bmatrix} -\alpha-\beta \\ \beta \end{bmatrix} & k_1=1 \end{cases}$$

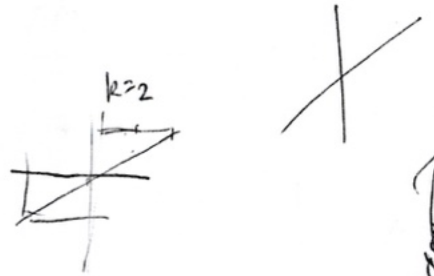


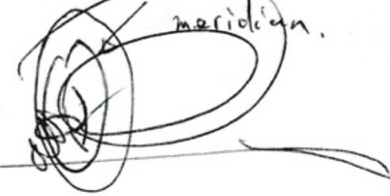
April 30

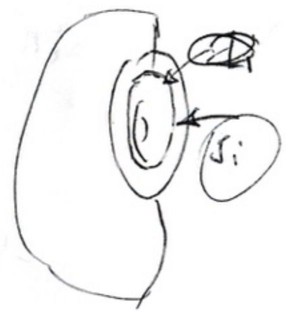


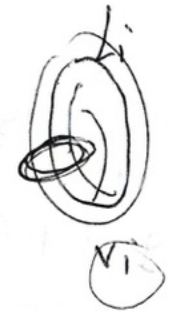
$q=1$

$$\begin{bmatrix} -1 & k+1 \\ -1 & k \end{bmatrix} \begin{bmatrix} m_2 \\ \lambda_2 \end{bmatrix} = \begin{bmatrix} -m_2 + (k+1)\lambda_2 \\ -m_2 + k\lambda_2 \end{bmatrix}$$









$S^1 \times D^2$

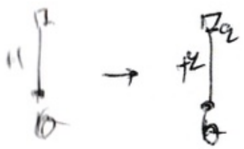
$D^2 = \mathbb{R}_+ \times S^1$

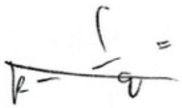
$L = L_1 \cup \cdots \cup L_n$.

$K_i = J_i \# L_i$

$L(k_i, 1)$

L_i deforms J_i





Dehn surgery: $[r_i] = [a_i l_i + b_i m_i] \overset{\text{map}}{\longleftrightarrow} [m_i]$ solid torus in $S^3 \setminus K$.

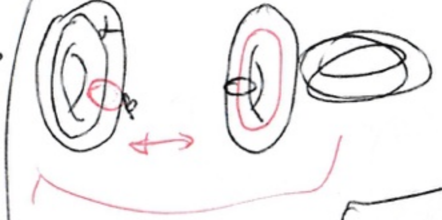
b_i / a_i

$J_i \; [l_i + k m_i] \overset{\text{map}}{\longleftrightarrow} [m_i]$

$$r, \quad \frac{1}{n+\frac{1}{r}} = \frac{r}{nr+1}$$

$$1 = \frac{1}{n+1} = \frac{1}{2}, \frac{1}{3}, \frac{1}{4} \dots$$

$S^1 \times D^2$



S^3

S^3

$1/0 = \infty$

gauge

$(\alpha, \beta) \longleftrightarrow (\beta, \alpha)$

torus switch

$(q=0, p=1)$

$$\frac{r}{1+nr}$$

$$\frac{1}{n+\frac{1}{r}} = \frac{r}{nr+1}$$

gauge $\alpha \longleftrightarrow J = q\alpha + p\beta$

meridian

p/q

$k=$

$$r \to \frac{r}{nr+1}$$

$L(p, q) =$ $\alpha \longleftrightarrow q\alpha + p\beta$

S^3

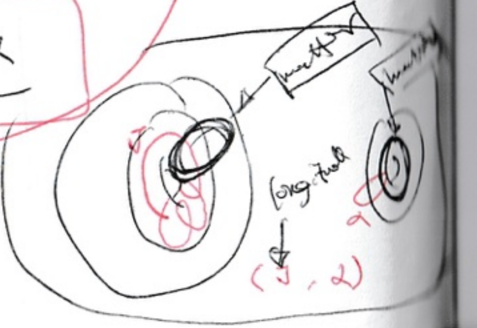
Dehn

$L(p, q) = 0$

$J = p\alpha + q\beta \longleftrightarrow \alpha$

parallel

$k = \frac{p}{q}$



matter

$S^1 \times S^2$

$(\alpha, 0) \longleftrightarrow (\alpha, 0)$

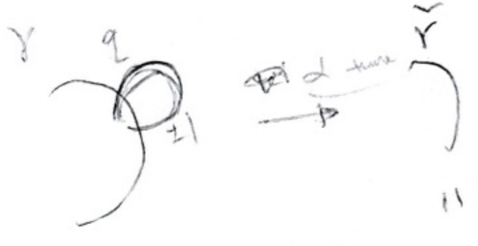
$1/0$ matter circle

$p=1, q=0$

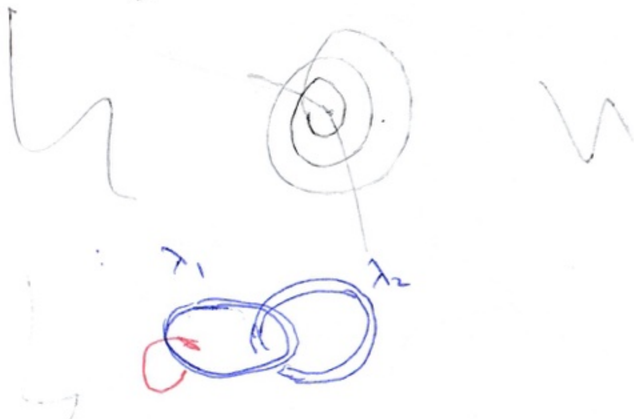
p/q

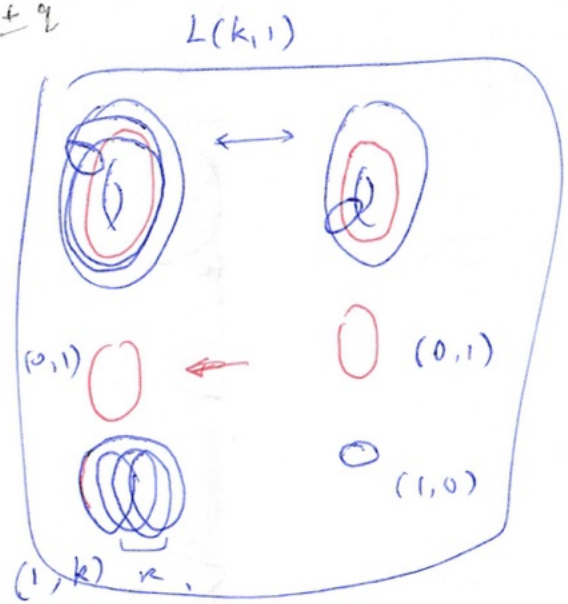
r_2

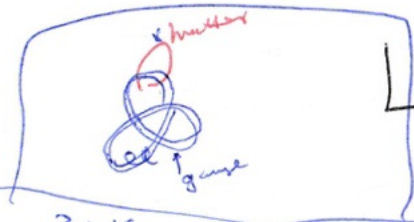
Jul 31

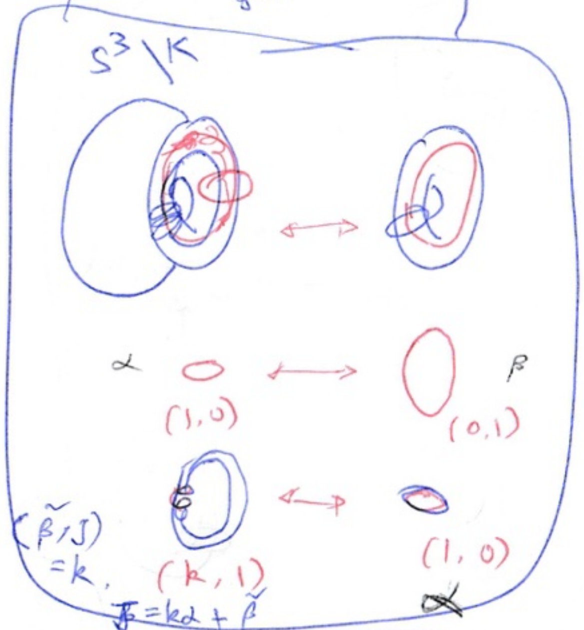


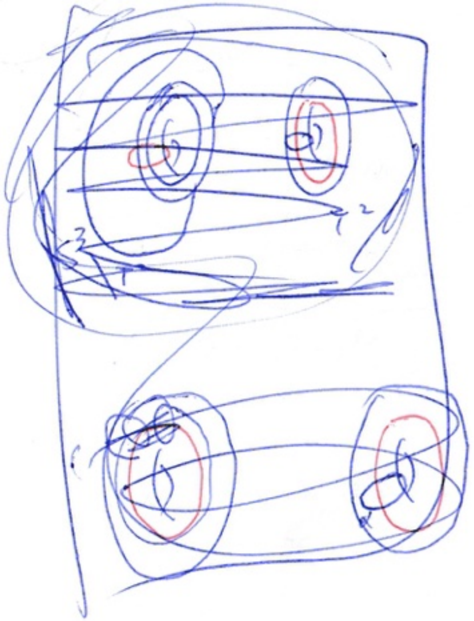
$\tilde{\gamma} = \gamma \pm q^2$

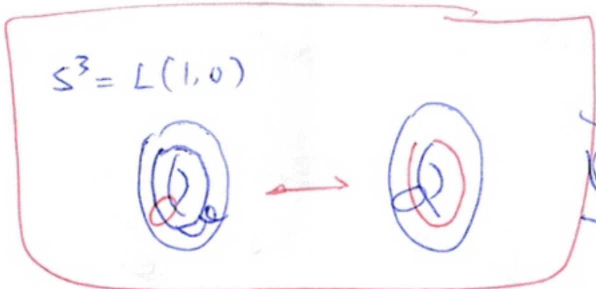








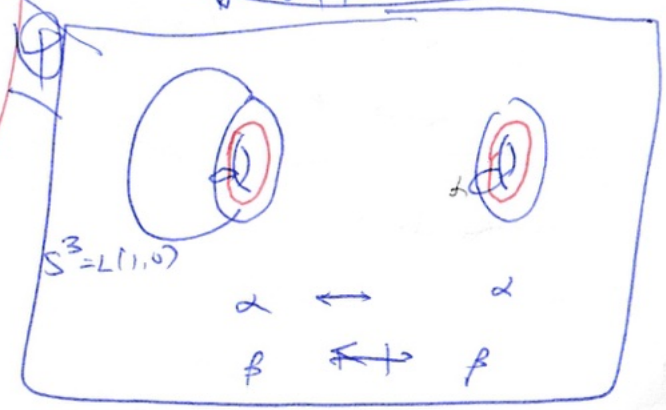




• Can matter circle

⟷ gauge circle

be exchanged ?

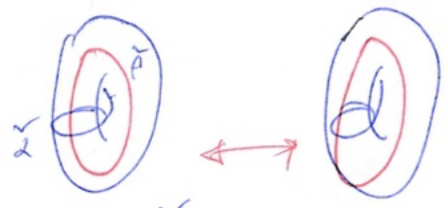


Aug 11

Aug 13

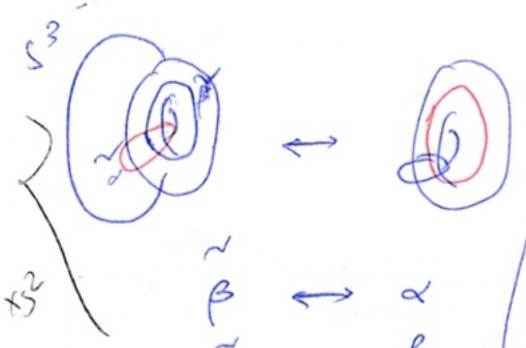
Aug 13

$L(0,1) = S^1 \times S^2$



$\tilde{\alpha} \leftrightarrow \alpha$

$\check{\beta} \leftrightarrow \beta$ } shrink... φ

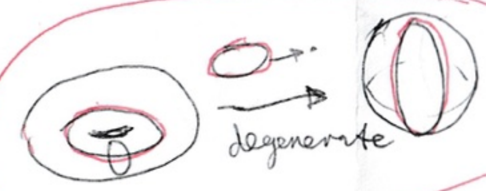


$\tilde{\beta} \longleftrightarrow \alpha$

$\tilde{\alpha} \longleftrightarrow \beta$

- How to determine if a circle shrinks?

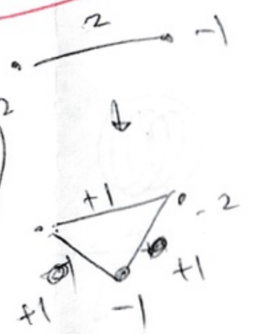
prime 3-mfd : $S^2 \times S^1$

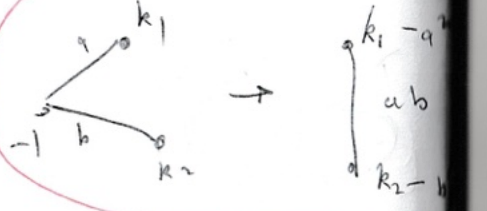


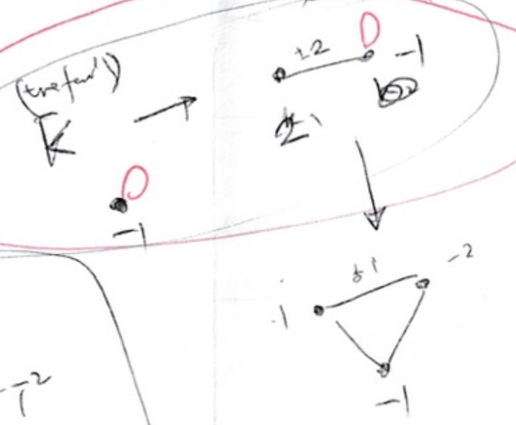
S^2 bundle over S^1

Aug 09

How to go from $S^1 \times S^2$ to S^3 (?)





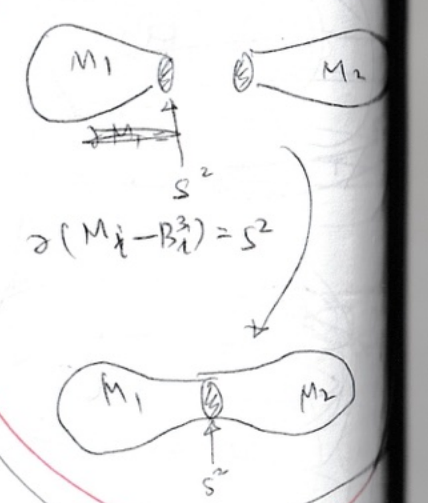


solid torus

$\partial(S^1 \times D^2) = T^2$

non-compact

$M_1 \# M_2$



$y_\mu = x^\mu + i p_\mu$

$x^\mu p_\mu = 0$

$u = z \tilde{u}$

$u = y_1 + i y_2 = x_1 + i p_1 + i x_2 - p_2$

$\tilde{u} = y_3 - i y_4 = x_3 + i p_3 - i x_4 + p_4$

$Li_2(e^{-RT_c})$, $Q = e^{-RT_c}$, $T_c \to \infty$, $e^{-RT_c} \to 0$ $\boxed{Li_2(0) = 0}$

$\boxed{Q \to 0}$ decoupling limit

$2\pi \lim_{N\to\infty} \frac{\log |J_N(k; s_N)|}{N} = \mathrm{Vol}(S^3 \backslash k)$ $\boxed{Li(s_N)}$

$\boxed{s_N = e^{\frac{2\pi i}{N}}} \sim \boxed{e^{i\lambda}}$

$t \sim e^{-RT_c} \sim \frac{2\pi i N}{k+N}$

$\lambda \sim \frac{2\pi i}{N} \sim T_c,$

$\boxed{e^{\lambda} = Q}$

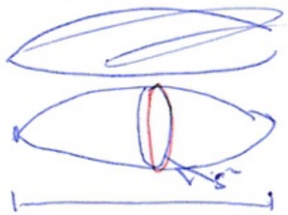
$\lambda = \frac{2\pi}{k+N}$, $t = \frac{2\pi i N}{k+N}$, $\lambda = g_{cs}^2$

$t \sim i N \lambda$

't Hooft coupling $\lambda N \sim t$

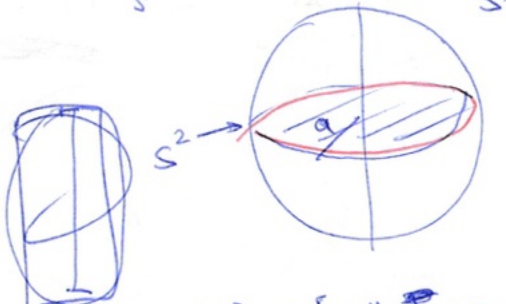
$N\lambda \to \infty$
$N \to \infty$
or $\lambda \to \infty$

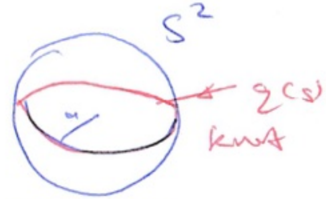
S^3



$\underbrace{x_1^2 + x_2^2 + x_3^2}_{S^2} + x_4^2 = a^2 - x_4^2$

S^3 $\uparrow x_4$





$z = (-) \frac{u}{v}$

$= (-) \frac{y_1 + i y_2}{y_3 - i y_4}$

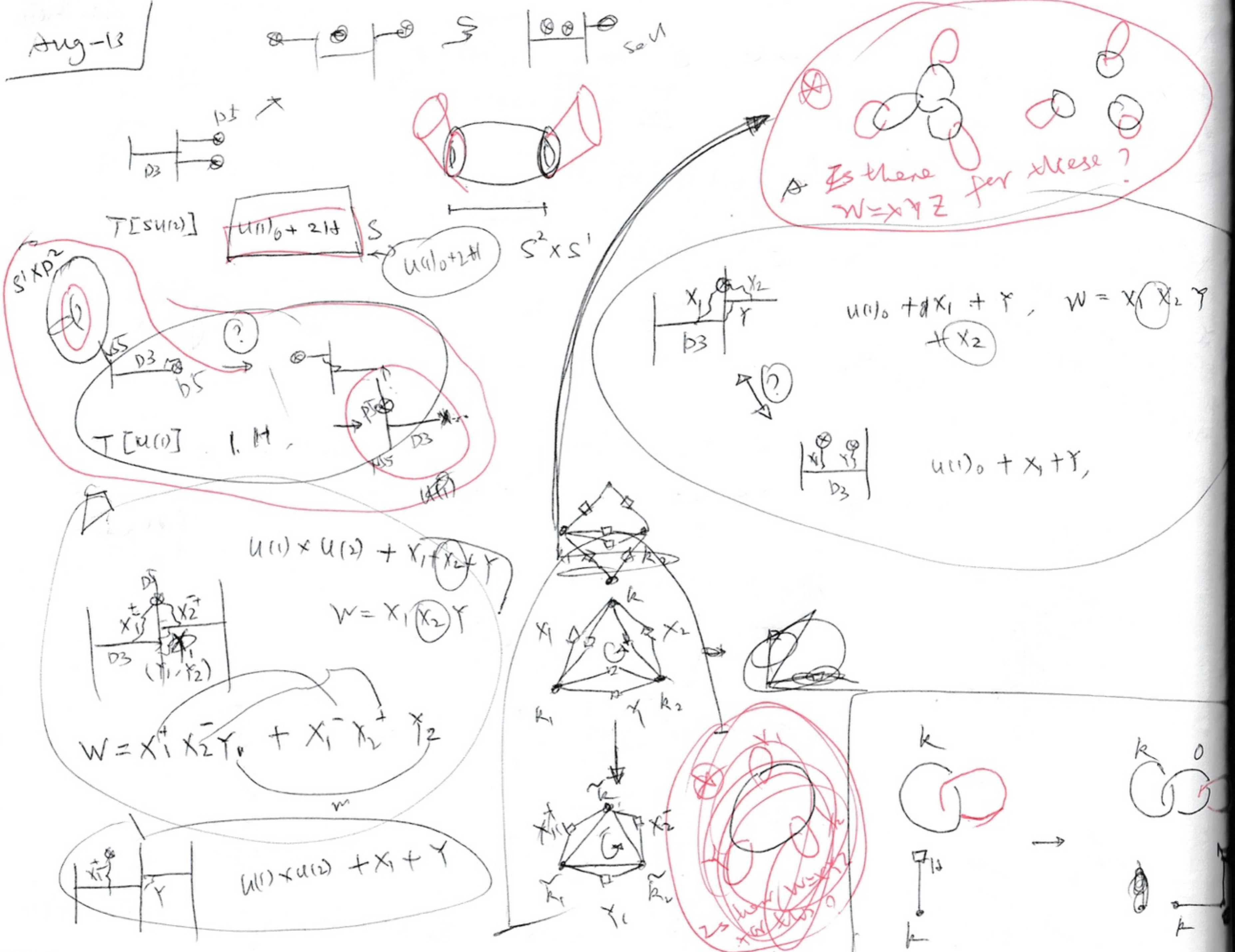
$\frac{(y_1 + i y_2)(y_3 + i y_4)}{(y_3 - i y_4)(y_3 + i y_4)} = [y_1 y_3 - y_2 y_4 + i(y_2 y_3 + y_1 y_4)]$) Φ

$y_1 y_3 + y_2 y_4 = 0$

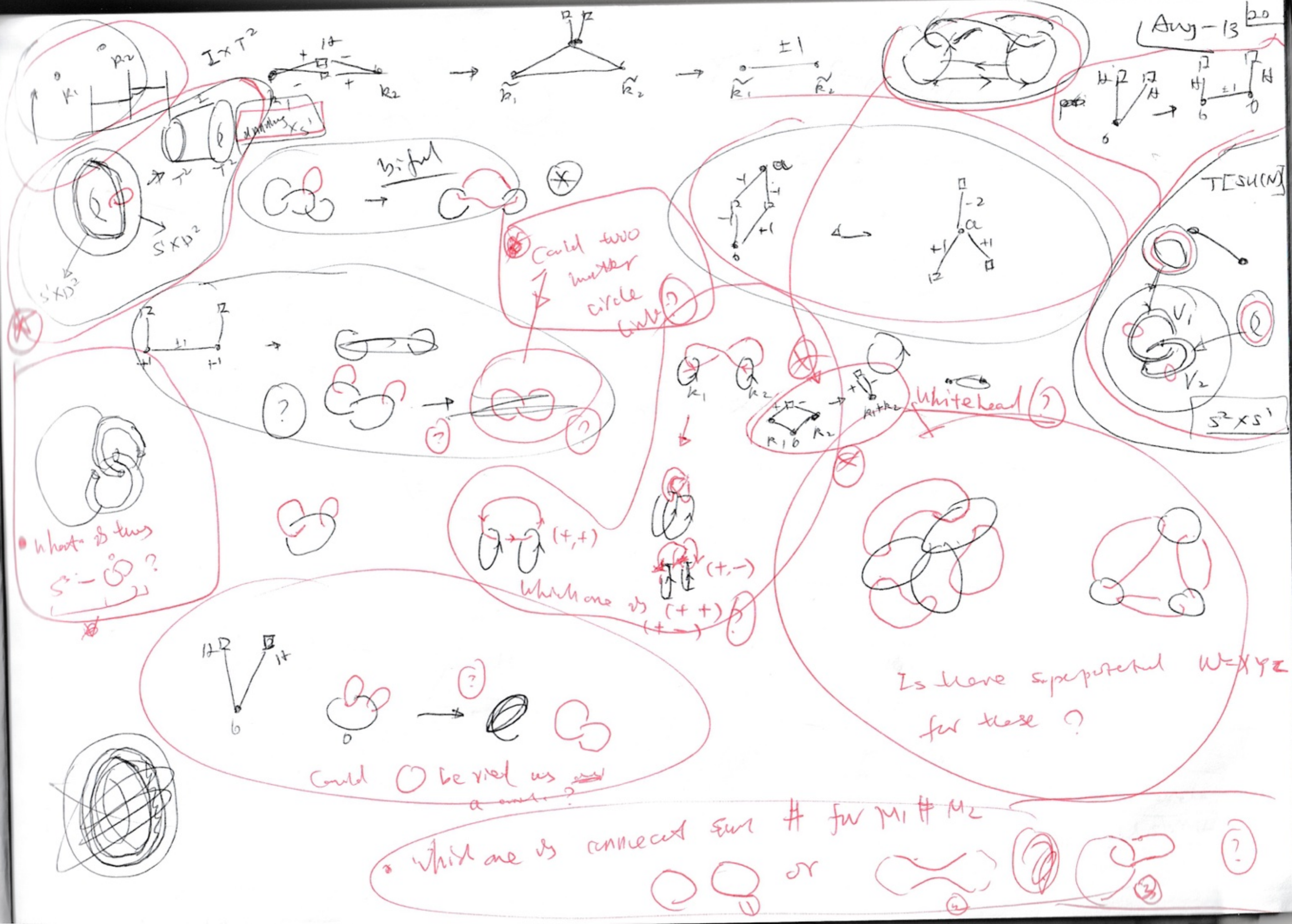
$\boxed{y_3 = y_4}$

$y_1 y_3 + y_2 y_3 = (y_1 + y_2) y_3$

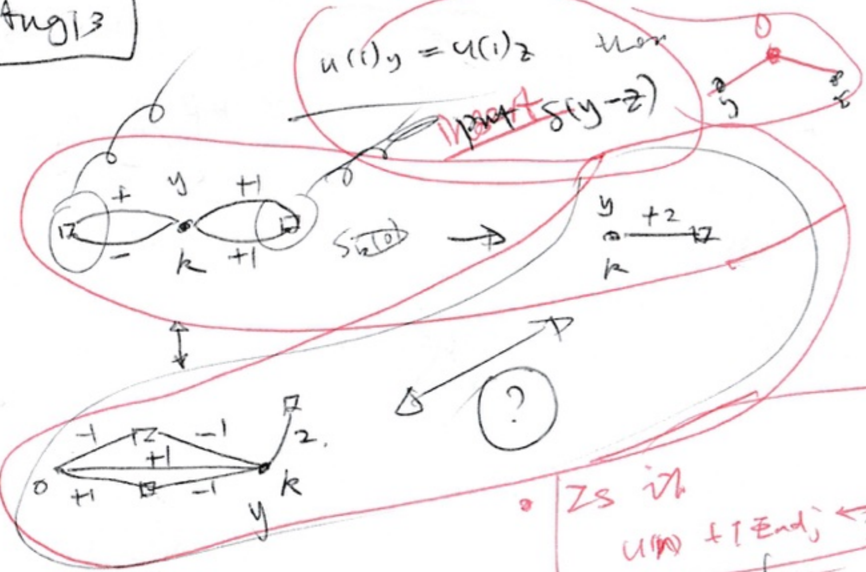
Aug-13



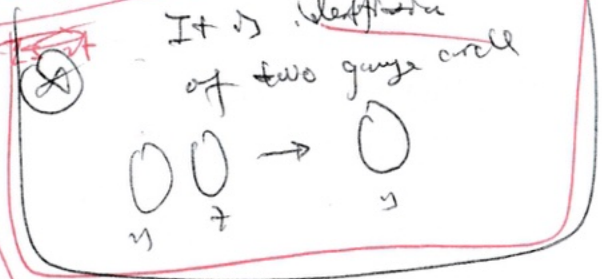
so(1)
D5
D3
T[SU(2)]
U(1)₀ + 2H
S
U(1)₀+2H
S²×S¹
S¹×P²
NS5
T[U(1)]
1. H
Is there W = XYZ for these?
U(1)₀ + X₁ + Y, W = X₁ X₂ Y
+ X₂
U(1)₀ + X₁ + Y,
U(1) × U(2) + X₁ + X₂ + Y
W = X₁ X₂ Y
W = X₁⁺ X₂⁻ Y₁ + X₁⁻ X₂⁺ Y₂
U(1) × U(2) + X₁ + Y
X₁
X₂
Y₁
k
k₁
k₂


Aug-13
20
I × T²
S¹ × D²
bifurl
Could two matter circle link?
T[SU(N)]
S² × S¹
Whitehead
What is this
Which one is (+, +)
(+, −)
Could be viewed as a ...?
Is there superpotential W = XYZ for these?
Which one is connected sum # for M1 # M2
or

Aug 13



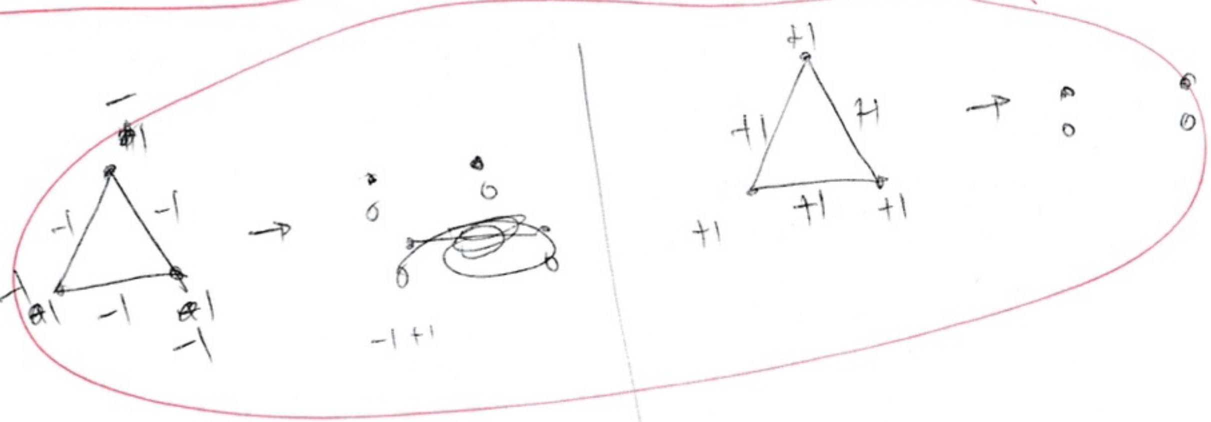
• Zs is
u(1) + 1 Endi ↔



$y = z$

$S_b(y \pm z) \longrightarrow S_b(0)\, S_b(2y)$

• What is the identification
of matter circles ?

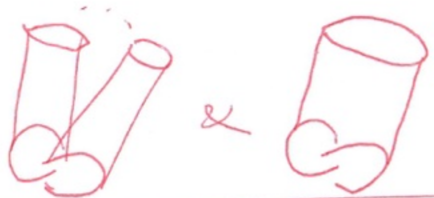


- What if the matter circle S^1 shrink?

- What if the matter circle $S^1 \to \circ$ shrink to a point?

  Is it decouple? / or FI → 0

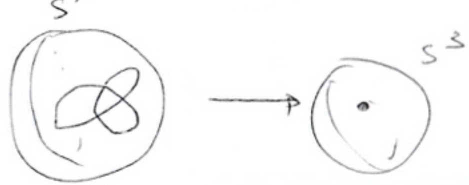
- What is this? Are they the same?



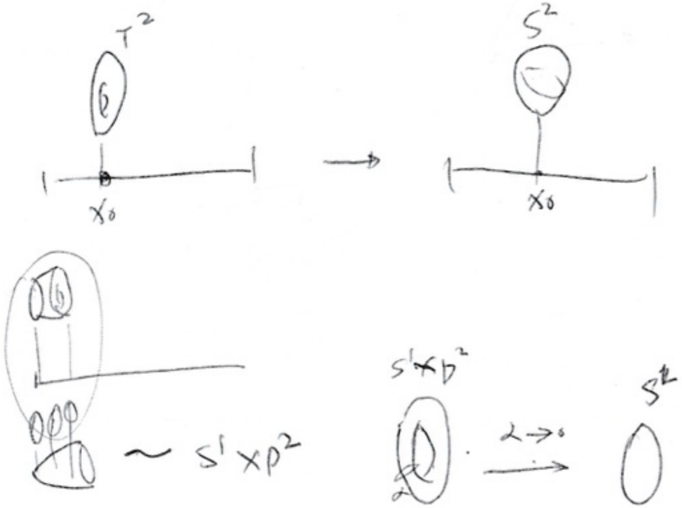
- Where is the FI parameter?

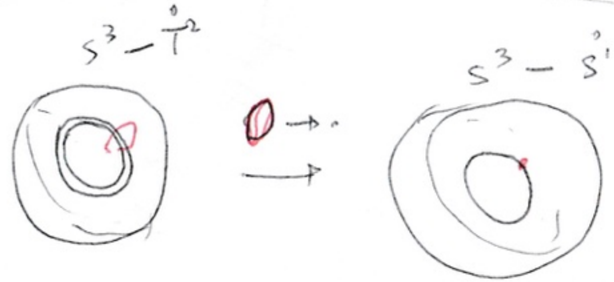
- Do we only need to find a elliptic fiber on M_3 to encode matter circle? (Could it shrink to a point?)

Ricci flow

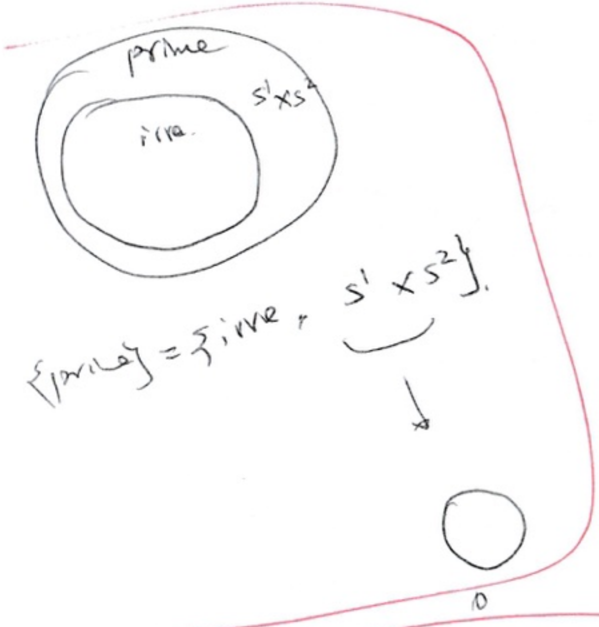


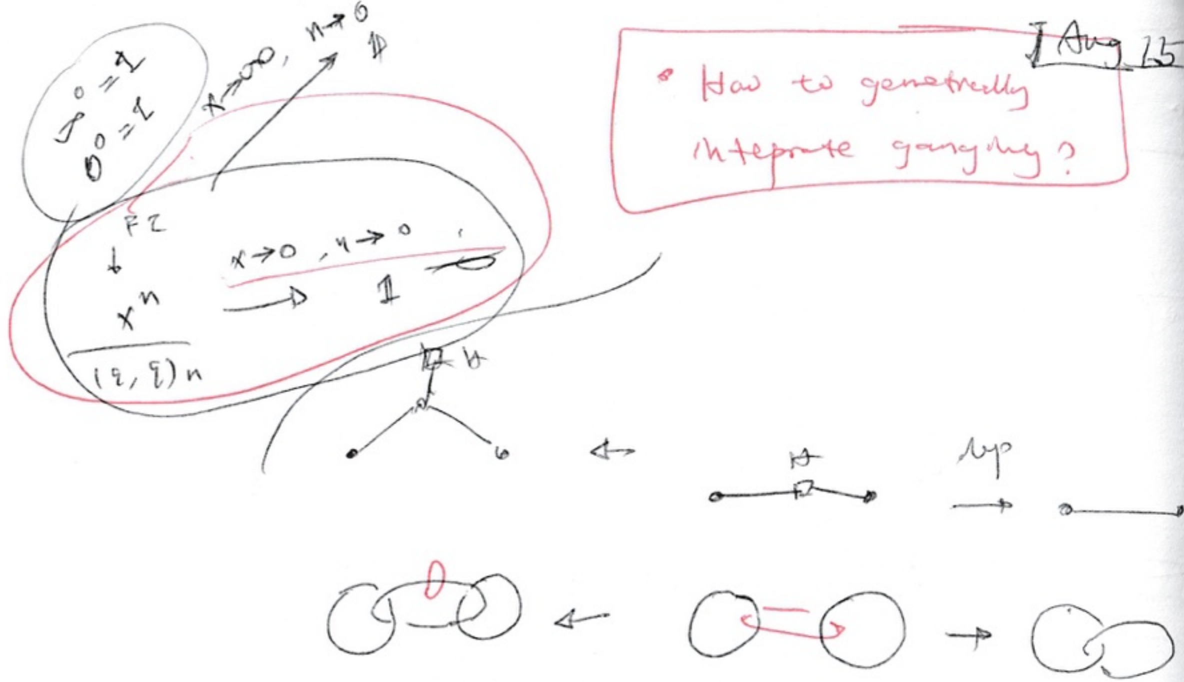
- How to interprete sphere & torus decomposition in physics?





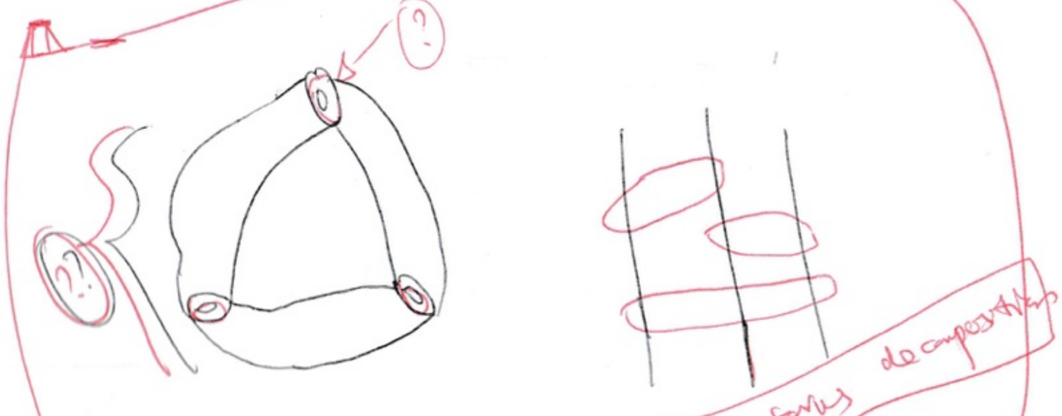
Aug 14



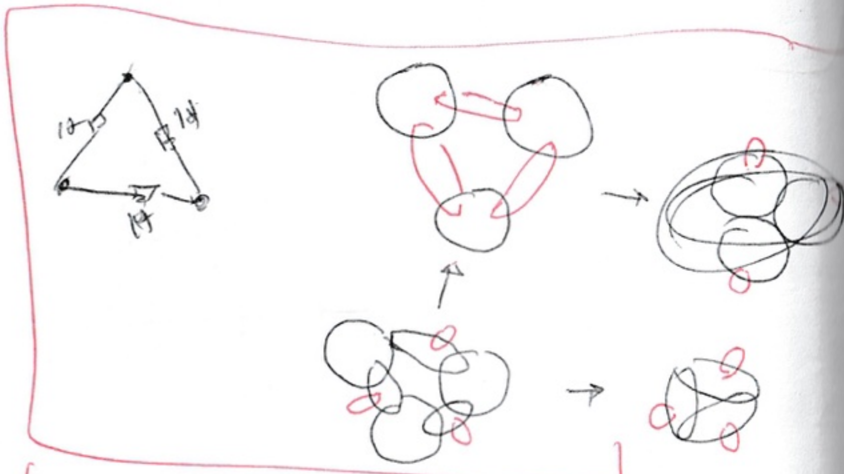


Aug 15

- How to genetrically integrate gangling ?

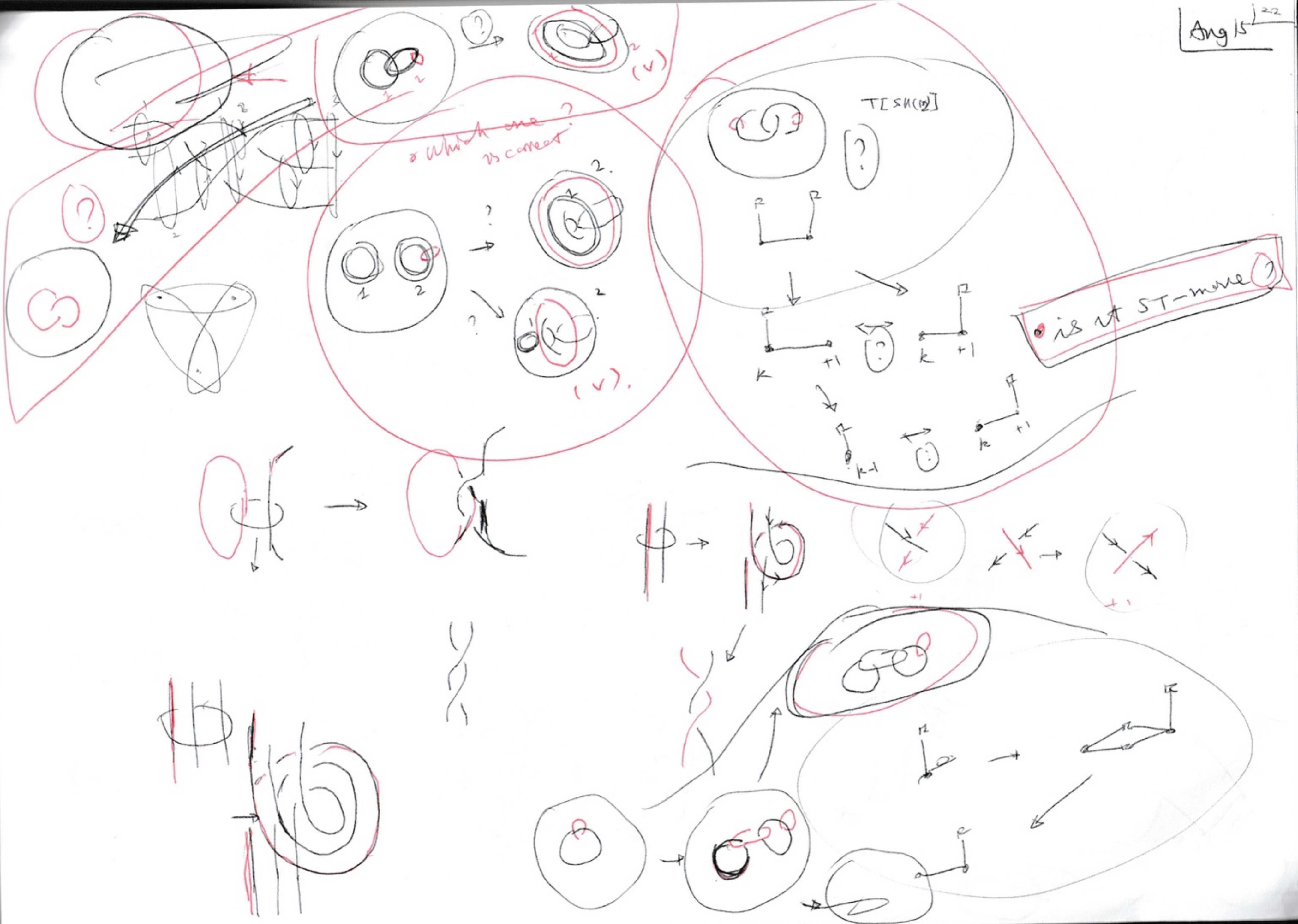


- Is this W = XYZ ?
- What is the sphere or torus decompositions for this ?



- Does Borromean ring appear ?

Aug 15 '22

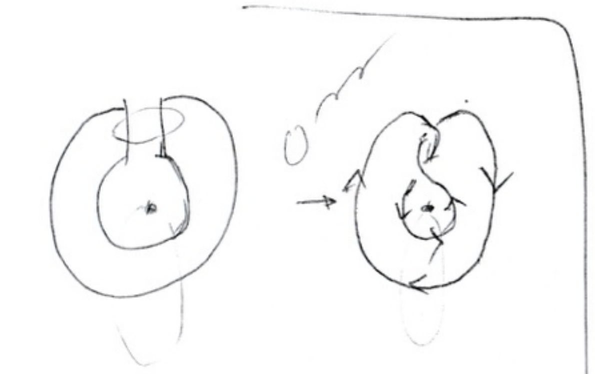


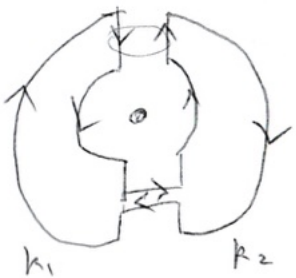
Aug-16

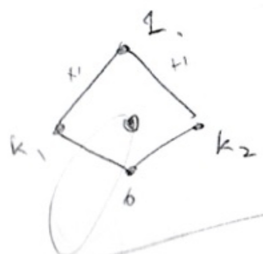
• Can ∞ be used to introduce (twist)
• What is it's relation w/ ST-β num?

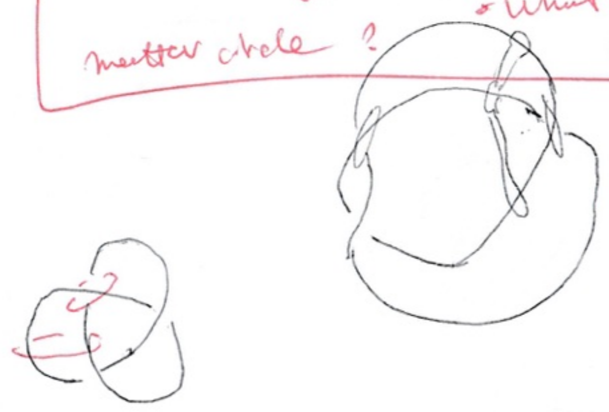
matter circle ?

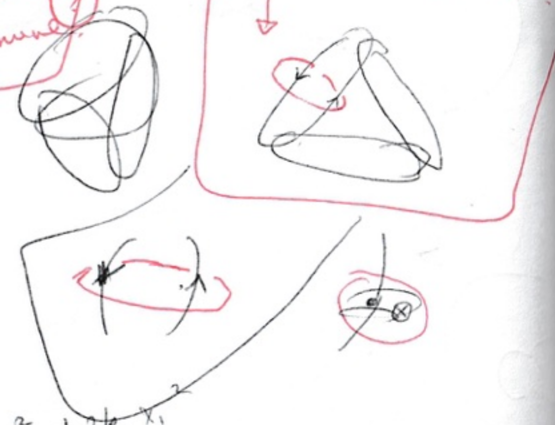
• what is this circle ?





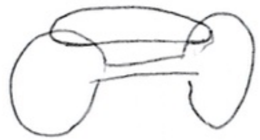


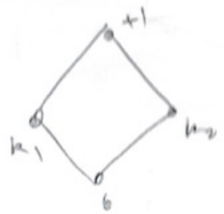


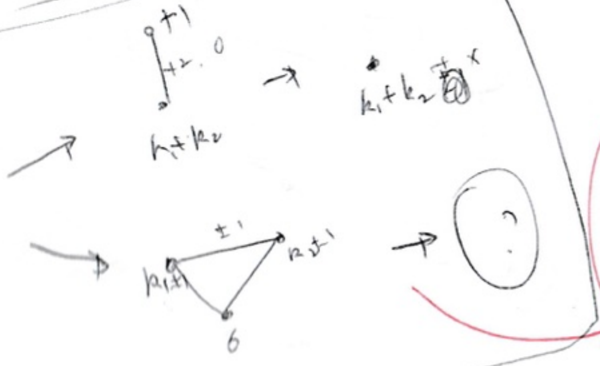


$$k_2 x_2^2 + k_1 x_1^2 + 2k x_1 x_2 \xrightarrow{x_2 \to x_1} (k_1+k_2) x_1^2 + 2k x_1^2 = (k_1+k_2+2k) x_1^2$$

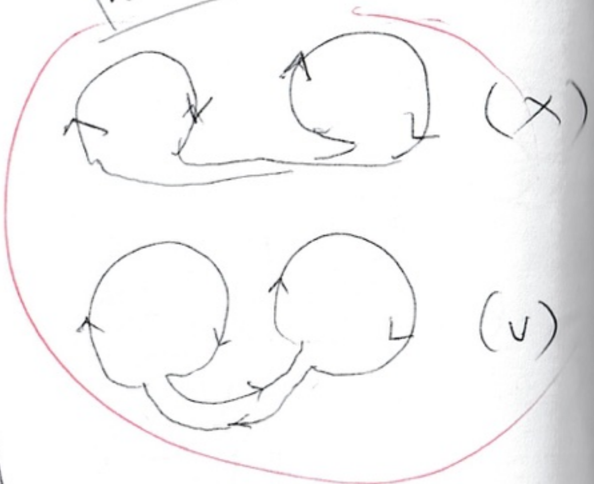
$$\xrightarrow{x_2 \to -x_1} (k_1+k_2) x_1^2 - 2k x_1^2 = (k_1+k_2-2k) x_1^2$$







need to preserve orientation

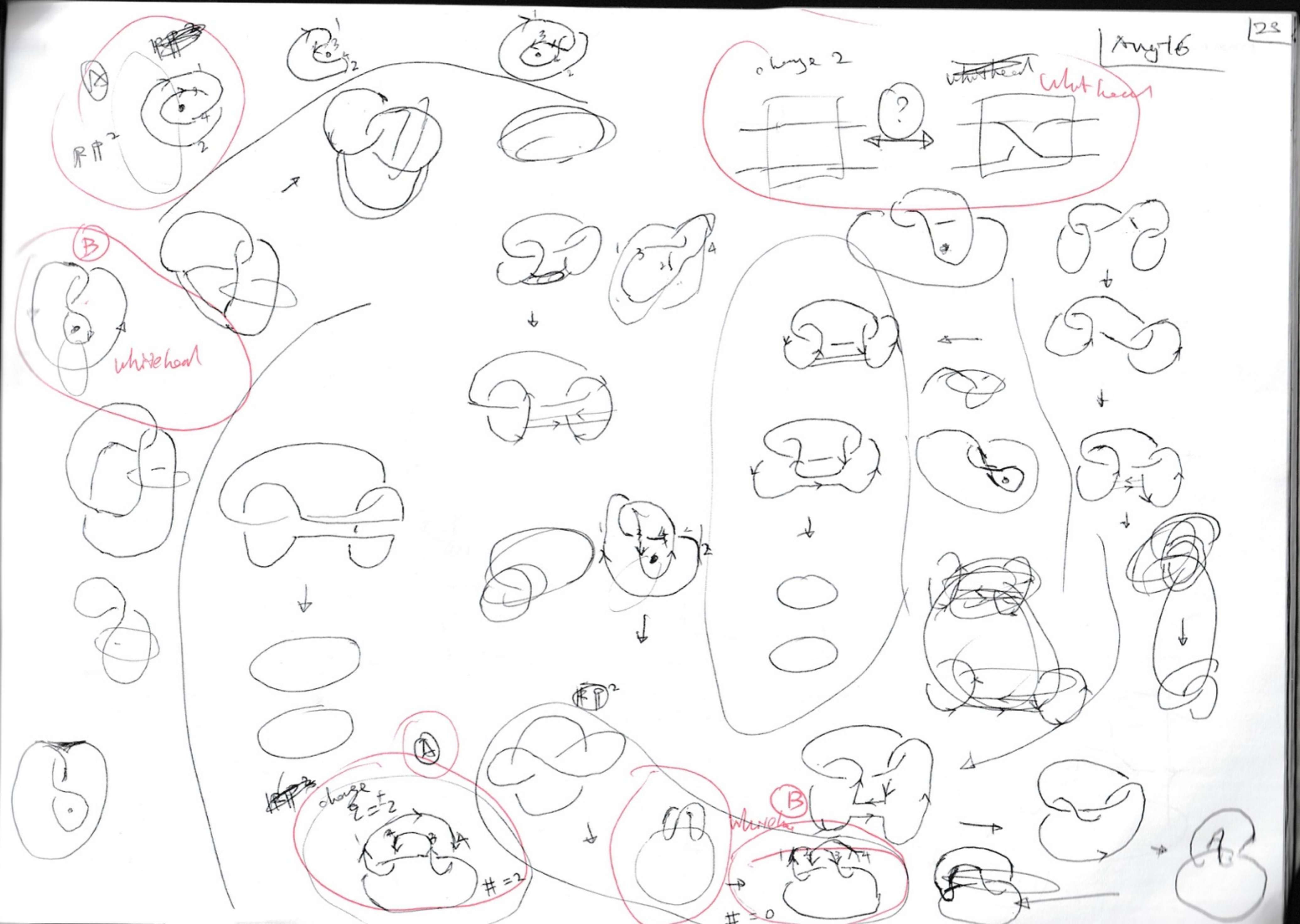


this
circle ?

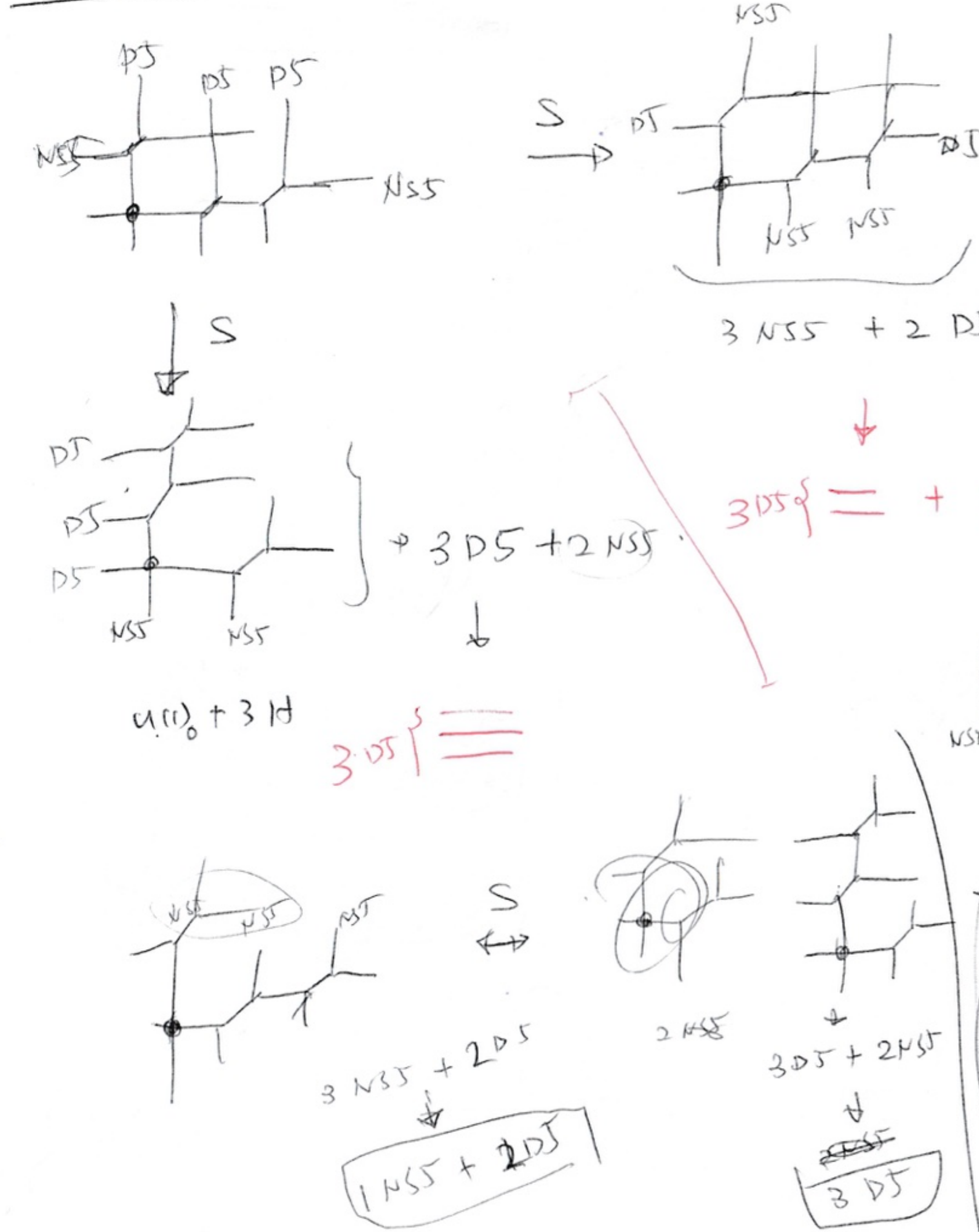
tation

(X)

(V)

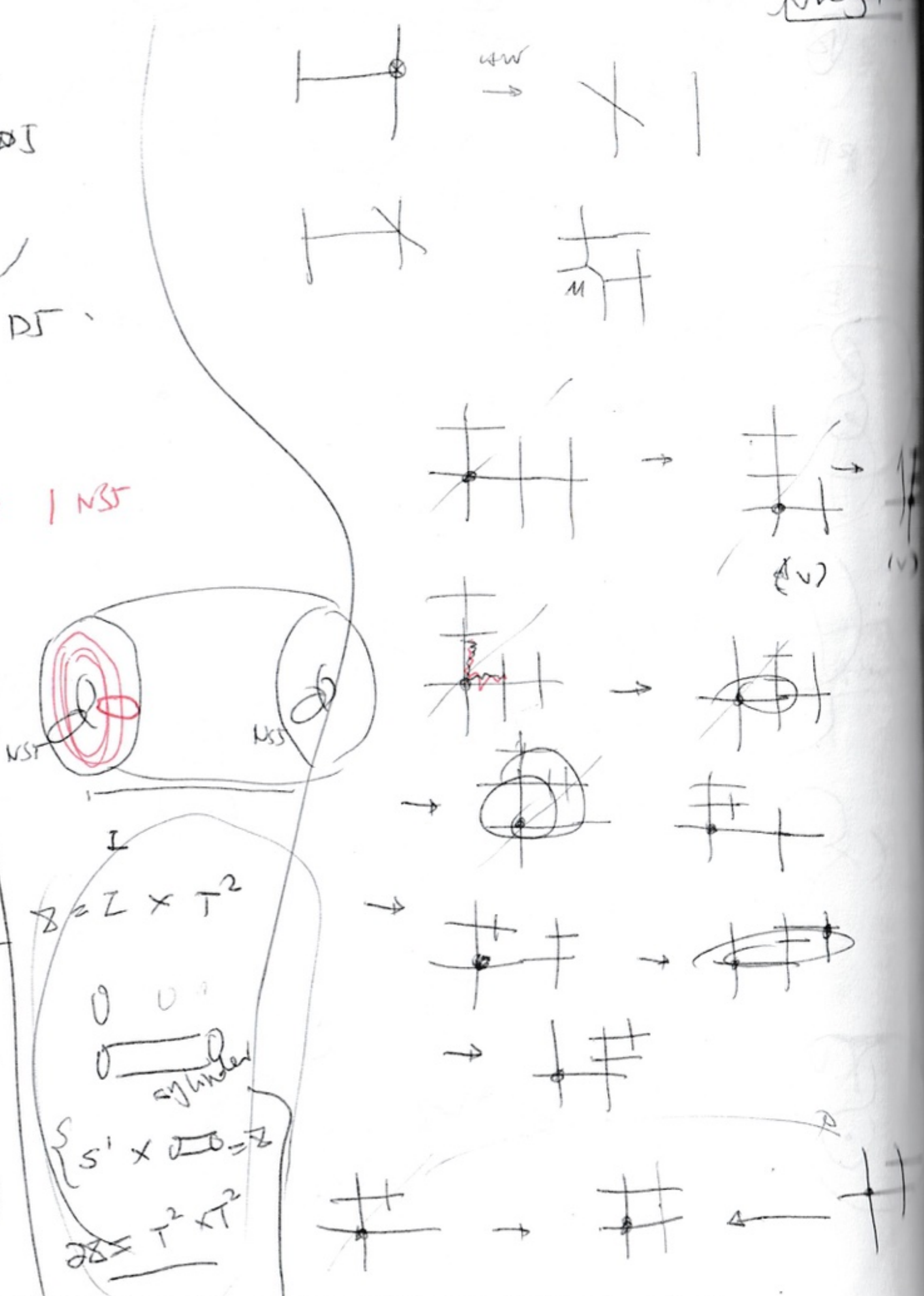


Aug 12



D5 D5 D5
NS5 NS5
S
D5 D5
NS5 NS5
3 NS5 + 2 D5
S
D5 D5 D5
NS5 NS5
+ 3 D5 + 2 NS5
U(1)_0 + 3 H
3 D5 =
3 D5 = + 1 NS5
NS5 NS5 NS5
S
2 NS5
3 NS5 + 2 D5
1 NS5 + 2 D5
3 D5 + 2 NS5
3 D5

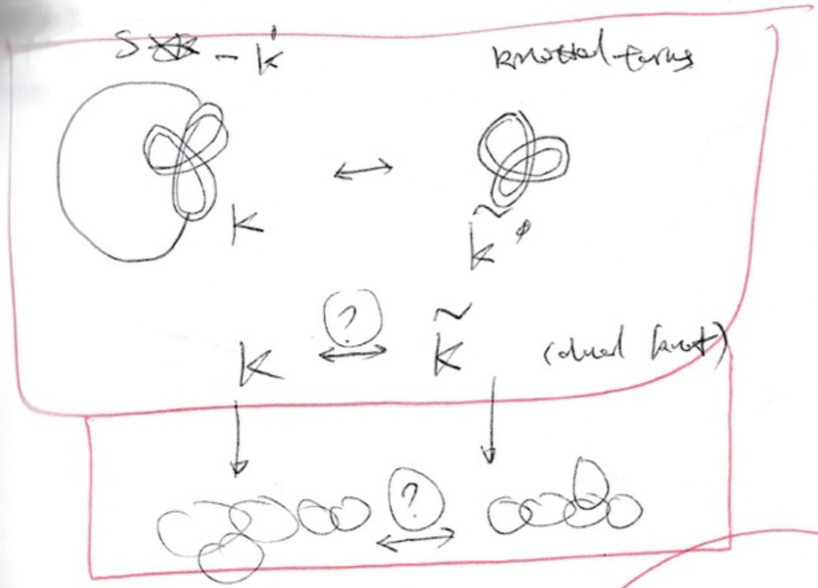
Aug 1?



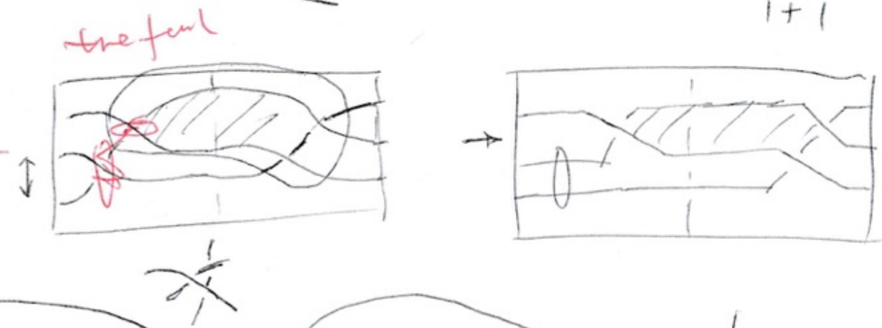
NS5 NS5
Z = Z × T^2
cylinder
S^1 × cylinder = Z
T^2 × T^2

Aug-18

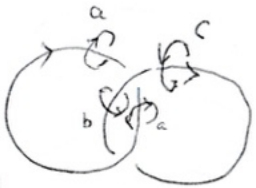
Aug-19



$$1 + \frac{1}{1+1} = \frac{3}{2}$$



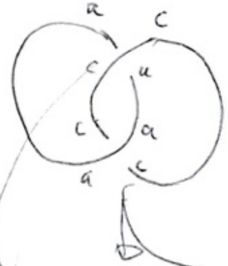
Aug 24



$c = a^{-1} b a$

$\downarrow b = c$

$c = a^{-1} c a$



$ca = ac$

$ac = ca$

$ac = ca$
$c = a^{-1} c a$

$a = c a c^{-1}$

$\Rightarrow$ $a = c^{2n} a c^{-2n}$

$ac = ca \to c^{-1} a c = a$

$\to a = c a c^{-1} = c^{-1} a c$

$c a c^{-1} = c^{-1} a c$

$\downarrow$

$ca = c^{-1} a c^2$

$\downarrow$

$a = c^{-2} a c^2$

$\downarrow$

$c^2 a c^{-2} = a$

3.1

$aba = bab$

$ab = bab a^{-1}$

$e^{ABA} = e^{BAB}$

$e^{ABA - BA}$

$ab = bab a^{-1}$

$e^{\int_{C_a} A} e^{\int_{C_b} A} = e^{\int_{C_a + C_b} A}$

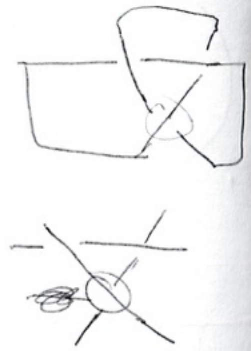
$\{ a, b, c, \; ac = cb = ba$

ac

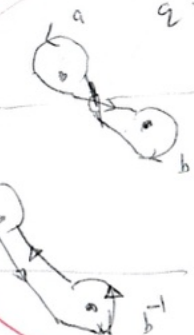
$(ab)(ab^{-1})(ba)$

$(ab)^{-1} = b^{-1} a^{-1}$

Aug

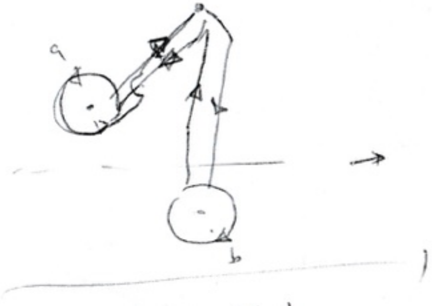


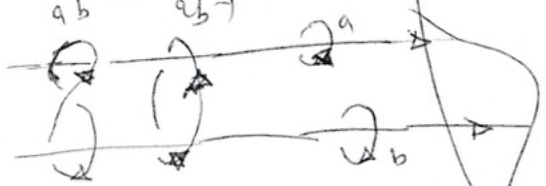
$q = 0$

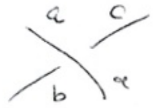


ab

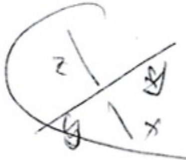
ab^{-1}







$c = a^{-1} b a$



$xy = yz$

$\Rightarrow z = y^{-1} x y$

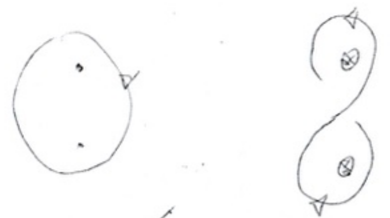
$ab = ba\, b a^{-1}$

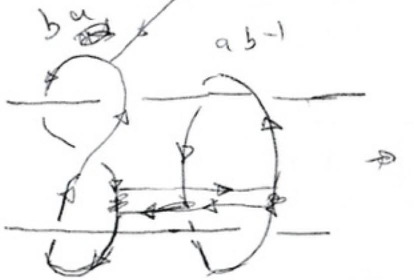
$ac = ba$

$ab^{-1} \xrightarrow{\text{ore}} a^{-1} b$

$c = b a b^{-1}$

$ba = a b\, a b^{-1}$

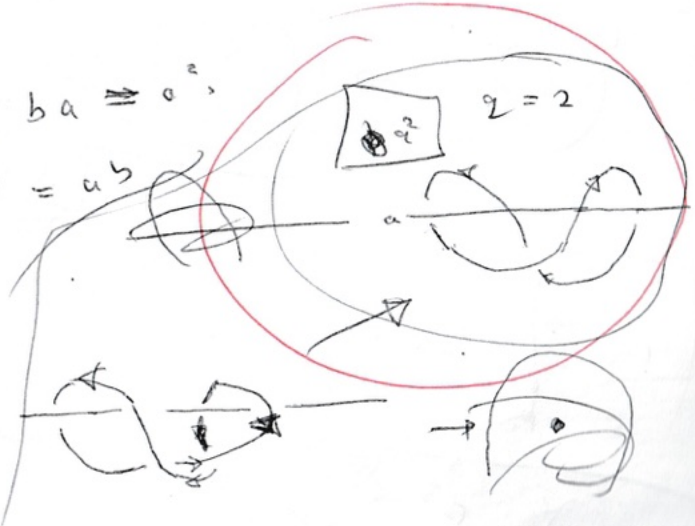




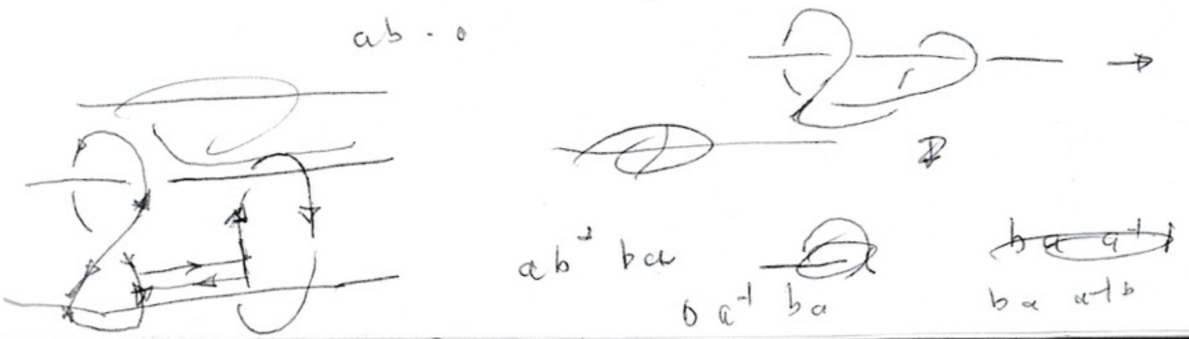
$ab^{-1},\ ba \Rightarrow a^2,$

$ba(ab^{-1})^{-1} = ab$

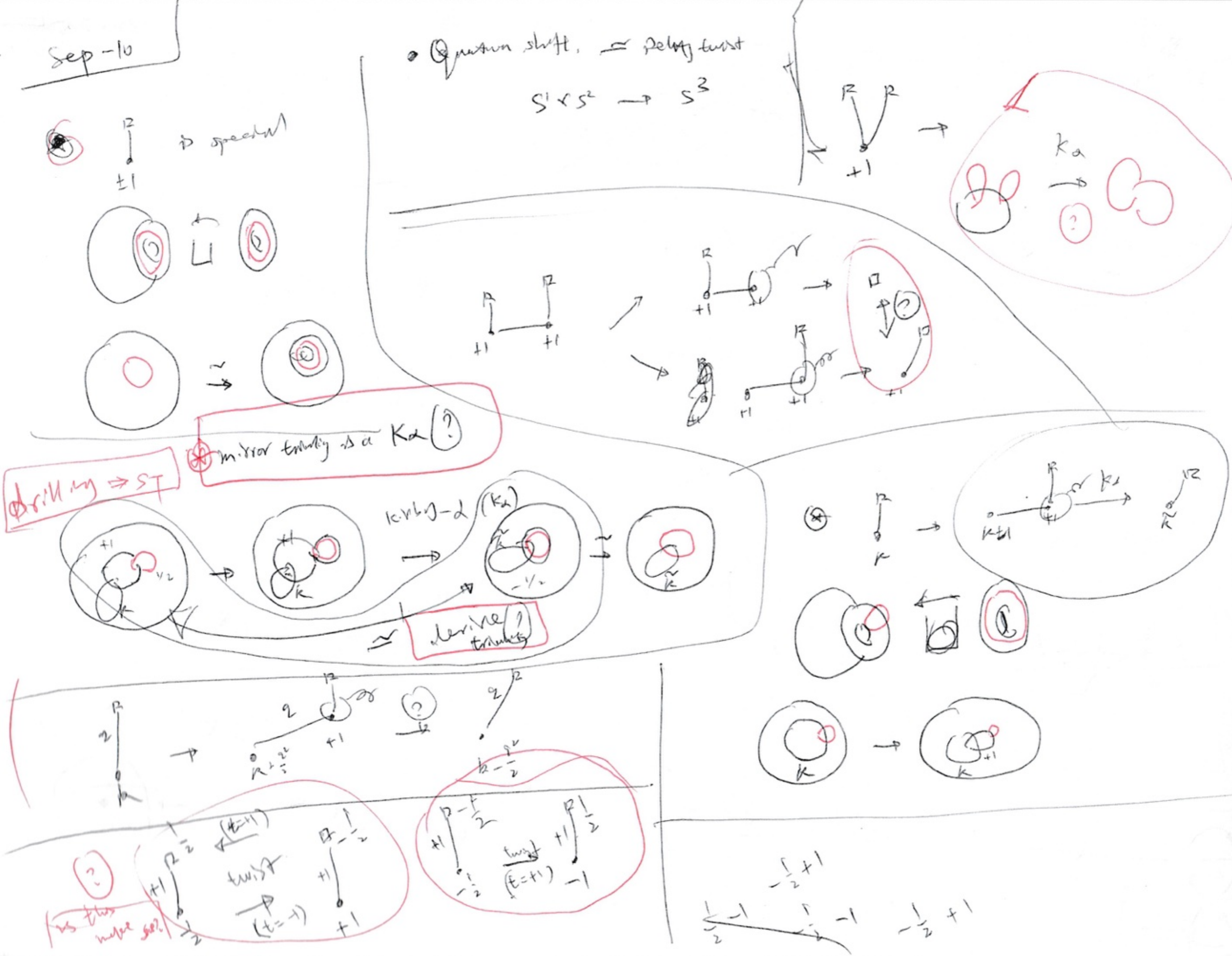
$= bab\, a^{-1}$

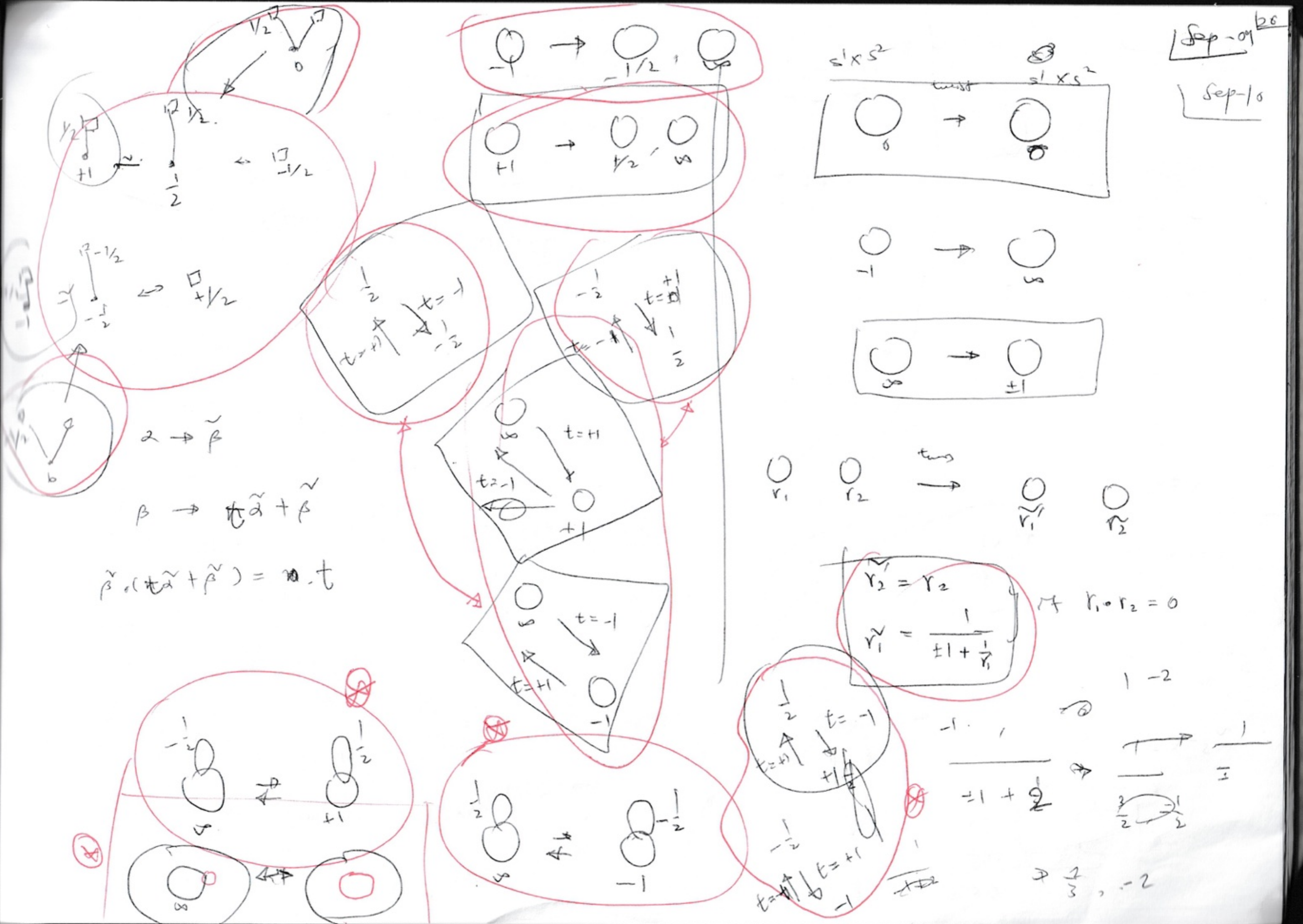


ab · 0



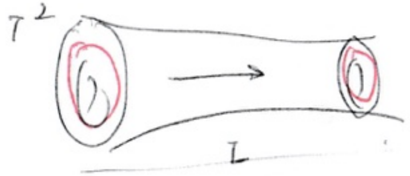
Sep-10


Quantum shift, ≃ Dehn twist
$S^1 \times S^2 \to S^3$
⇒ special
mirror trinity is a Kα ?
drilling ⇒ ST
kinky-α (Kα)
derive trinity ?
twist
(t=+1)
(t=−1)
is this make sense?



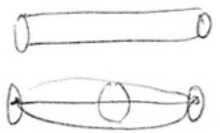
Sep-09
Sep-10
26
$S^1 \times S^2$
twist
$S^1 \times S^2$
$\alpha \to \tilde\beta$
$\beta \to t\tilde\alpha + \tilde\beta$
$\tilde\beta \cdot (t\tilde\alpha + \tilde\beta) = t$
t=+1
t=-1
r_1 r_2
$\tilde r_1$ $\tilde r_2$
$\tilde r_2 = r_2$
$\tilde r_1 = \frac{1}{\pm 1 + \frac{1}{r_1}}$
if $r_1 \cdot r_2 = 0$

Sep-12



$T^2 \times I$

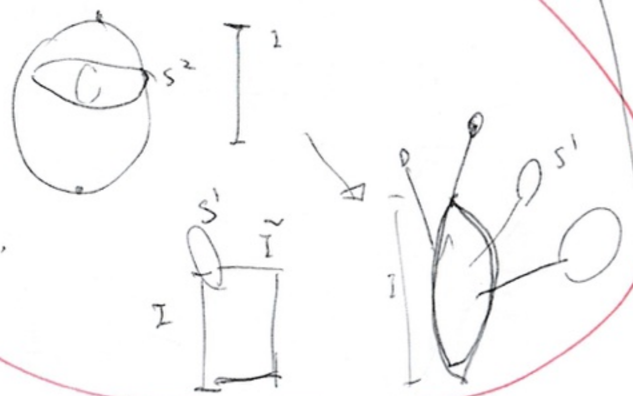
$S^1 \times S^2 \simeq S^1 \times S^1 \times I$



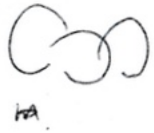
$S^2 \setminus \{\pm \infty\} = S^1 \times I$.

$S^1 \times S^2 \setminus \{\pm \infty\} = T^2 \times I$

$S^3 \setminus_{\{\pm \infty\}} =$



$\simeq S^2 \times I$.



$m \to L \to m$

Sep-13

- Dehn twist <-> effective k
- n, m freedom for surgery
- bifund AF, decoupling -> Δk_{ij}
-  ST -> $\mp$ twist

  $\mp$ twist

Sep-22

- twist along α -> ① -> { ST-move, effective k^{eff} chl
- Derive ST using $L(\pm 1, 1)$ and ~~strategy~~ and the drilling
- Drilling & (derive) ST-move by Kirby integrality (kirby-α)
- Integral Surgery

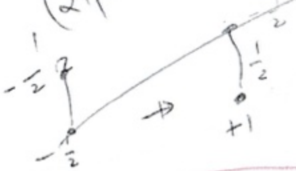
sep-21

$\alpha^2 = -\frac{1}{2}$ $\quad \alpha \cdot \beta = +1$

$\beta^2 = -\frac{1}{2}$

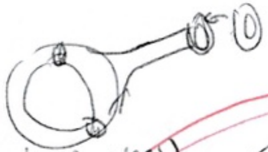
$(\alpha+\beta)^2 = \alpha^2 + 2\alpha\cdot\beta + \beta^2 = -\frac{1}{2} + 2 - \frac{1}{2} = +1$

$(\alpha+\beta)\cdot\alpha = \alpha^2 + \alpha\cdot\beta = -\frac{1}{2} + 1 = \frac{1}{2}$



$M(1,(1,0)) = T^3$

$= S^1 \times S^2 \# S^1 \times S^2 \setminus N(S^1)$



sep-11

$\beta \xrightarrow{\text{twist along } \alpha} \beta'$

$= \beta + t\alpha$.

S^3: $\beta + t\alpha = n\alpha' + \beta'$

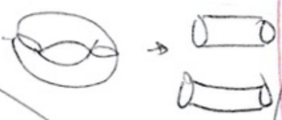
$n = t$, integral sugery

$L(k,1)$: $\beta + t\alpha = \alpha'$

$S^1 \times S^2$: $\beta + t\alpha = \alpha' + m\beta'$

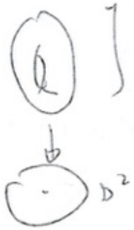
only if $t = 1, m = 1$,

integral sugery

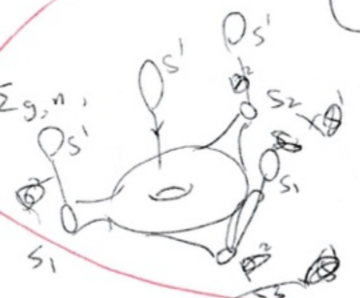


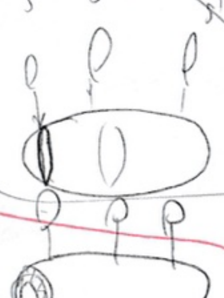
Seifert fibration

$\pi: D^2 \times S^1 \to D^2$



$T_1 = S^1 \times S^1$





$\Sigma_{1,3}$

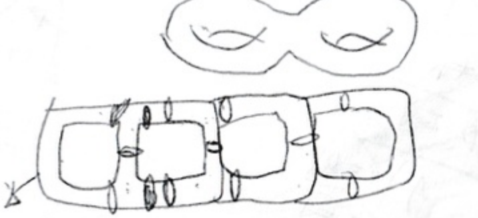
$S^1 \times S^2 \setminus N(S^1 \times n)$

$S^1 \times \mathbb{C}$

$\Sigma_{0,n}$: $S^1 \times S^2 \setminus N(S^1 \times S^1 \times S^1)$

$\Sigma_{0,2}$: $T^2 \times I \setminus N(S^1)$

annulus $\times S^1$



$2(g-1) + 2 = 2g$

Sep 22

$L(p, q)$

$ps + r = 1$

$L(p, 1)$, $ps + r = 1$ → $s = 0$, $r = 1$

$ps + qr = 1$

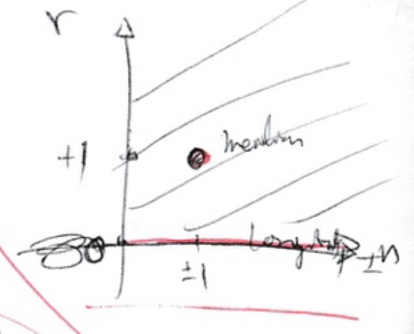
$p = 0$, $q = 1$

$0 + r = 1$

$r = 1$

$0 \cdot s + 0 \cdot r = 1$

$s = 1$



$ps + qr = 1$.

$$\begin{cases} \alpha = p\alpha' - q\beta' \\ \beta = r\alpha' + s\beta' \end{cases}$$

twist

$$\alpha' = \alpha'' + n\beta'$$

$$\beta' = \beta''$$

$$\begin{cases} \alpha = \alpha' \\ \beta = \tilde{n}\alpha' + \beta' \end{cases}$$

integral freedom

$L(1, 0)$ $(\alpha, \beta) \leftrightarrow (\alpha', \tilde{n}\alpha' + \beta')$

twist

$L(1, n)$. $$\begin{cases} \alpha = \alpha' - n\beta \\ \beta = r\alpha' + s\beta' \end{cases}$$

$$\begin{cases} \alpha = \alpha'' + n\beta' \\ \beta = \tilde{n}(\alpha'' + n\beta') + \beta' \\ \quad = \tilde{n}\alpha'' + (\tilde{n}n + 1)\beta' \end{cases}$$

$ps - qr = (\tilde{n}n + 1) - \tilde{n}n = 1$

$s + nr = 1$

$r = \tilde{n}$, $n \neq n$

if $n = 0$: $\alpha = \alpha''$, $\beta = \tilde{n}\alpha'' + \beta''$, $r = 1$

$s - \tilde{n}n = 1$

$s = \tilde{n}n + 1$

$r = n$

$q = n$, $p = 1$

$s = \tilde{n}n + 1$

$= rq + 1$

$\beta = r\alpha'' + (rn + 1)\beta''$

$\tilde{n}$ $rn + 1$

$L(1, 0)$: $\beta = r\alpha'' \times \beta''$

$L(1, n)$:

$\alpha = \alpha'' + n\beta''$

$\beta = r\alpha'' + (rn + 1)\beta''$

if $r = 0$, $\beta = \beta''$

if $r = 1$, $\beta = \alpha'' + (n + 1)\beta''$

if $r = -1$, $\beta = \alpha'' + (1 - n)\beta''$

$L(1, 1)$

$n = -1$, $\beta = \alpha''$

$n \neq -1$

$n = +1$, $\beta = \alpha''$

$n \neq -1$

$rn + 1 = 0$

$rn = -1$ ⇒ $r = 1, n = -1$; $r = -1, n = 1$, $L(1, \pm 1)$

Sep 22 28

$L(0,1) = S^2 \times S^1$

gluing

$$\begin{cases} \alpha = -\beta' \\ \beta = \alpha' + s\beta' \end{cases}$$

$ps + qr = 1$

$\begin{cases} s \in \mathbb{Z} \\ r = 1 \end{cases}$

S^3

$$\begin{cases} \alpha = \alpha' \\ \beta = r\alpha' + \beta' \end{cases}$$

twist

$$\begin{cases} \beta' = \beta'' + t\alpha'' \\ \alpha' = \alpha'' \end{cases}$$

$$\begin{cases} \alpha = \alpha'' \\ \beta = r\alpha'' + \beta'' + t\alpha'' \\ \quad = (r+t)\alpha'' + \beta'' \end{cases}$$

long

$r(\alpha'' + n\beta'') + \beta''$

$\alpha = -\beta$

$\beta =$

twist

$$\begin{cases} \alpha' = \alpha'' + n\beta'' \\ \beta' = \beta'' \end{cases}$$

twist β''

$$\begin{cases} \alpha = -\beta'' \\ \beta = \alpha'' + (n+s)\beta'' \end{cases}$$

$\Rightarrow n+s=0$

$$\begin{cases} \alpha = -\beta'' \\ \beta = \alpha'' \end{cases}$$

$$\begin{cases} \alpha' = \alpha'' \\ \beta' = \beta'' + n\alpha'' \end{cases}$$

twist α''

$\alpha = -\beta'' + n\alpha'' = n\alpha'' - \beta''$

$\beta = \alpha'' + s\beta'$

$= \alpha'' + s\beta'' + sn\alpha'' = (sn+1)\alpha'' + s\beta''$

$= s\alpha'' + (s$

$sn + 1 = 0$

$\beta \to s\beta''$

$s = 1, n = -1$

$s = -1, n = 1$

$L(-n, -1) \to \begin{cases} \beta \to \beta'', L(1,-1) \\ \beta \to -\beta'', L(-1,-1) \end{cases}$

$ms - r = 1$

$r = ms - 1$

$L(k, 1)$

$L(0,1) = L(0,1)$

$L(p,q) = -L(p,-q)$

$s = -1$

$k + 1 = 0$

$k = 1$

$s = 1$

$-k - 1 = 0$

$k = -1$

$L(-1,1)$

$L(-m,-1)$

$= -L(-m,1)$,

$t(s+1) + s$

sn

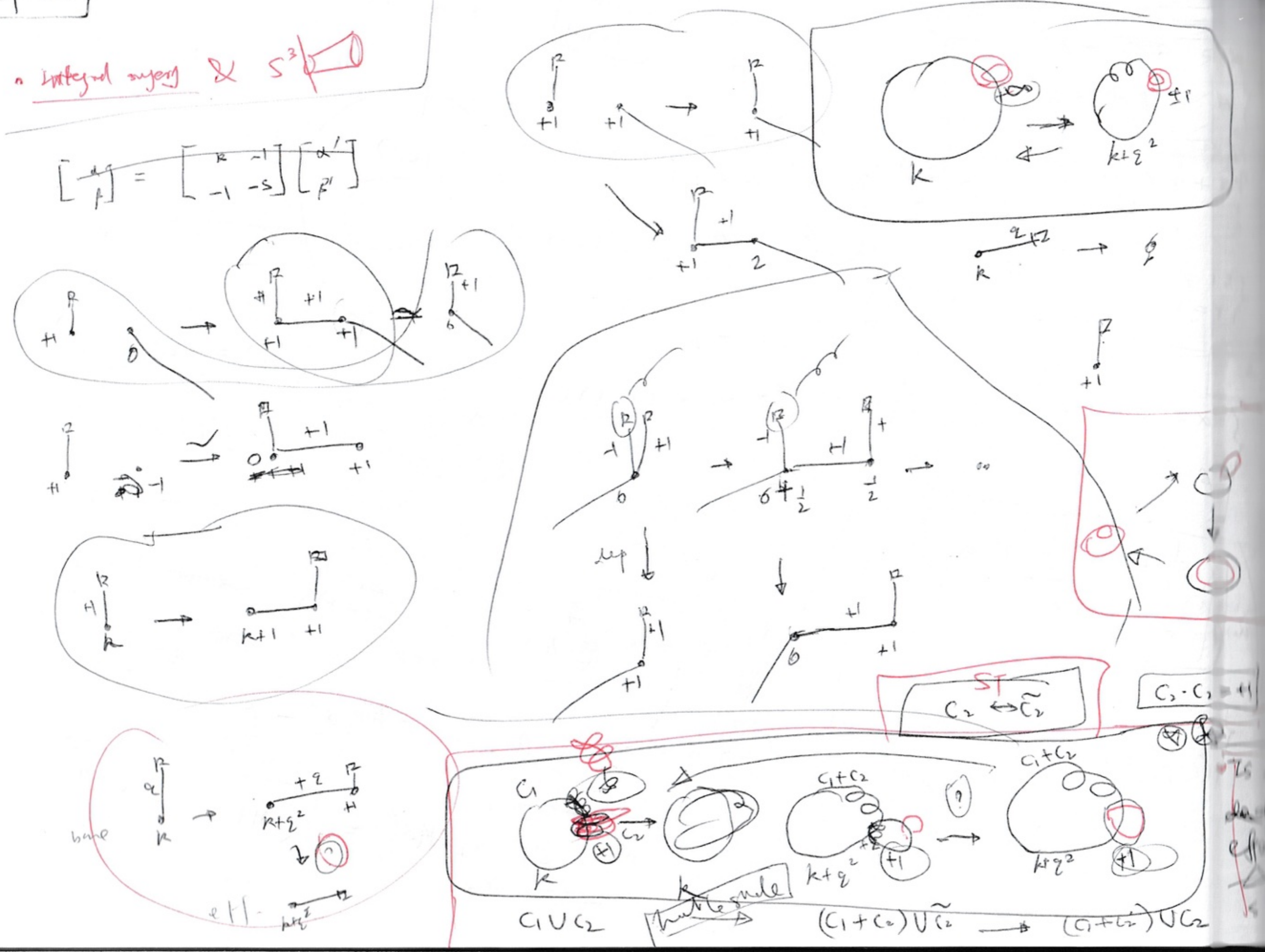
$ns + sn + 1$

Sep-22

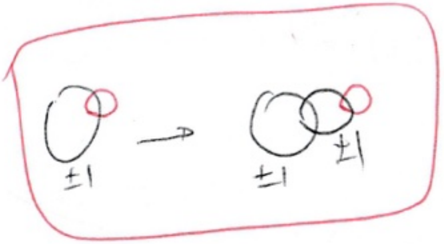
Sep-24

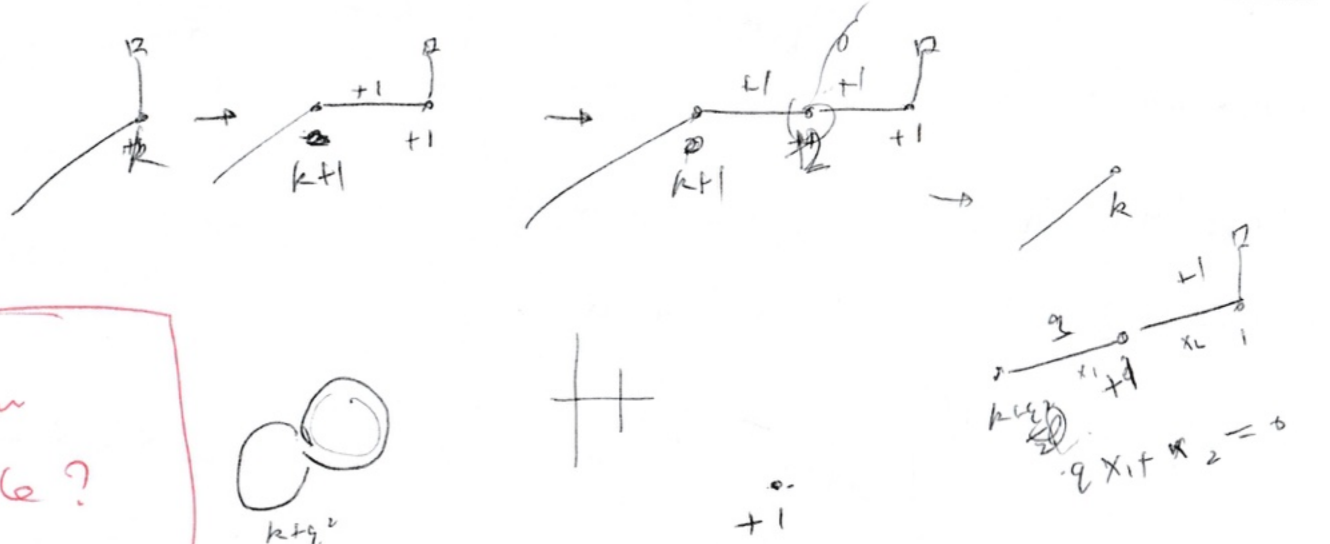
• Integral surgery & S^3

$$\begin{bmatrix}\alpha\\ \beta\end{bmatrix} = \begin{bmatrix} k & -1\\ -1 & -s\end{bmatrix}\begin{bmatrix}\alpha'\\ \beta'\end{bmatrix}$$



sep-25



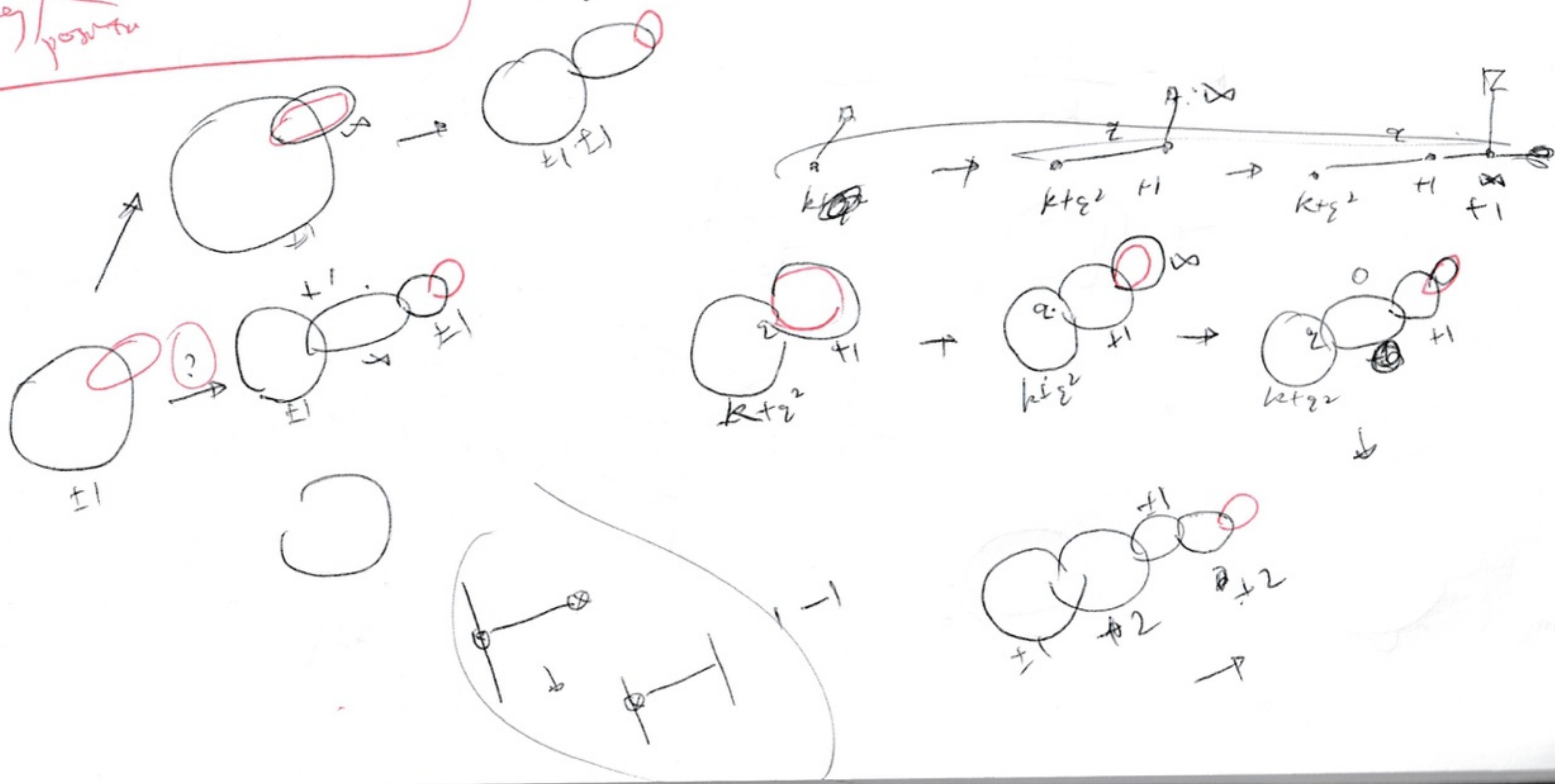


rational

pres integral surgery

matter circle?

change positive



Sep-28

$= b_1\alpha' + (bt+a)\beta'$

$\alpha_1 = b_1\alpha + a_1\beta$

$\tilde{\alpha}_1' = b_1\alpha' + (tb_1 + a_1)\beta' = b_1\beta' + (b_1\alpha' + a_1\beta')$

$= b_1(\alpha' + t\beta') + a_1\beta' \quad := b_1\beta' + \alpha$

$\begin{cases} \alpha = \alpha' + t\beta' \\ \beta = \beta' \end{cases}$ $\quad \frac{b}{bt+a} = \frac{1}{t + \frac{b}{a}}$

$b\alpha' + (bt+a)$

$k_1' = \frac{k}{k+1} = \frac{1}{1+\frac{1}{k}}$

$k=-1, s=-1$ $-\beta'$

$k=-1, s=0$, $\alpha'+\beta'$

$(1 - sk)(\alpha' + \beta') + s\beta'$ $\begin{cases} k=1, s=0, \alpha' \\ k=1, s=1, \\ L(1,1) \end{cases}$

$(1-s)(\alpha'+\beta') + s\beta'$

$(1+s)(\alpha'+\beta') + s\beta'$

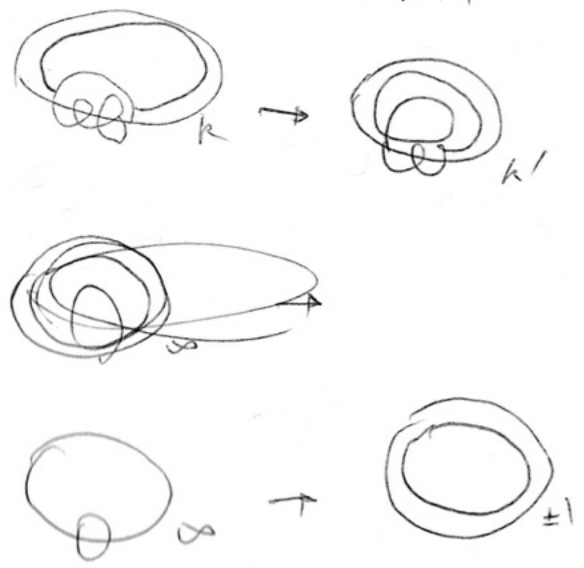
$(-sk+1)(\alpha'+\beta') + s\beta'$ $\rightarrow \begin{cases} s=0, \alpha' \\ k=0, \end{cases}$

β

$\tilde{\beta} = \alpha' + \beta' - s[k_1\alpha' + (k_1 + 1)\beta']$

$= \alpha' + \beta' - sk\alpha' - s(k+1)\beta'$

$= [(1-sk)\alpha' + (1-sk-s)\beta']$

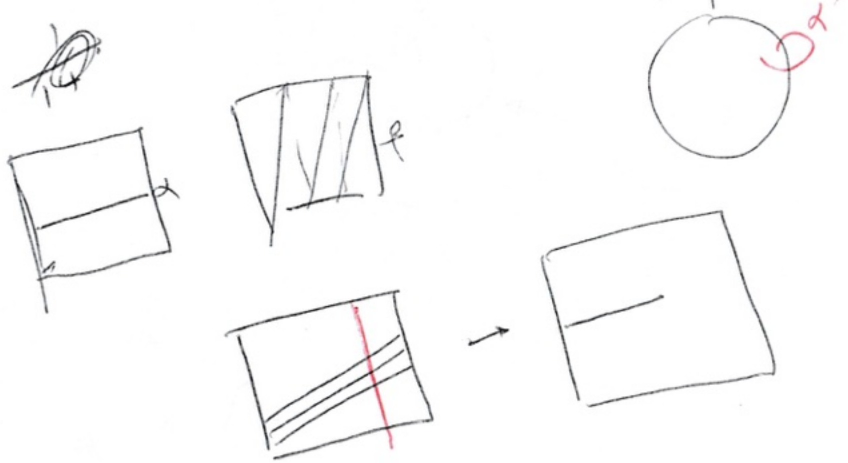


$t=+1$

$\infty \rightarrow +1$

$t=-1$

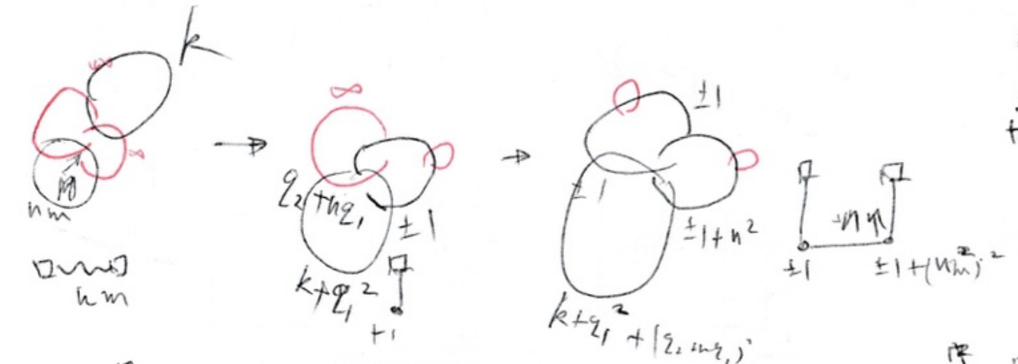
$\frac{b}{bt+a} =$

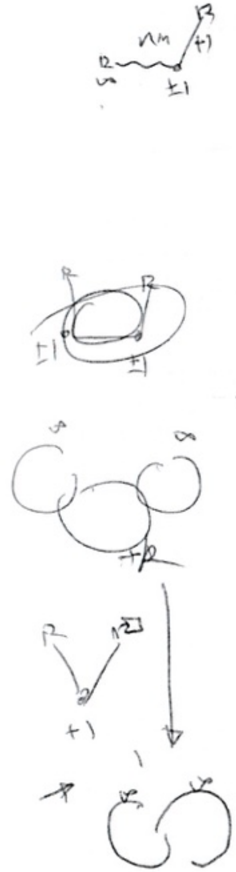


Lens space

sep-20

sep-25





$L(1, 1)$

$$\alpha = \alpha' - \beta'$$

$$\beta = \alpha' - s(\alpha' - \beta') = (1-s)\alpha' + s\beta'$$

$1-s$

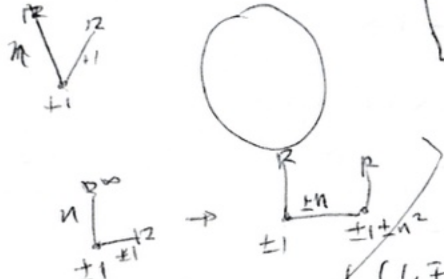
$S^3_\infty = L(1, 0)$

$$\alpha = \alpha''$$

$$\beta = r\alpha'' + \beta''$$

① $r = 0$, $\beta = \beta''$

② $r = 1$, $\beta = \alpha'' + \beta''$



$1-s \leftrightarrow r$

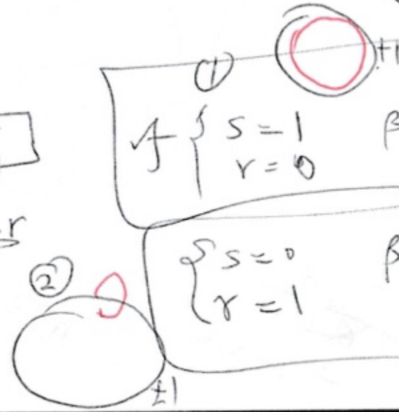
$1-s = r$

$s = 1-r$

$L(1, \mp 1)$, → $L(1, 1)$

$$\alpha = \alpha'' - \beta''$$

$$\beta = r(\alpha'' - \beta'') + \beta'' = r\alpha'' + (1-r)\beta''$$



① if $\begin{cases} s = 1 \\ r = 0 \end{cases}$ $\beta = \beta''$, β''

② $\begin{cases} s = 0 \\ r = 1 \end{cases}$ $\beta = \alpha'$, α''

sep 20

$k s - (1 - s k) = k s + s k - 1$

$\alpha' \cdot \beta' = 1$

L(1, 1), k = 1:
$\alpha = \alpha' - \beta'$
$\beta = (-s+1)\alpha' + s\beta' = \alpha' - s\alpha$

$r\alpha' + \beta' = r(\alpha'' + n\beta') + \beta' = r\alpha'' + (nr+1)\beta''$

$\begin{bmatrix} 1 & 0 \\ r & 1 \end{bmatrix}$

$(p\alpha' - q\beta') \cdot (r\alpha' + s\beta') = ps - qr = 1$

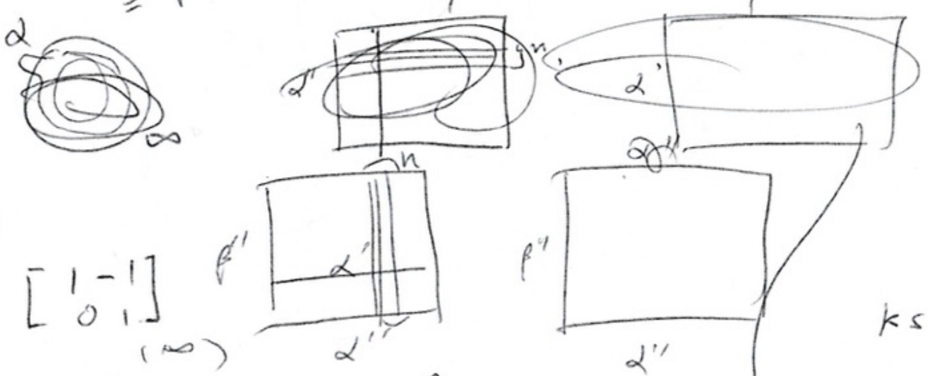
$ps + qr = 1$

L(1, 0) $\xrightarrow[\text{(twist)}]{n = -1}$
$\alpha = \alpha'' - \beta''$
$\beta = r\alpha'' + (1-r)\beta'' = \beta'' + r\alpha$

$\xrightarrow{s = 1 - r} (1-s)\alpha'' + s\beta'' = \alpha'' - s\alpha$

$s = 1 - r$

$\begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix}$ (∞)

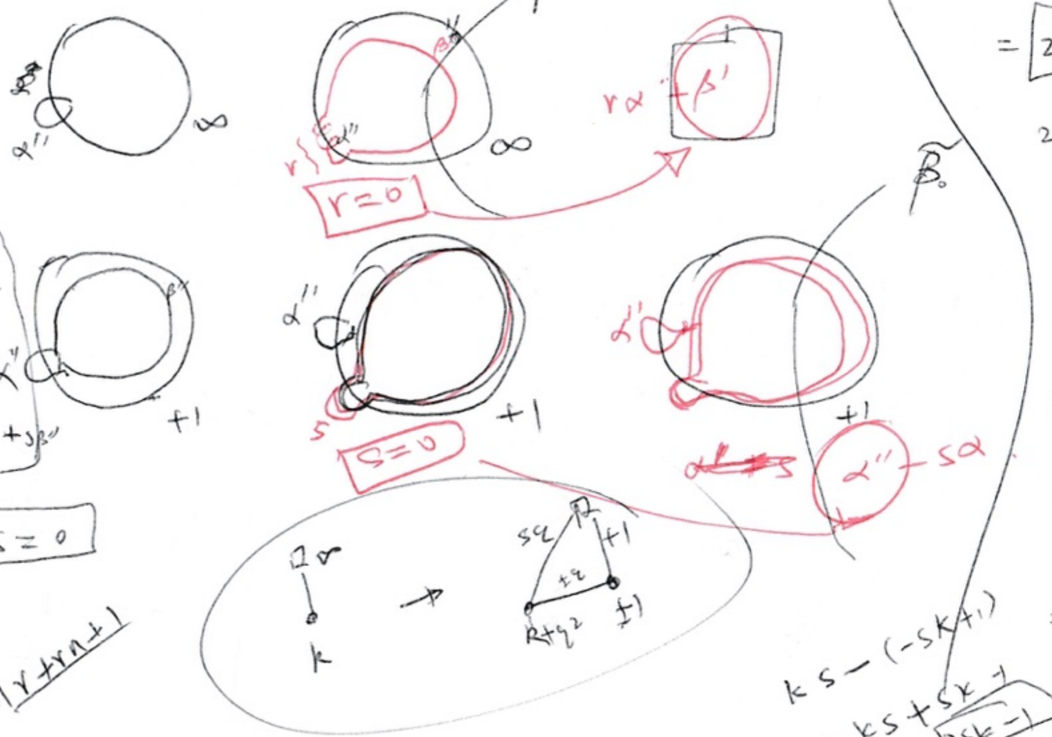


$\alpha \cdot \beta = rn + 1 + rn = 2rn + 1$

$\alpha \cdot \beta = r\alpha'^2 + \alpha' \cdot \beta'$

L(1, 0): $\alpha = \alpha'$, $\beta = r\alpha' + \beta'$

L(1, 1): $\alpha = \alpha' - \beta'$, $\beta = (1-s)\alpha' + s\beta''$



$\beta \cdot \alpha_0 = \beta' \cdot \beta_0 = q$

$\alpha \cdot \beta_0 = -q$

$\beta \cdot \beta_0 = s\beta'' \cdot \alpha_0 = sq$

if $s = 0$

$\alpha \cdot \beta = \beta' \cdot \alpha' - (1-s) + s$

$nr + rn + 1$

$ks + (1 - sk)$

$ks - (-sk + 1) = ks + sk - 1 = 2sk - 1 = 1$

$2sk = 2$

$sk = 1$

$s = 1$

$\alpha = k\alpha' - \beta'$

$\beta = (1-k)\alpha' + \beta'$

$k - (1 - k) = 1$

$ks - (-sk + 1) = ks + sk - 1 = 2sk - 1$

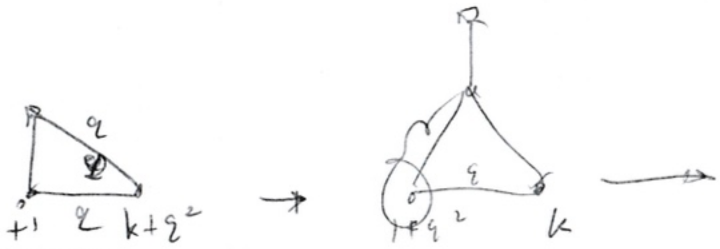
sep-27

$\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$

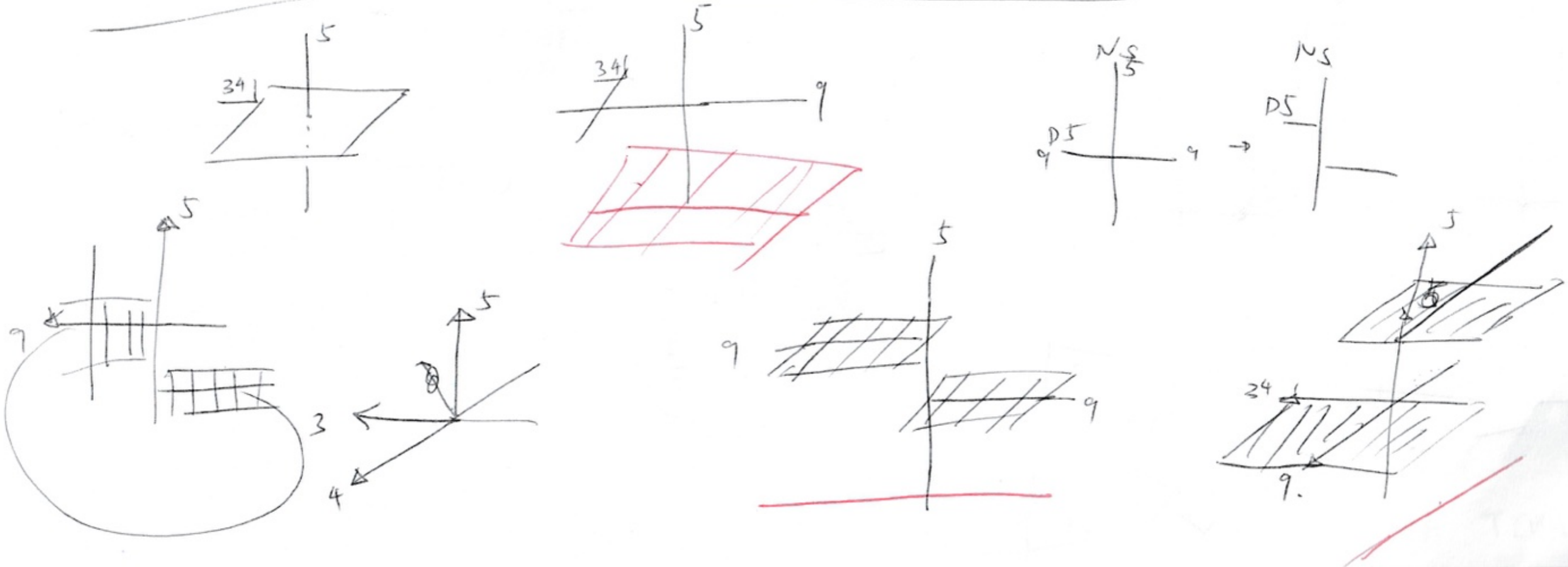
$ST = \begin{bmatrix} -1 & 1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} \alpha' \\ \beta' \end{bmatrix} = \begin{bmatrix} \alpha' - \beta' \\ -\beta' \end{bmatrix} = \begin{bmatrix} \alpha \\ \beta \end{bmatrix}$

$\begin{bmatrix} 1 & -1 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 1 & -1 \\ 0 & -1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

-1

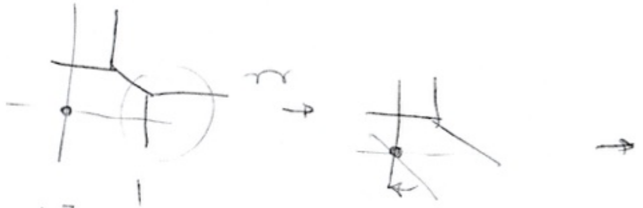


sep30



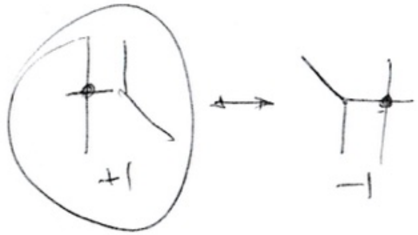
Oct-01

Oct 03



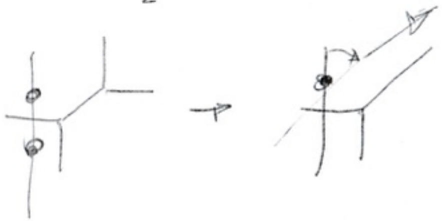
$\Delta F = \frac{1}{2}$

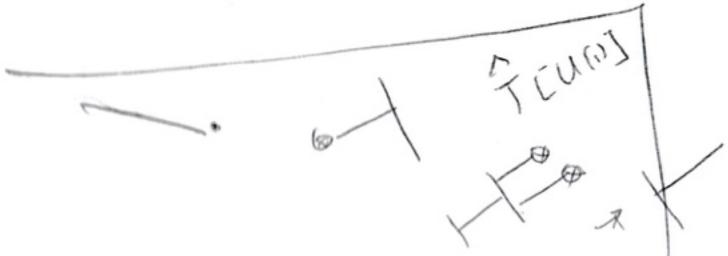
$\Delta AF = -\frac{1}{2}$

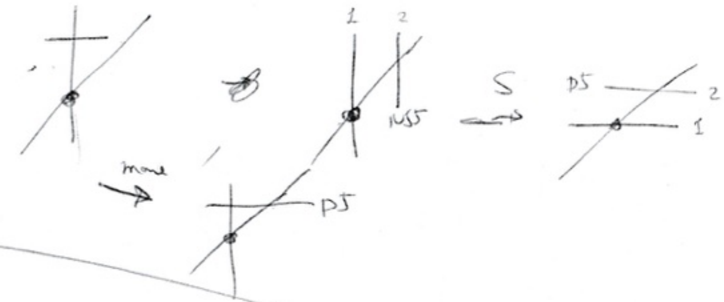


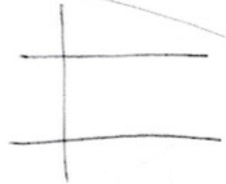
$\Delta F = -\frac{1}{2}$

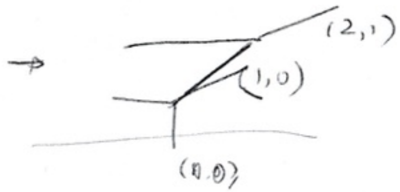
$\Delta AF = \frac{1}{2}$

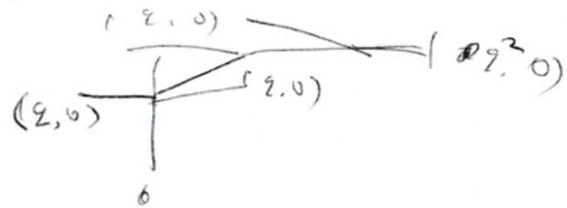












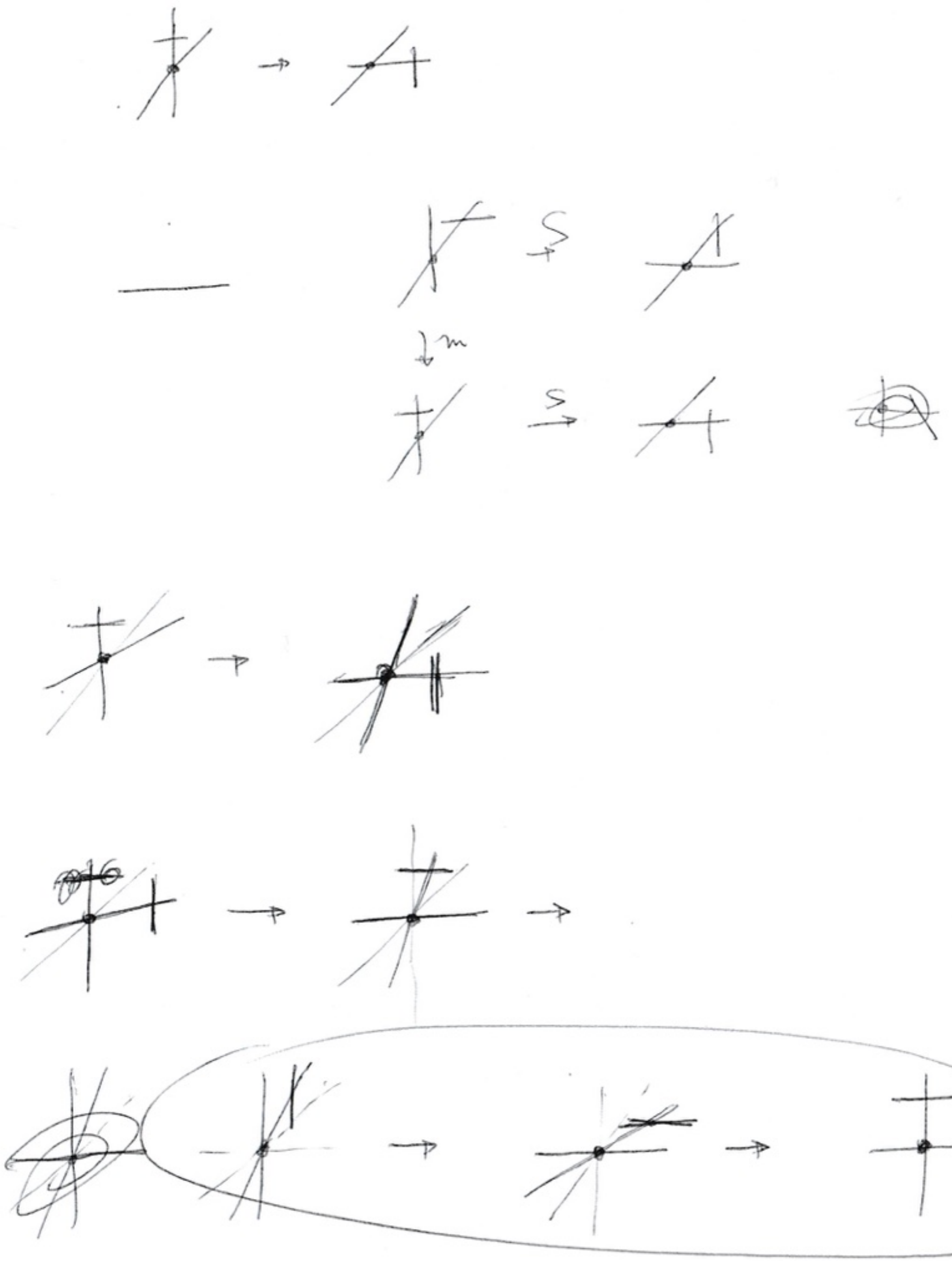
$2^2/2 = 4/2 = 2$

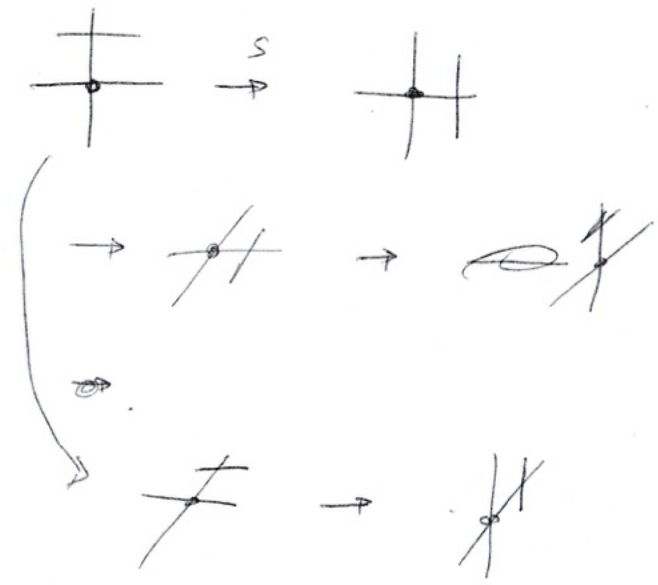
$3^2/2 = 9/2 = \boxed{q \cdot \frac{q}{2}}$

$\boxed{q \times q} = q^2$

32

Oct-04





$k = \frac{1}{n} = \tan\theta$,

$U(1)_{\frac{k}{n}} + 1$ NS5 $\rightarrow$ $T[U(1)] + 1$ D3