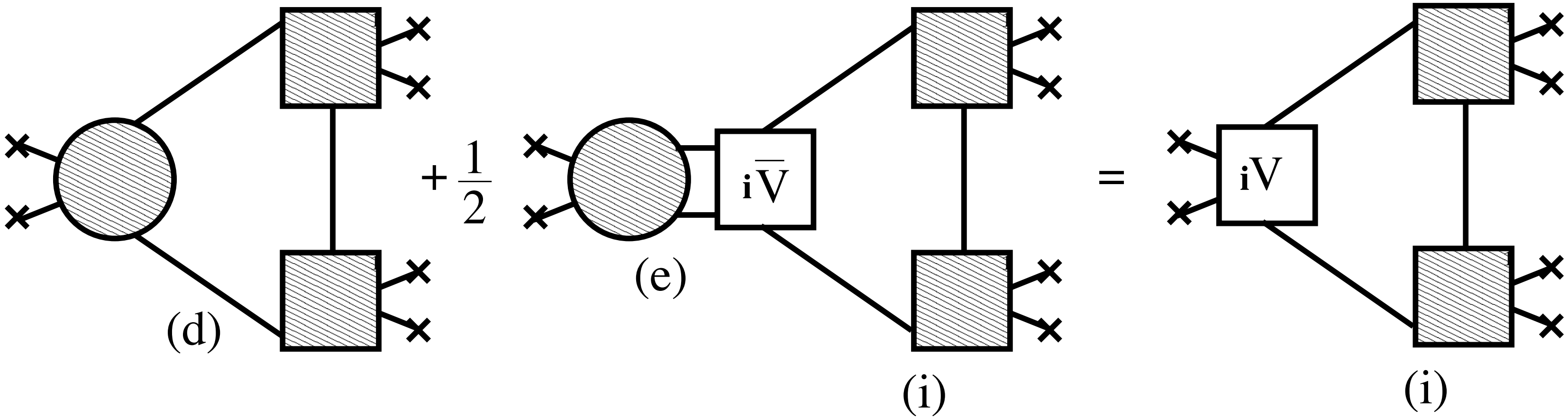
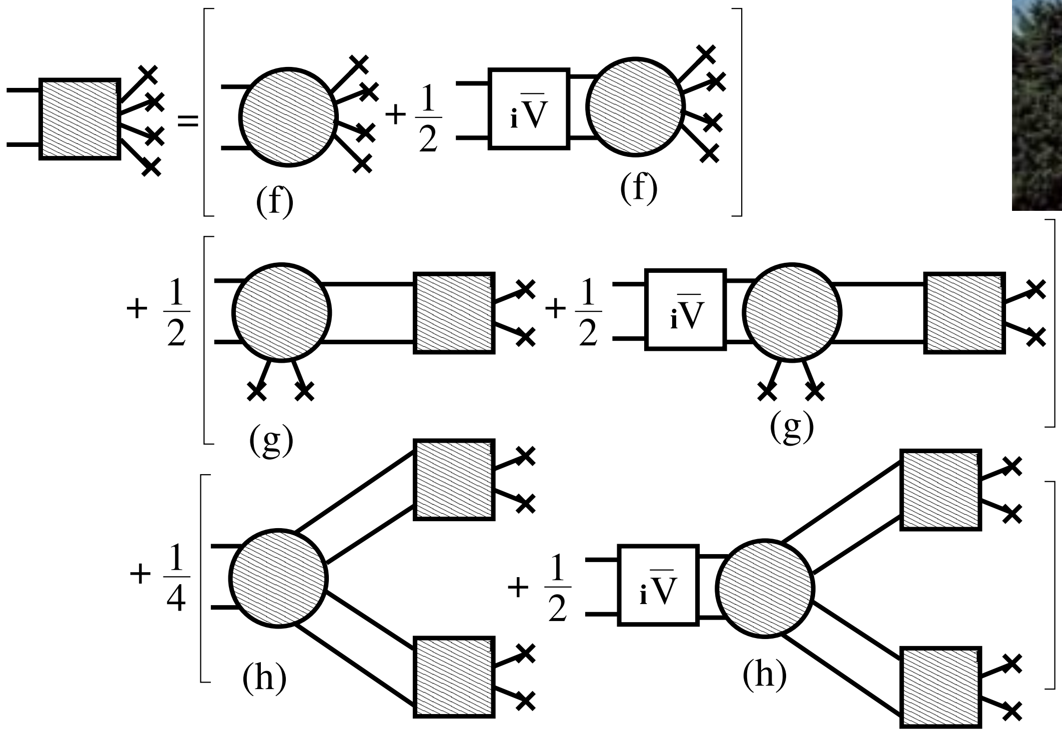
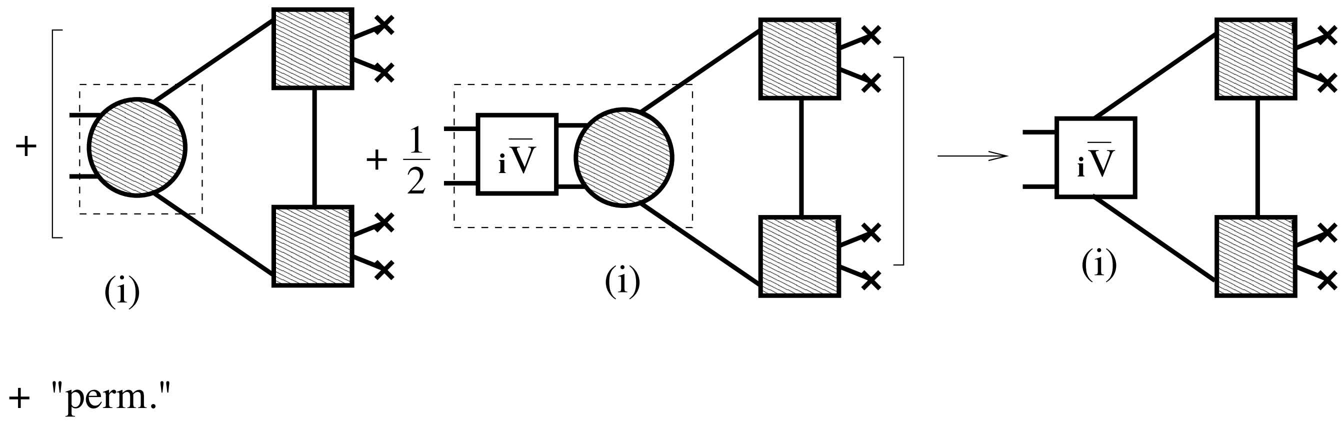
THE M~~E~~ASS OF THE GLUE

Back in the days
(Heidelberg, 2002...)

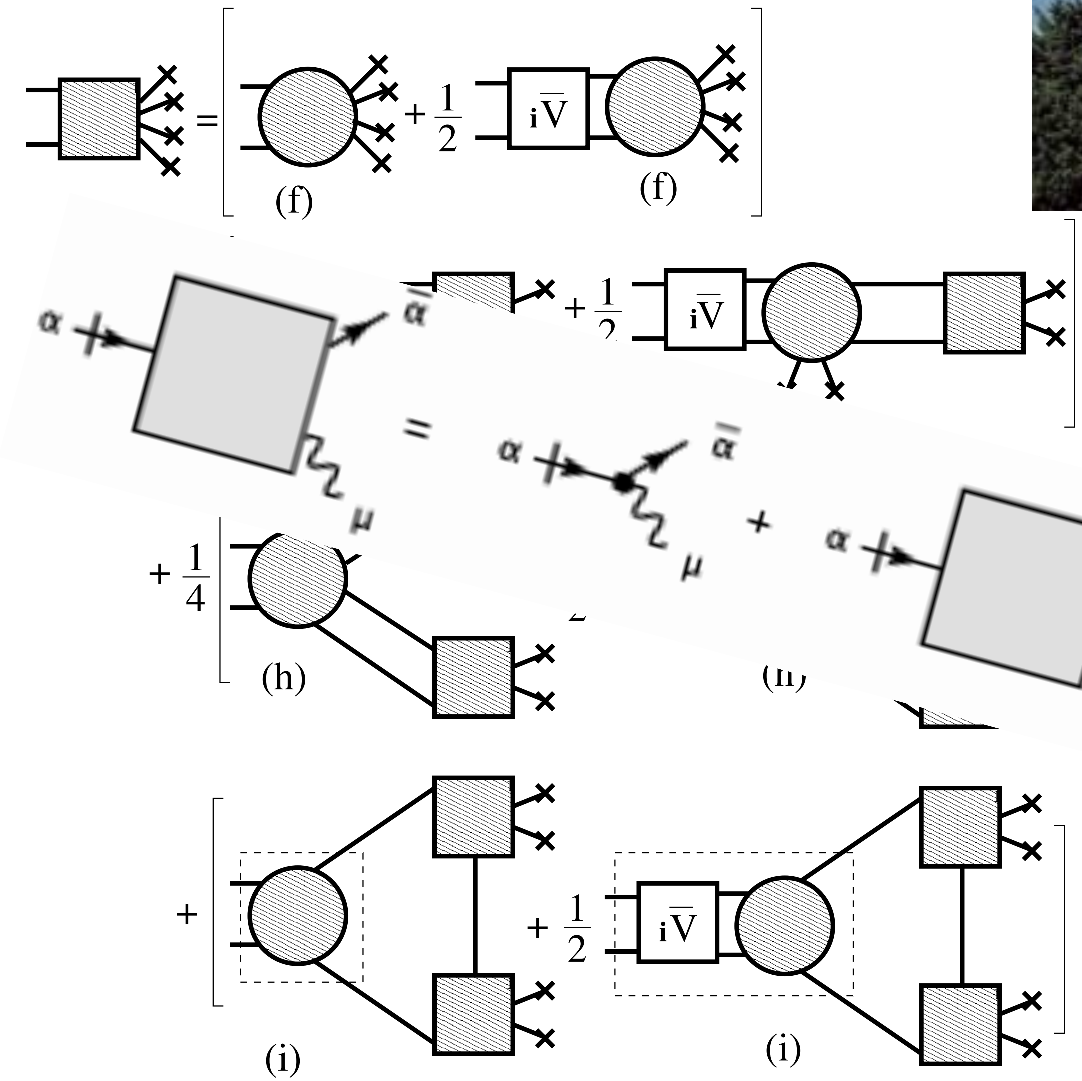
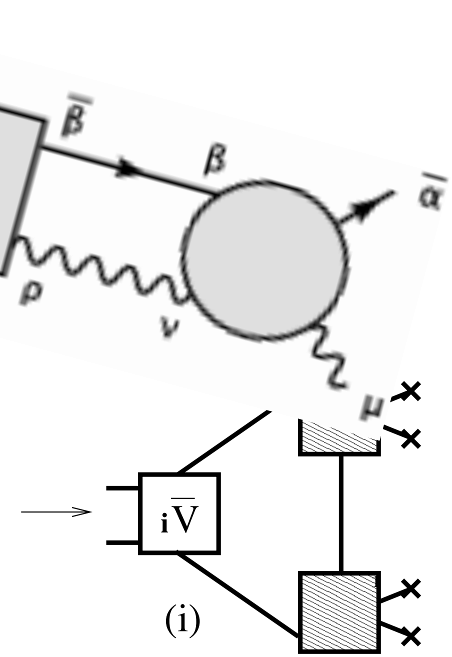




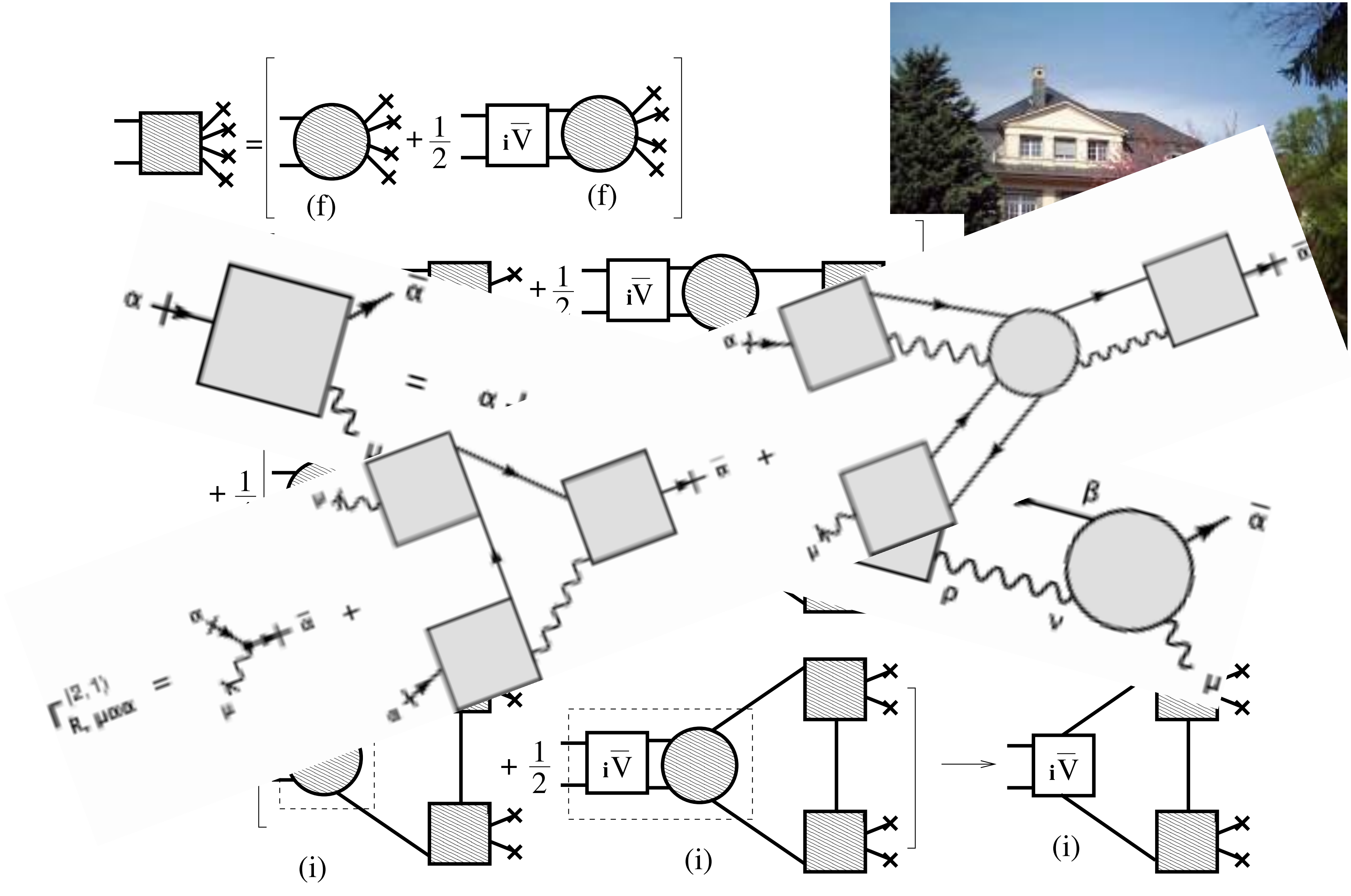
=
+ 1/2
$i\bar{V}$
(f)
(f)
+ 1/2
+ 1/2
(g)
(g)
+ 1/4
+ 1/2
(h)
(h)



+
+ 1/2
$i\bar{V}$
(i)
(i)
(i)
+ "perm."

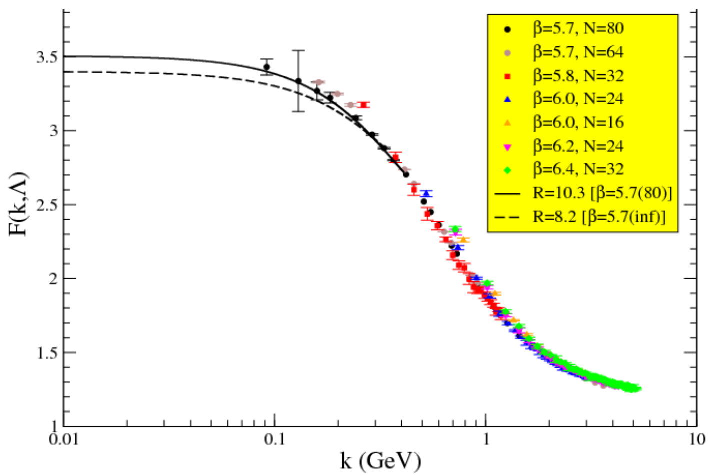



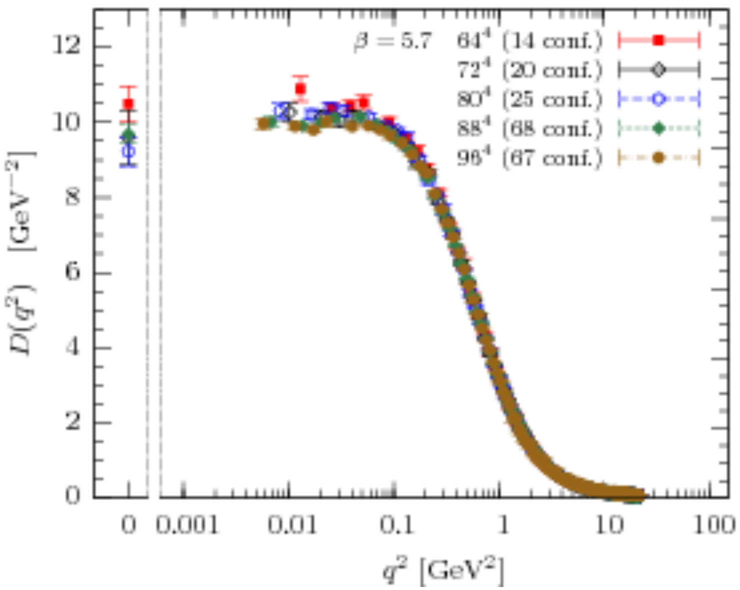
+ "perm."

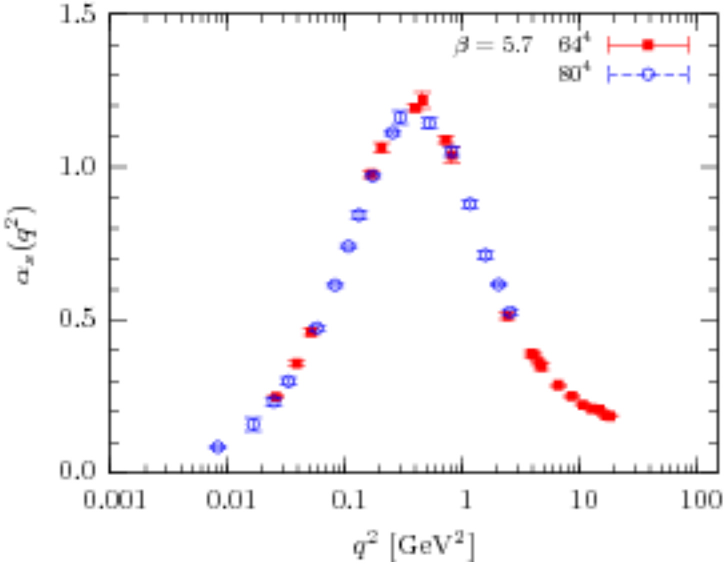


+ "perm."

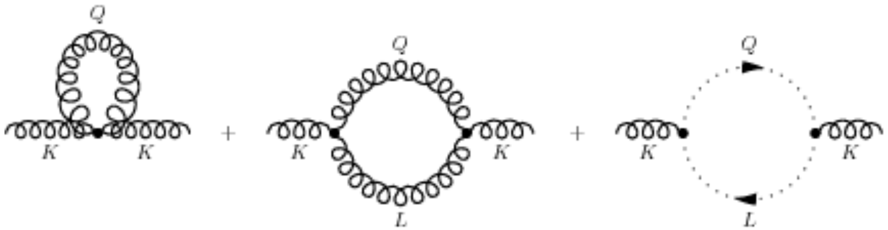
Meanwhile,
on the lattice...



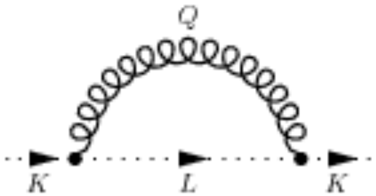


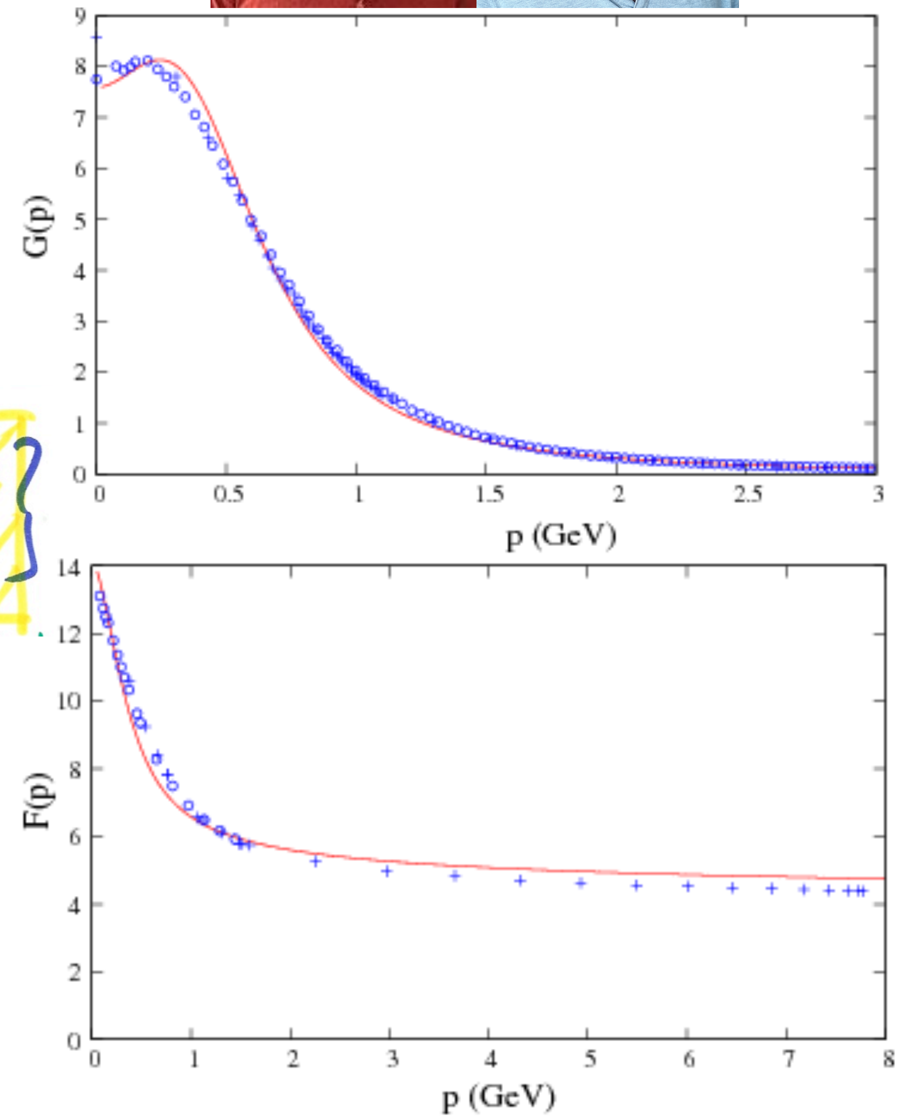


A BreakThrough (2010)

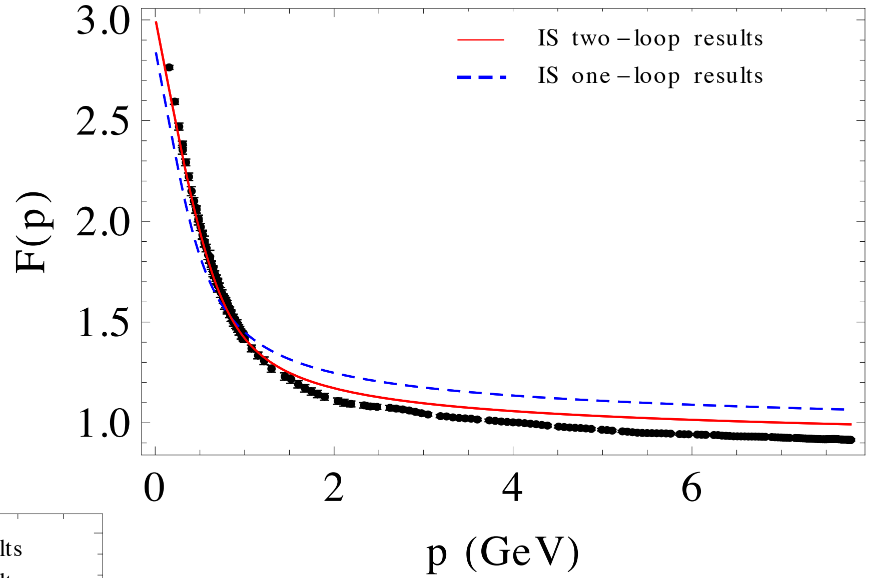


$$S = \int_x \left\{ \underbrace{\frac{F^2}{4} + ih\partial A + \partial\bar{c} D c}_{\text{Fadeev-Popov}} + \boxed{\frac{m^2}{2} A^2} \right\}$$

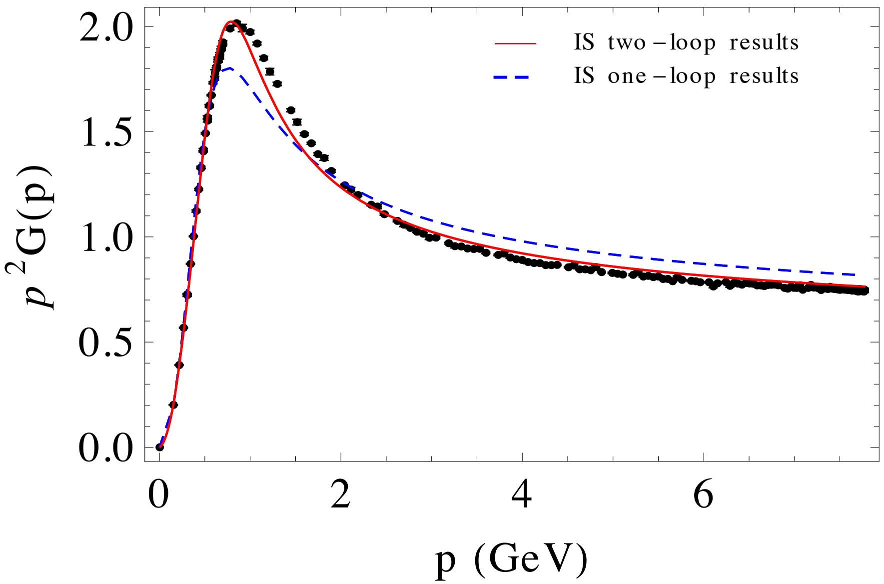




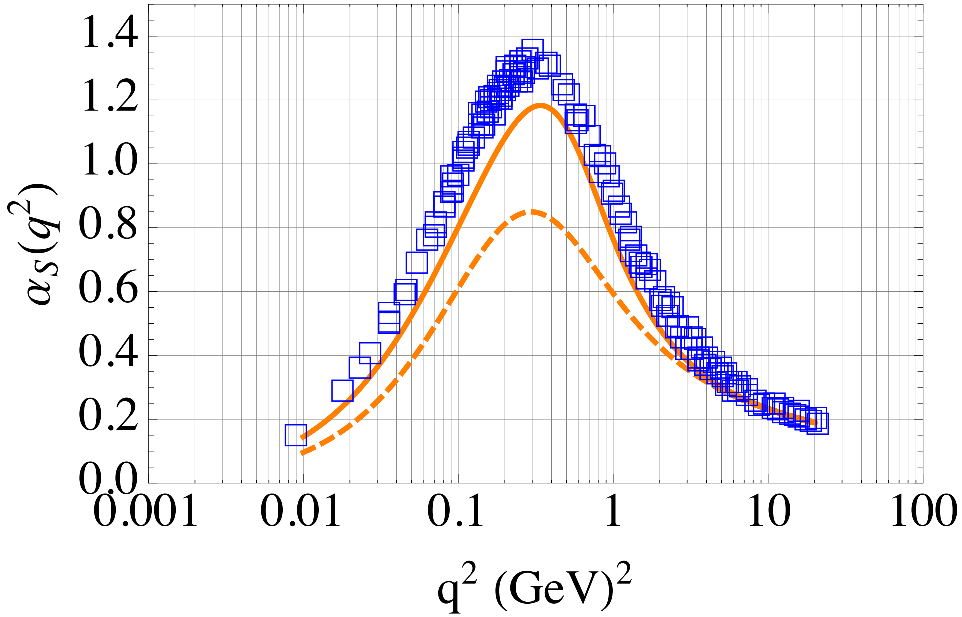
Two Loop



IS two – loop results
IS one – loop results
F(p)
p (GeV)



IS two – loop results
IS one – loop results
p ²G(p)
p (GeV)



$\alpha_S(q^2)$
q² (GeV)²

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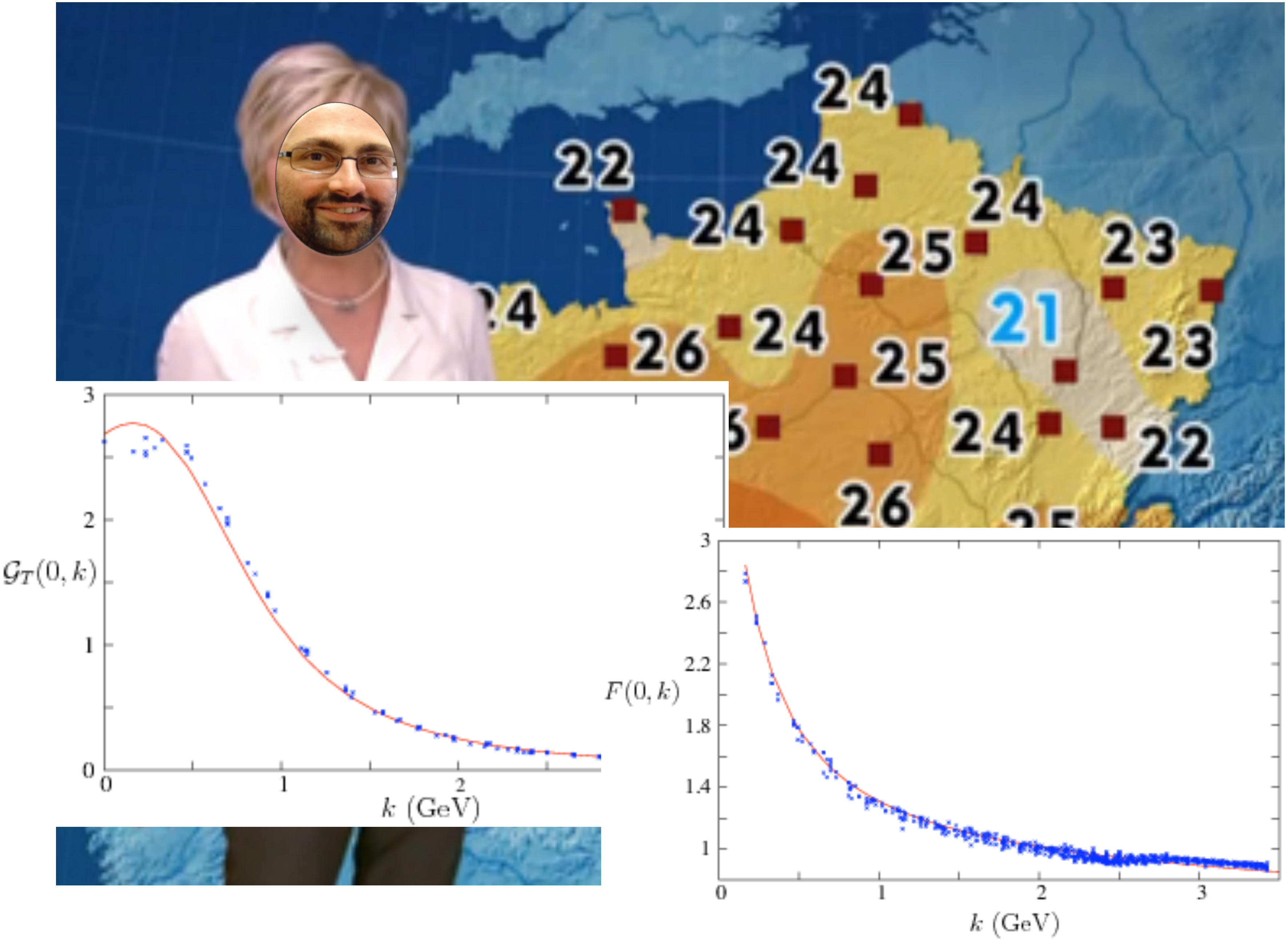

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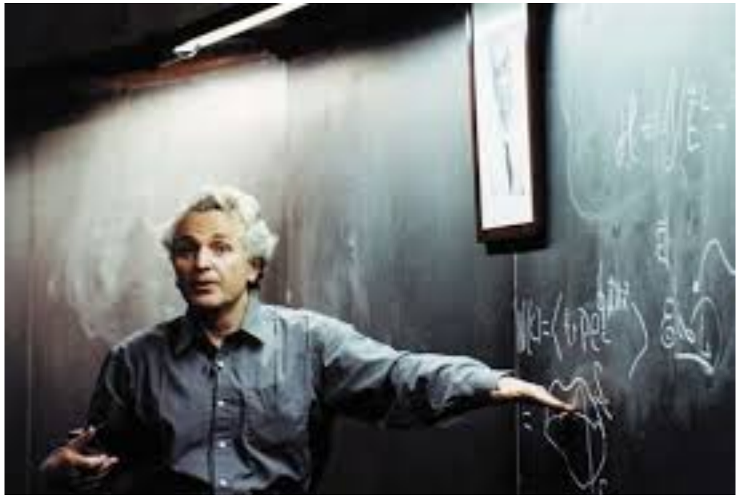
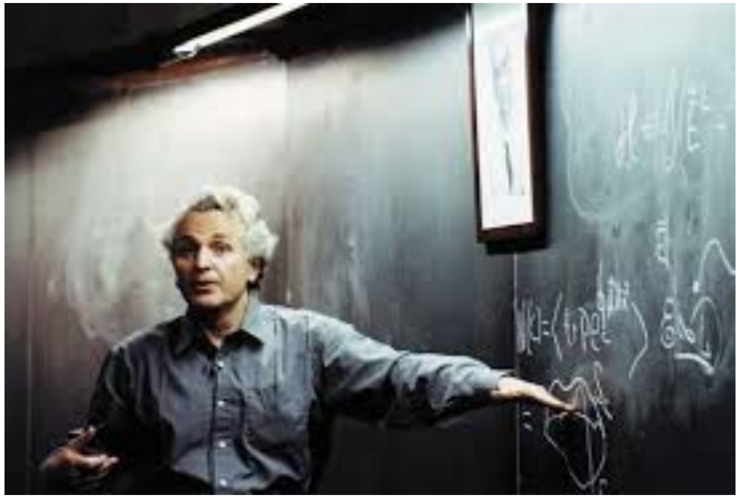
$\mathcal{G}_T(0,k)$
0
1
2
3
k (GeV)
$F(0,k)$
1
1.4
1.8
2.2
2.6
3
0
1
2
3
k (GeV)



The Polyakov loop

$$\ell \sim e^{-F_q/T}$$



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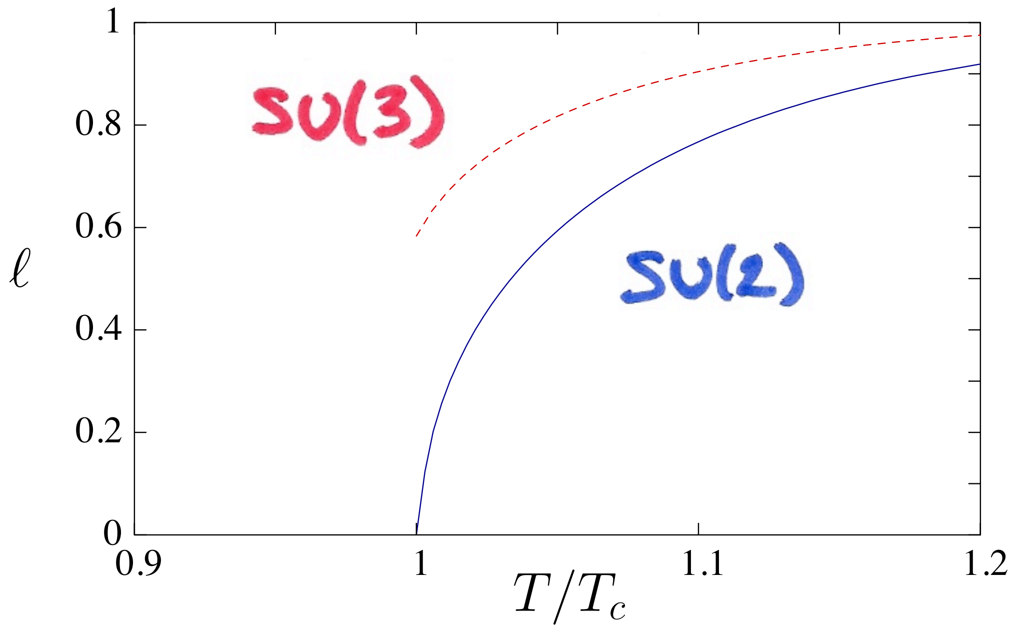

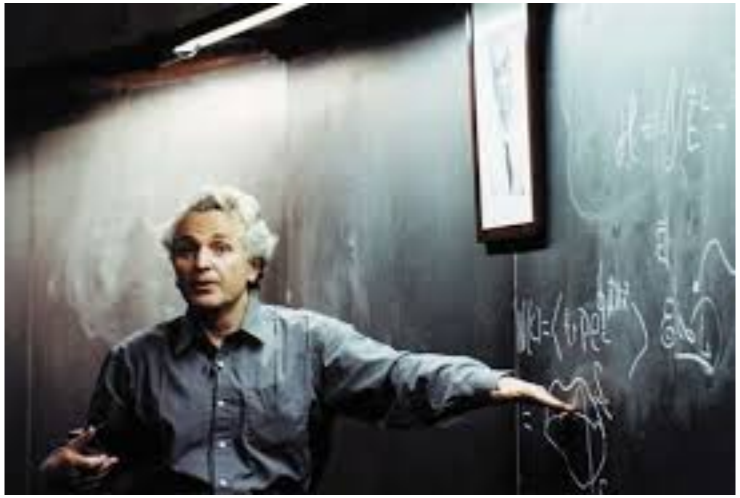

The Polyakov loop

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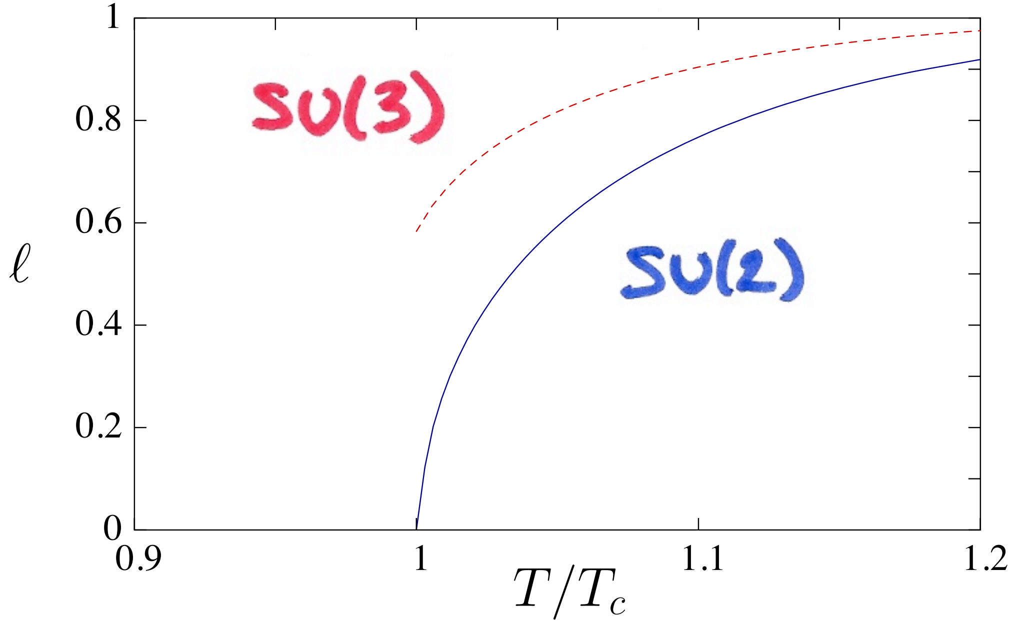
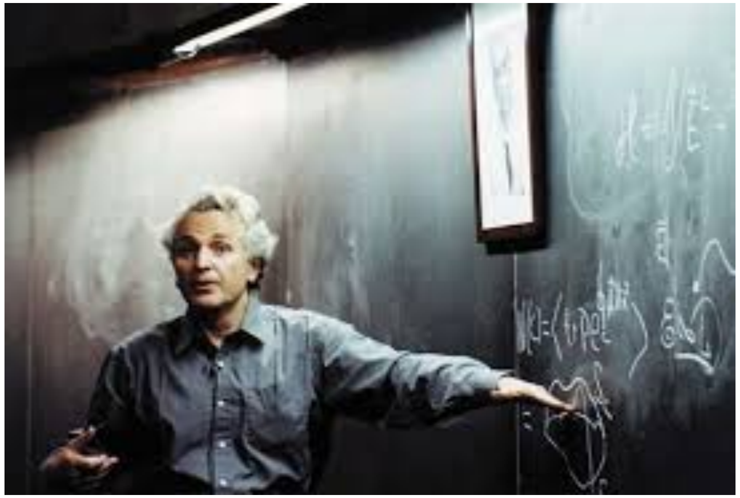


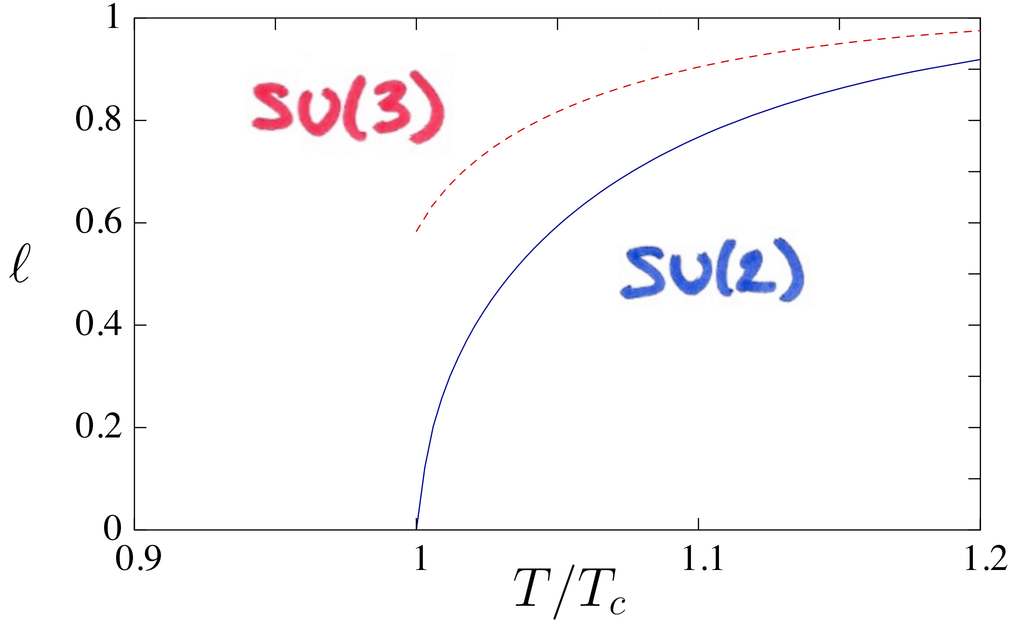
	T_c/m	m	T_c	$T_c^{\text{latt.}}$ *
SU(2)	0.33	710	238	295
SU(3)	0.36	510	185	270

(All in MeV)



The Polyakov loop

$$\ell \sim e^{-F_q/T}$$

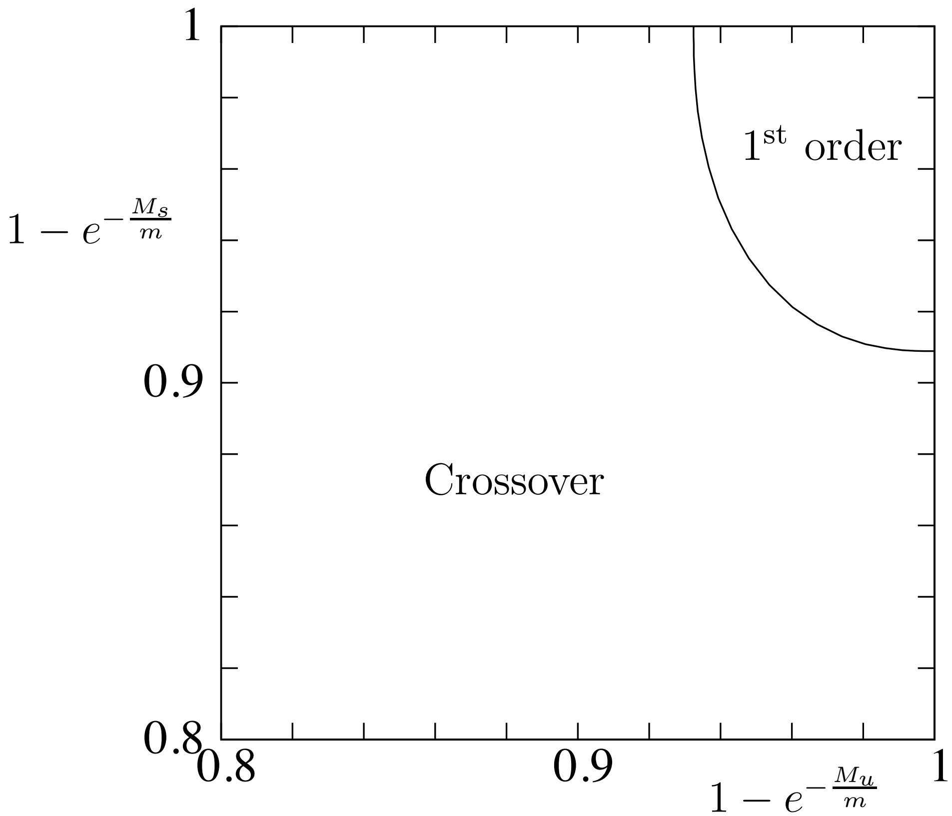


	T_c/m	m	T_c	$T_c^{\text{latt.}}$ *
SU(2)	0.33	710	238	295
SU(3)	0.36	510	185	270

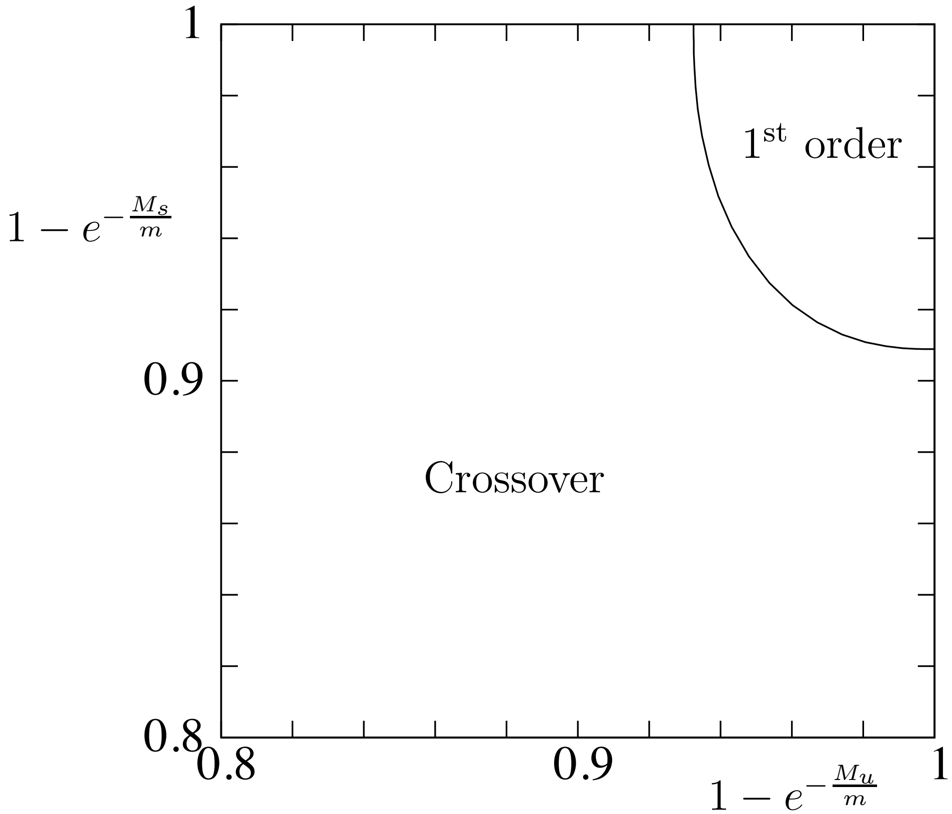
(All in MeV)

(de)confinement of static color charges from pert. theory!

Adding (heavy) quarks...

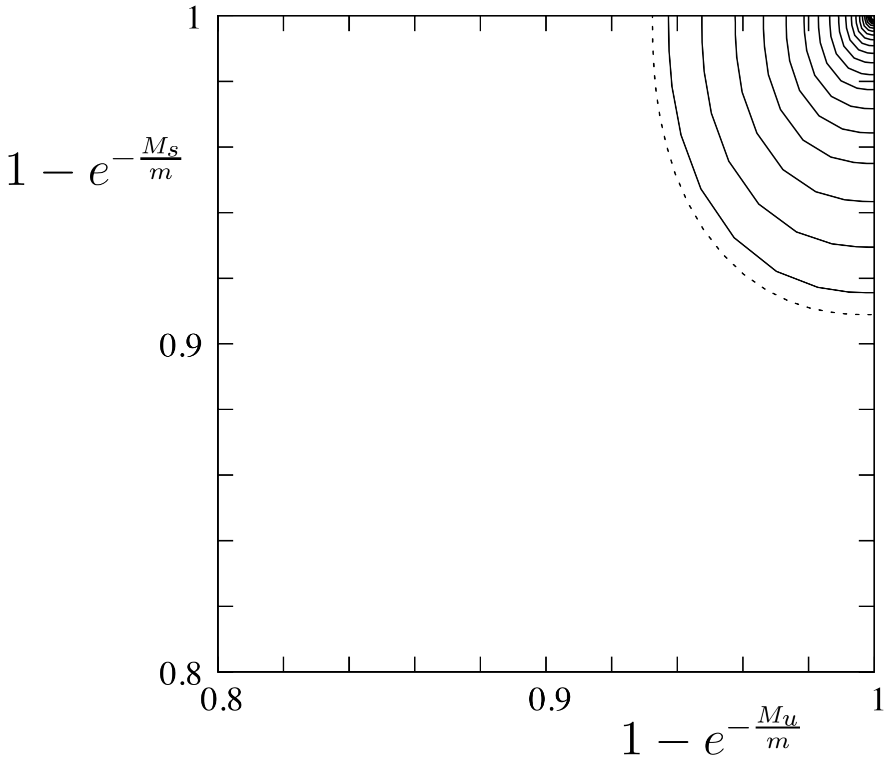


Adding (heavy) quarks...

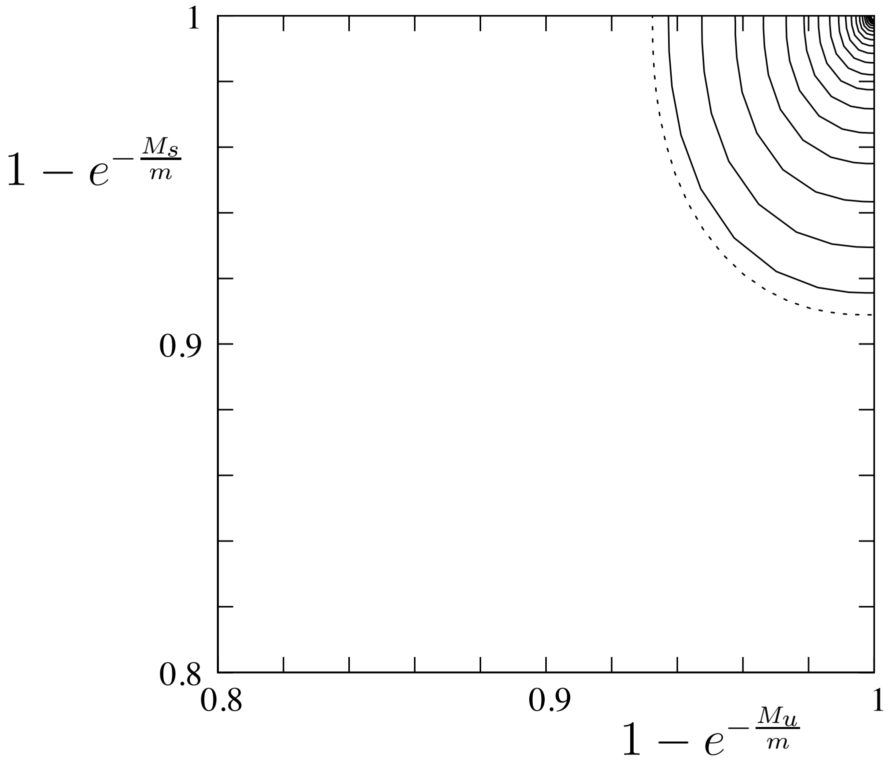


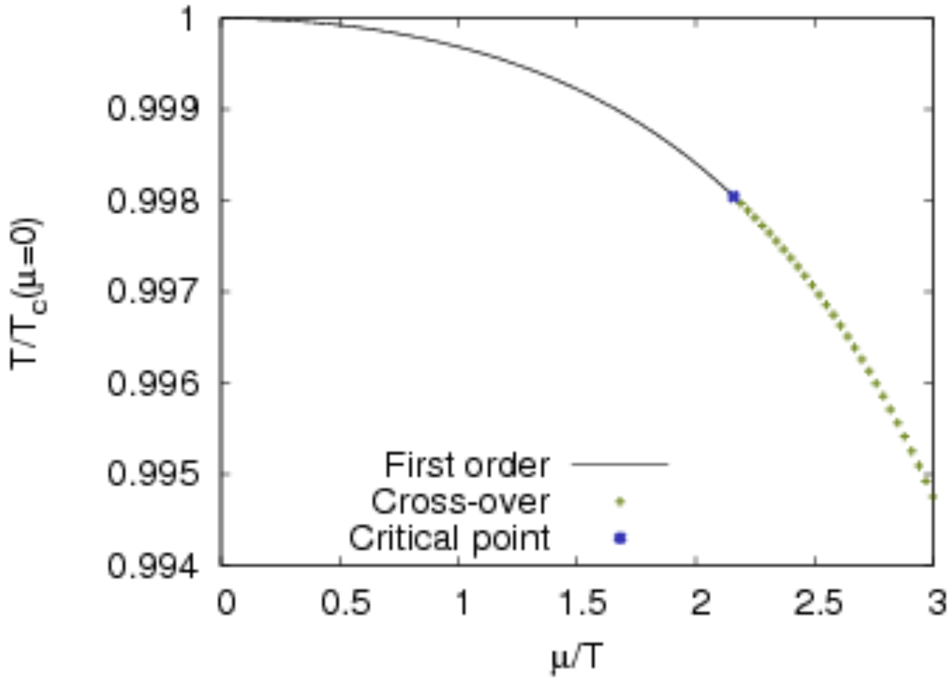
N_f	M_c/T_c	latt.*
1	6.74	7.22
2	7.59	7.91
3	8.07	8.32

With a chemical potential

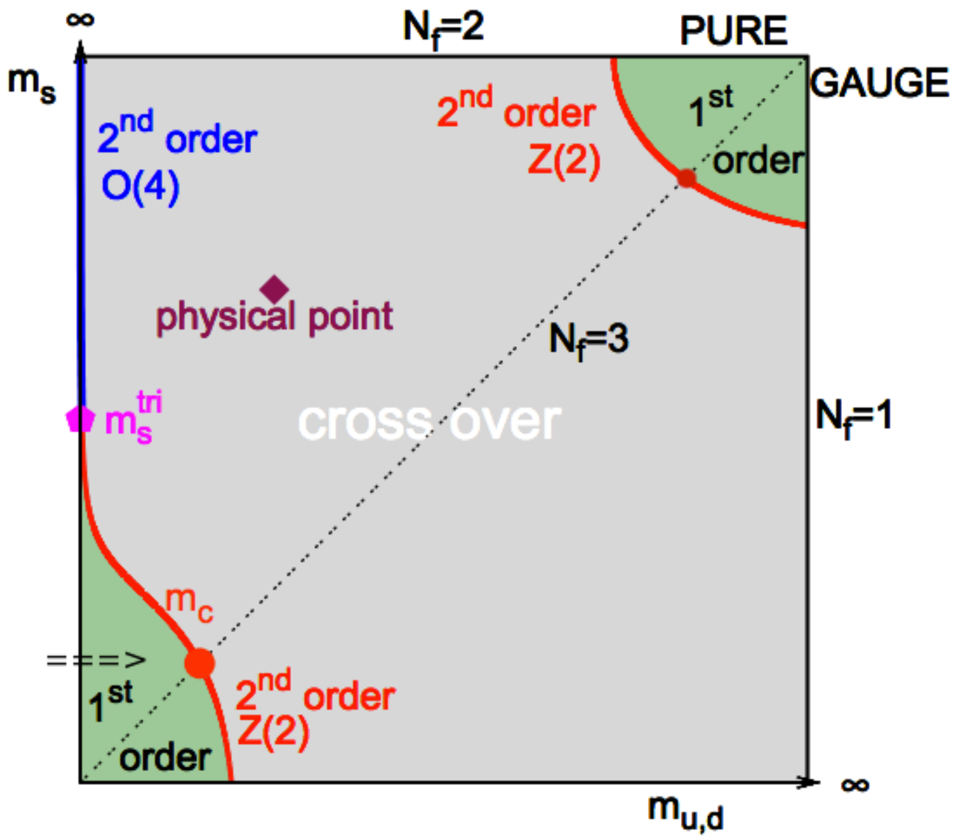


With a chemical potential

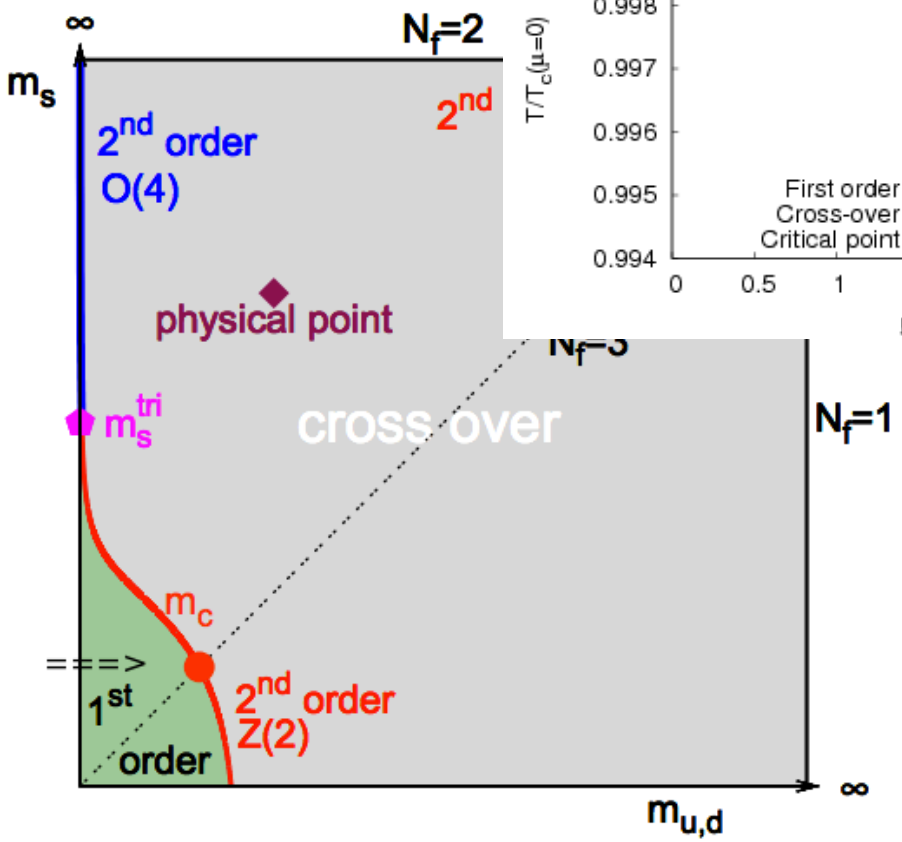


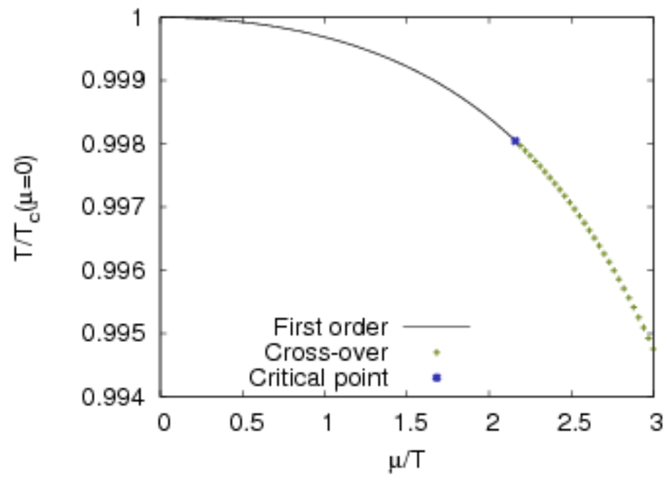


Light quarks ?

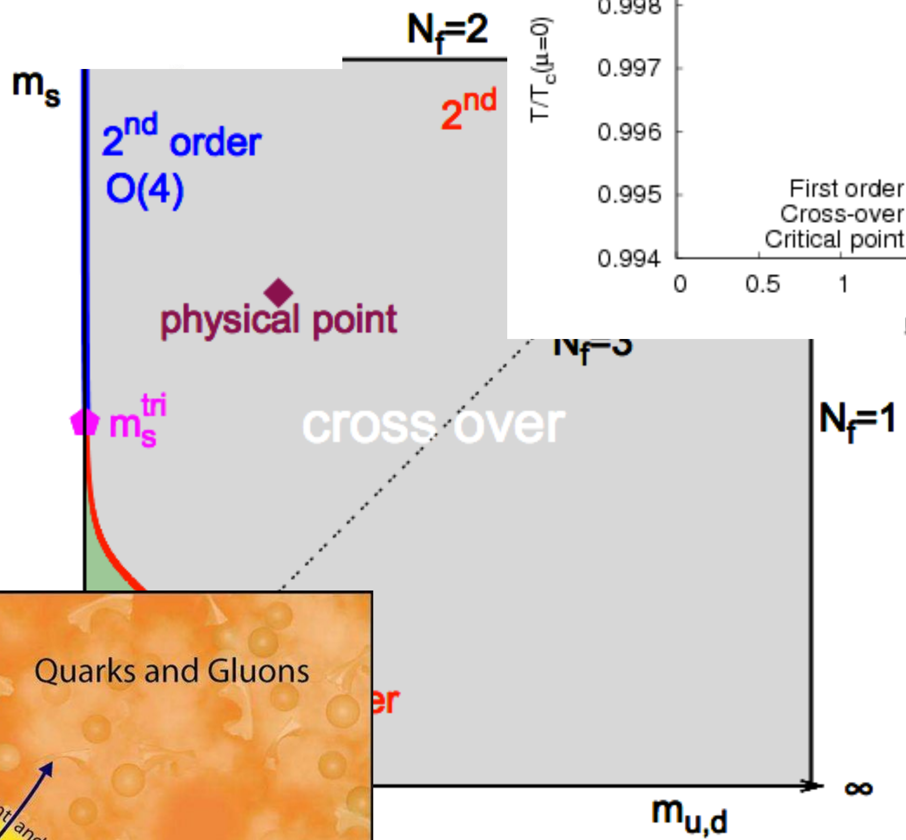


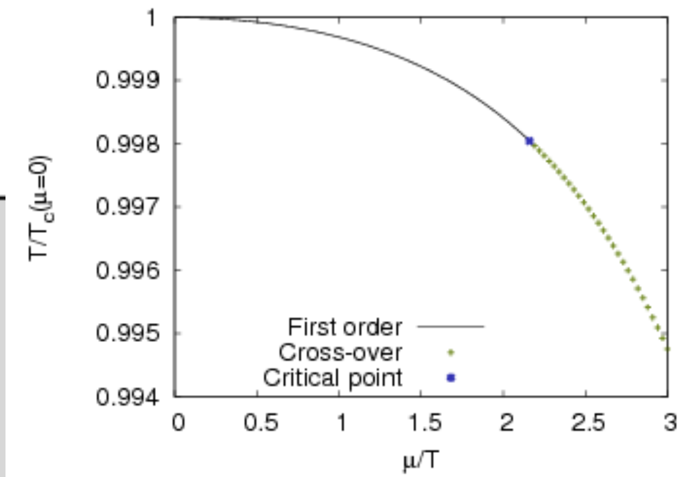
Light quarks ?

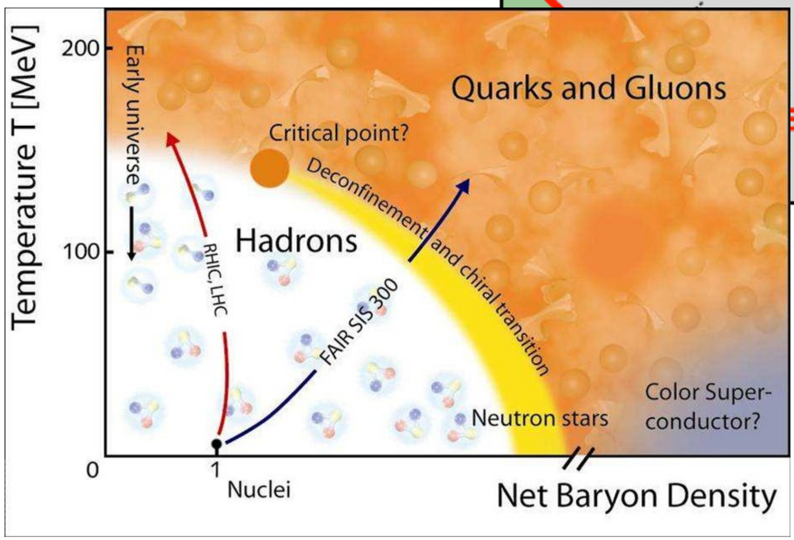




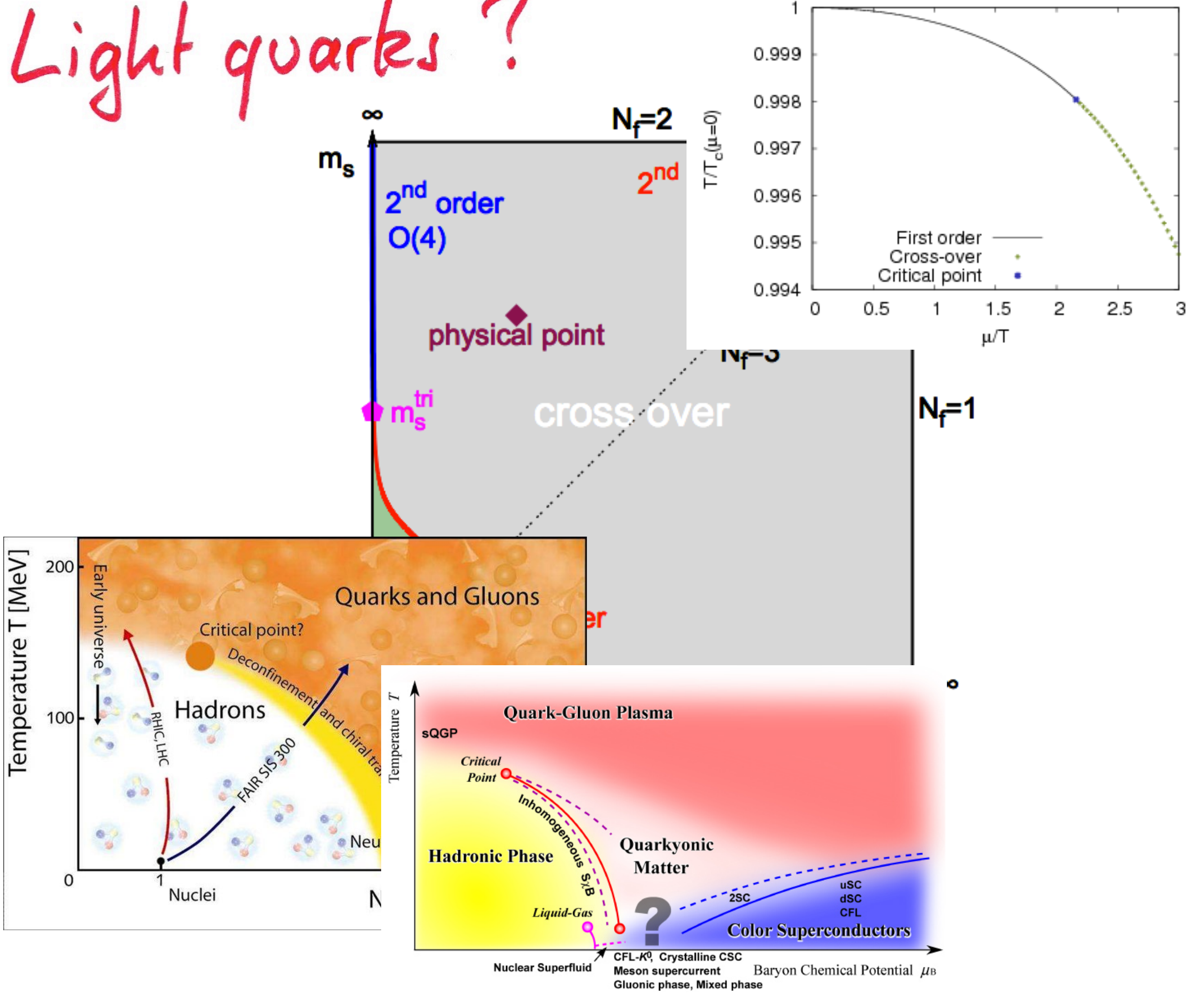
Light quarks ?



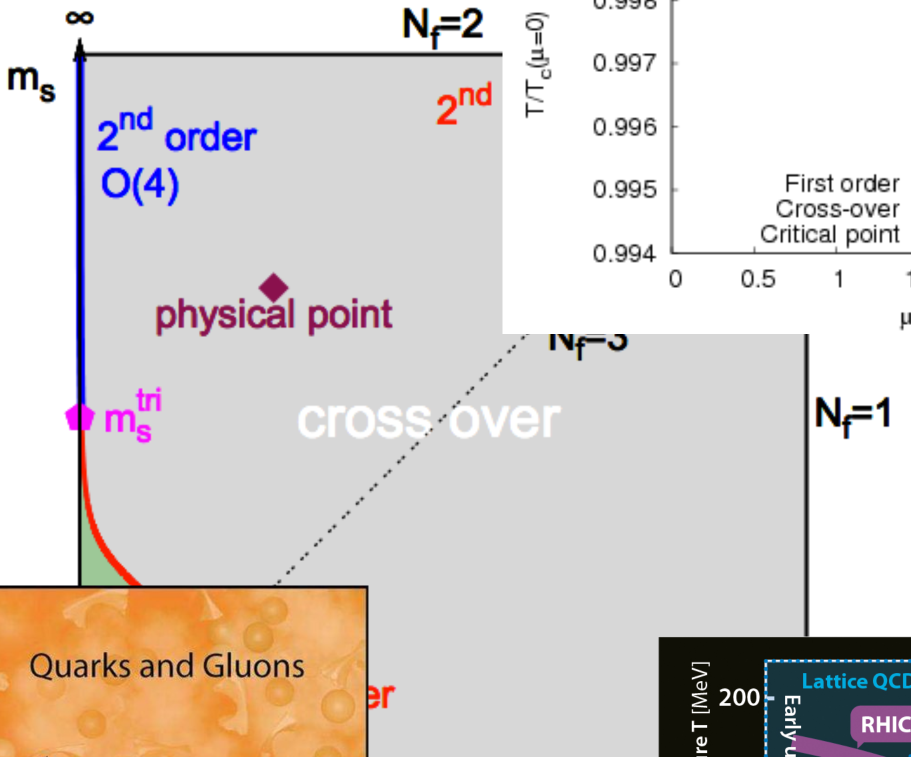


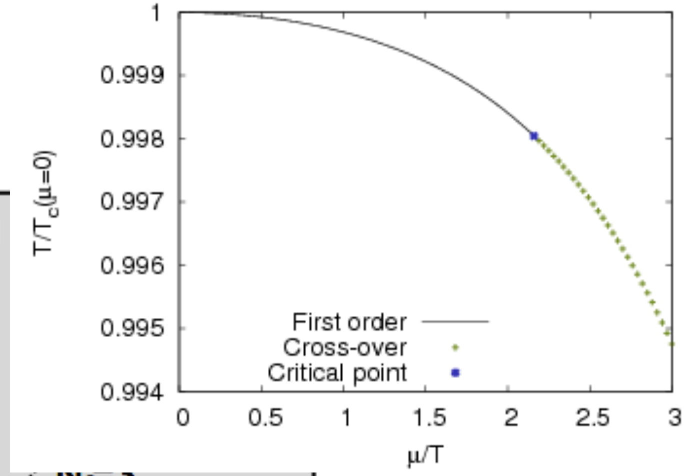


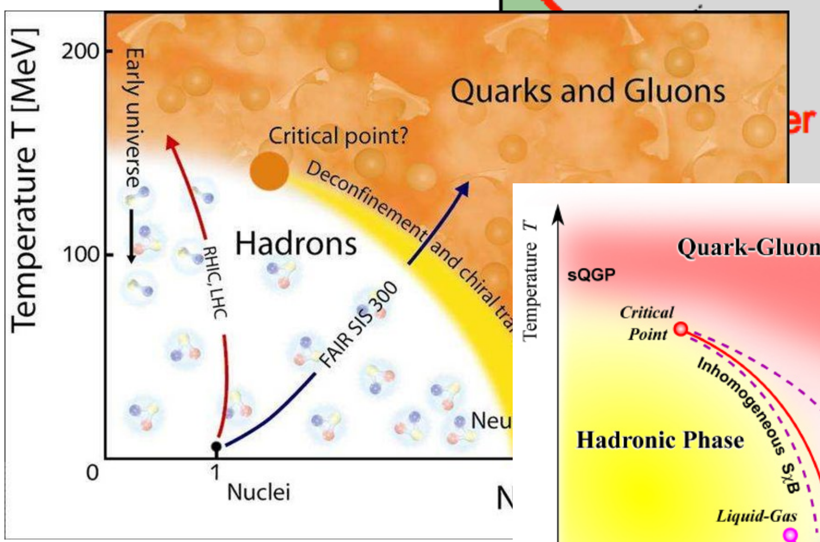
Light quarks ?

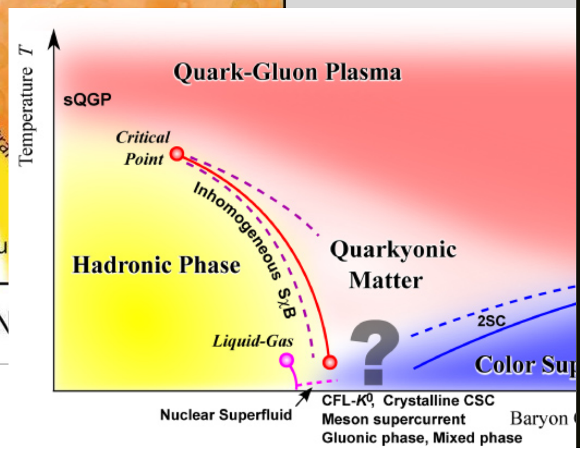


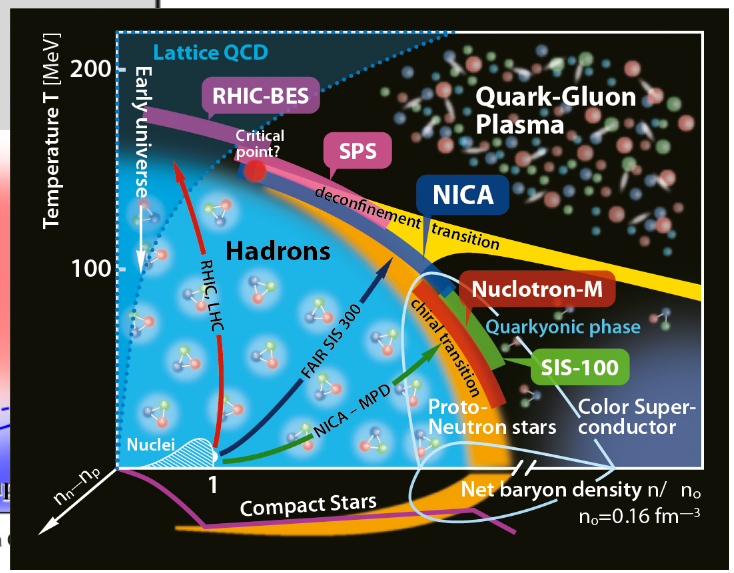
Light quarks ?



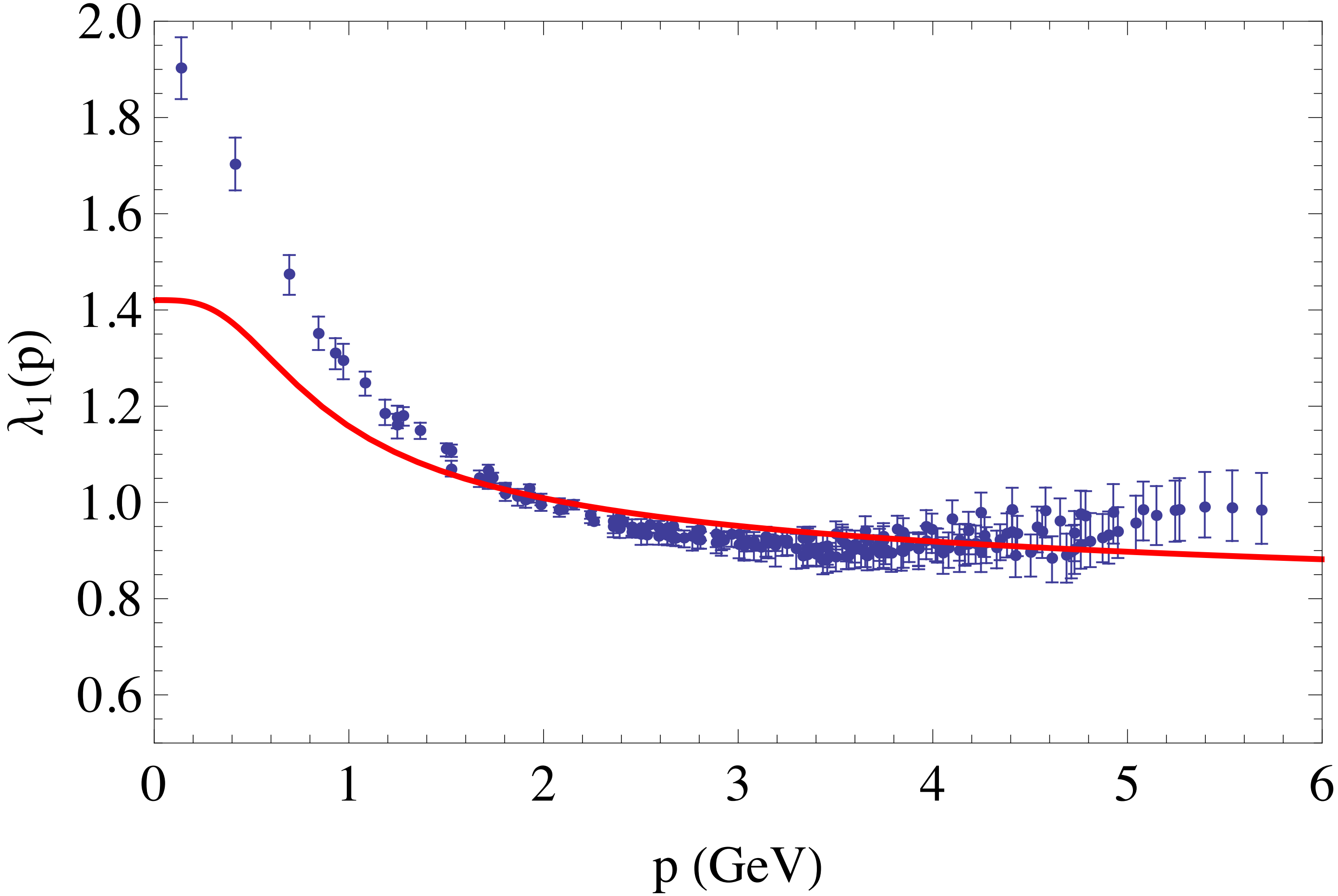




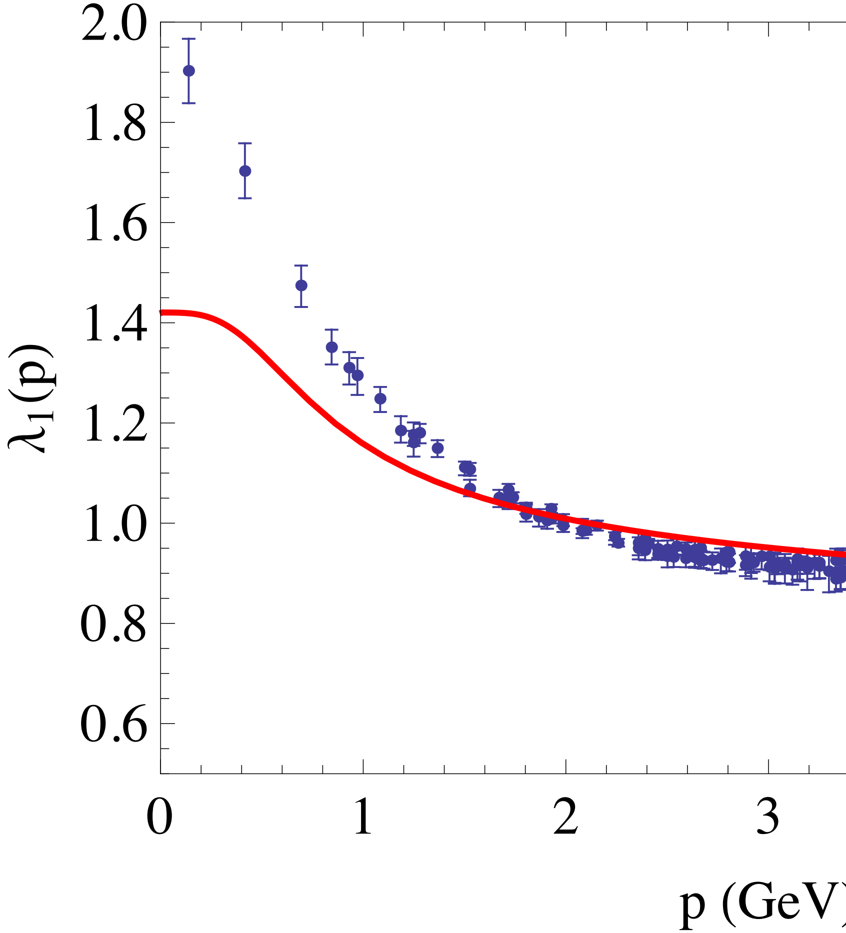


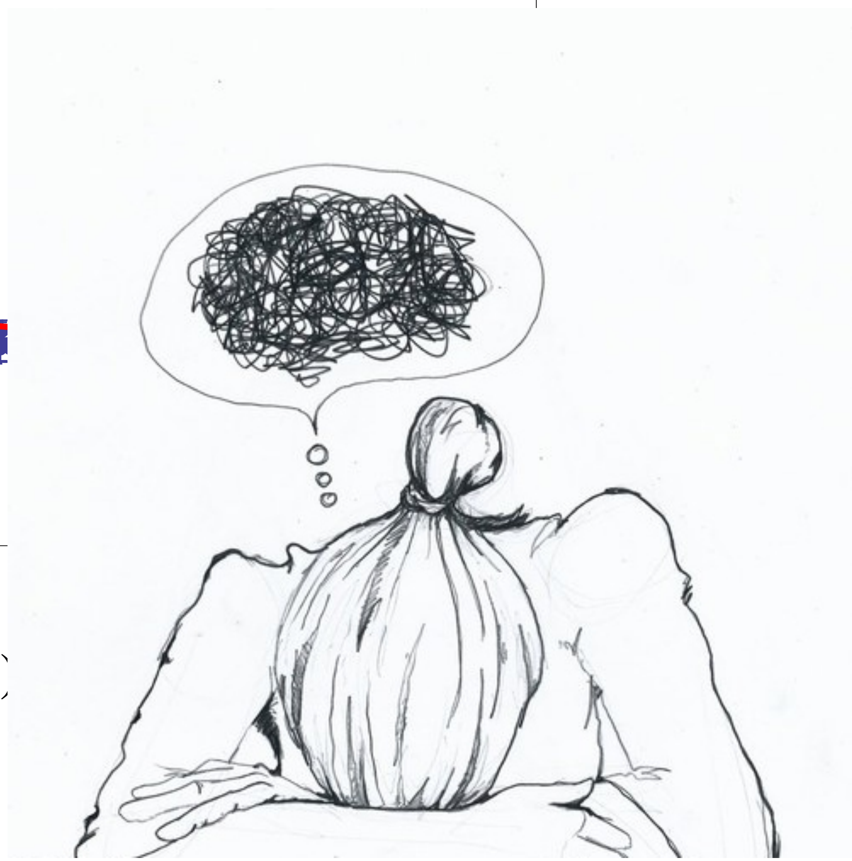


The quark-gluon coupling in the infrared

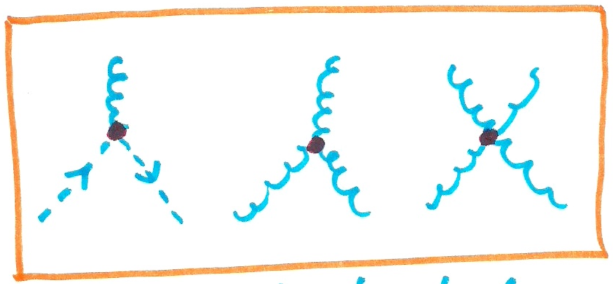


The quark-gluon coupling in the infrared

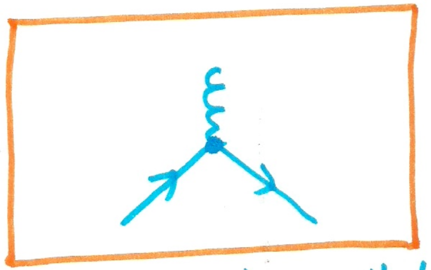




Small parameters in infrared QCD

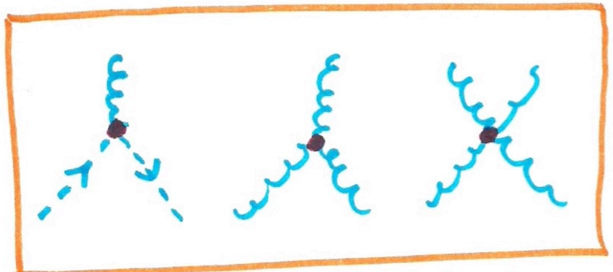


g_g : can be treated perturbatively

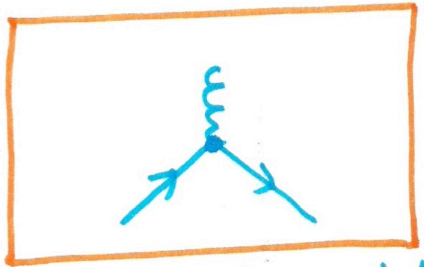


g_q : <u>not small</u> !!

Small parameters in infrared QCD



g_g : can be treated perturbatively

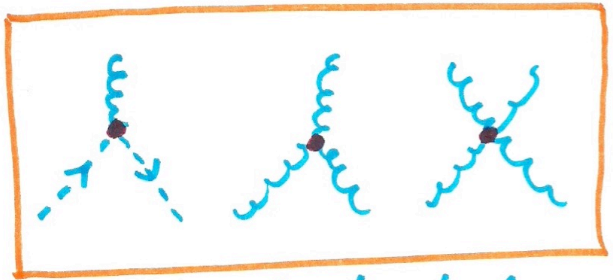


g_q : not small !!

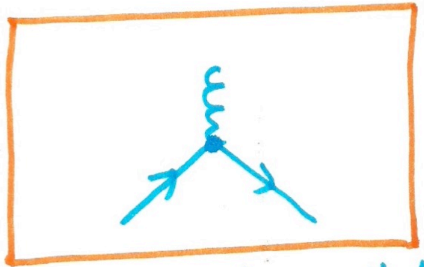
① Expand in g_g, not in g_q

e.g. : only QED-like diagrams survive at L.O. in the quark sector

Small parameters in infrared QCD



g_g : can be treated perturbatively



g_q : not small !!

1 Expand in g_g, not in g_q

e.g. : only QED-like diagrams survive at L.O. in the quark sector

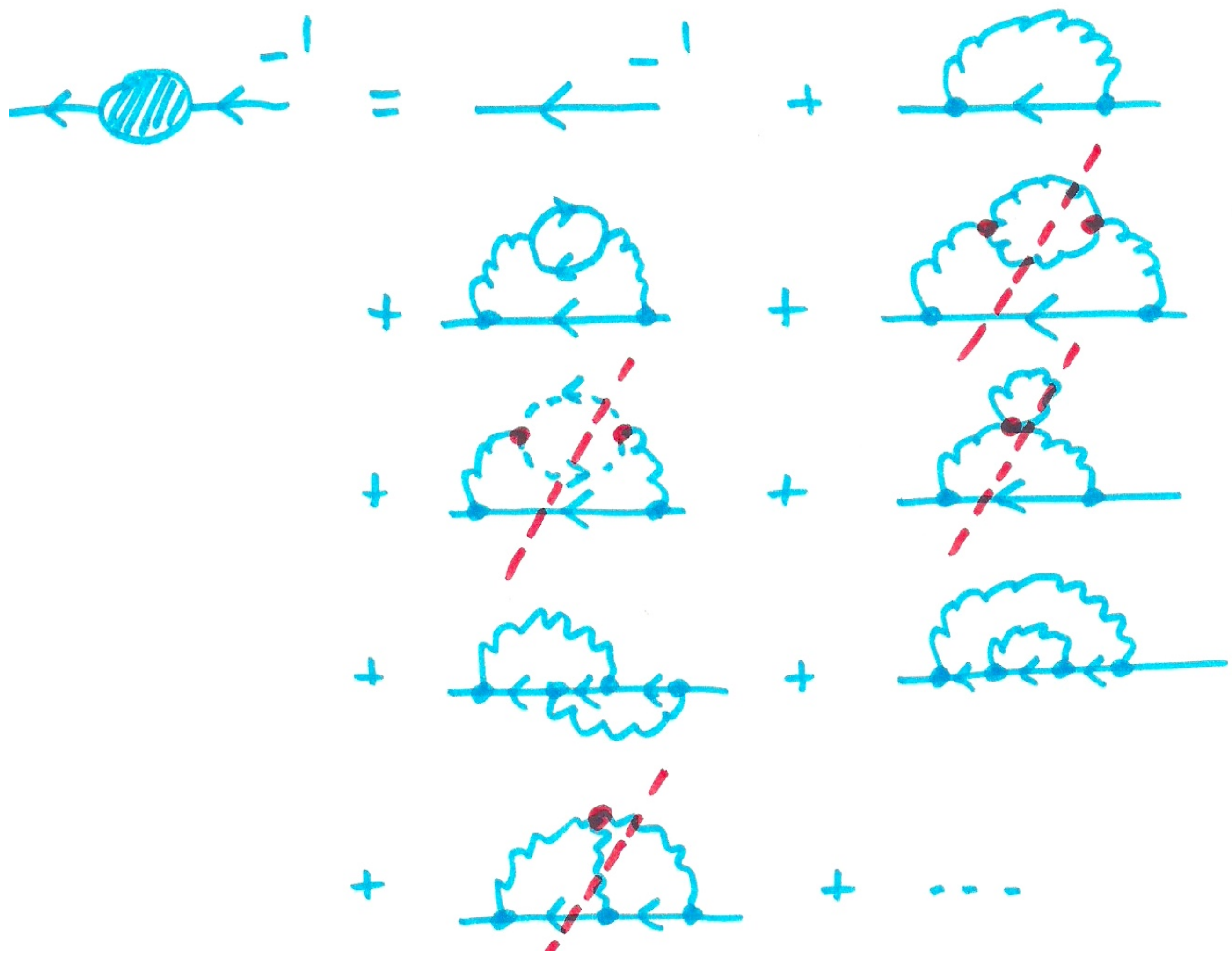
2 Expand in $1/N_c$ with $g_q^2 N_c$ fixed

['t Hooft ('74) ...]

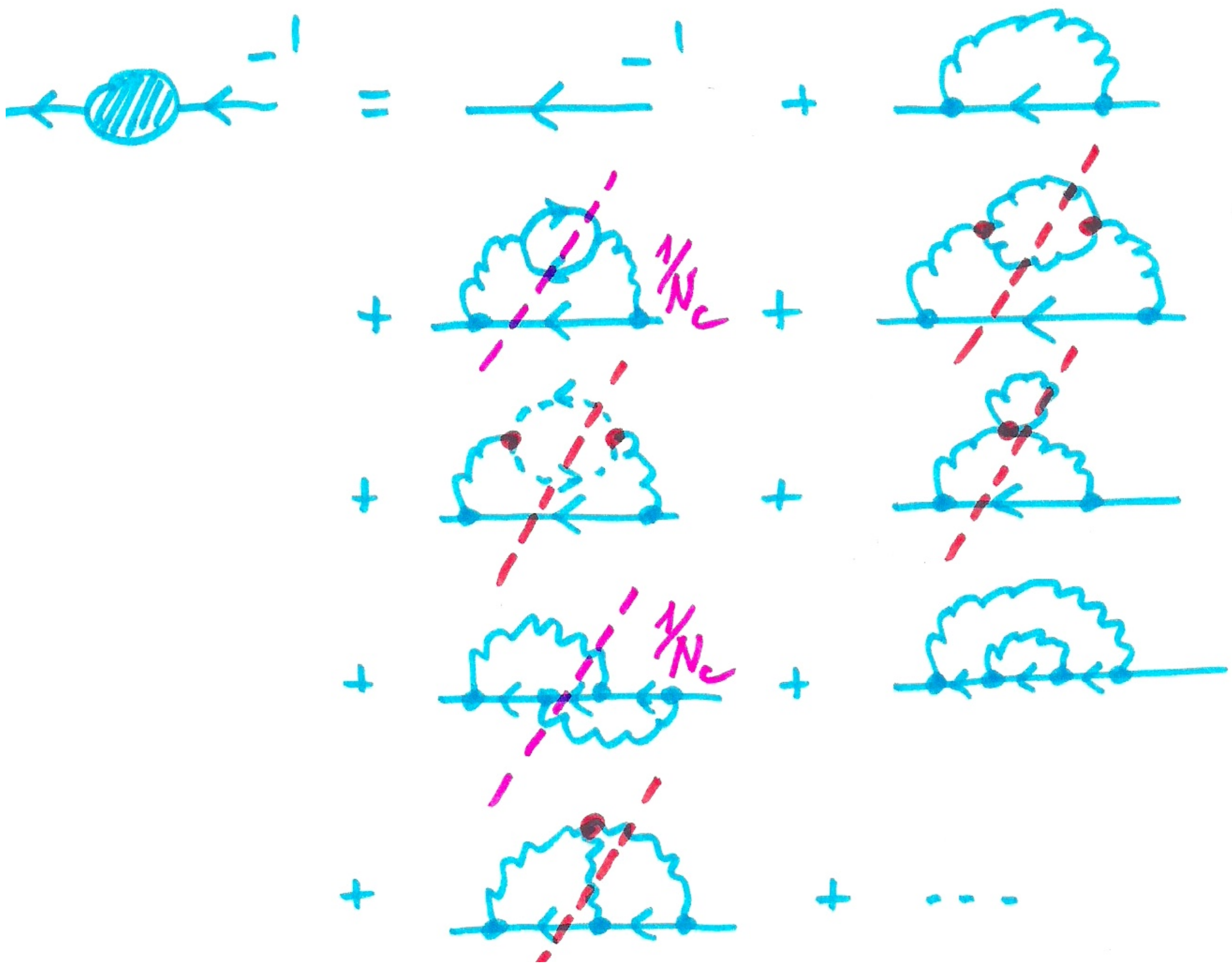
Captures essential aspects of QCD dynamics

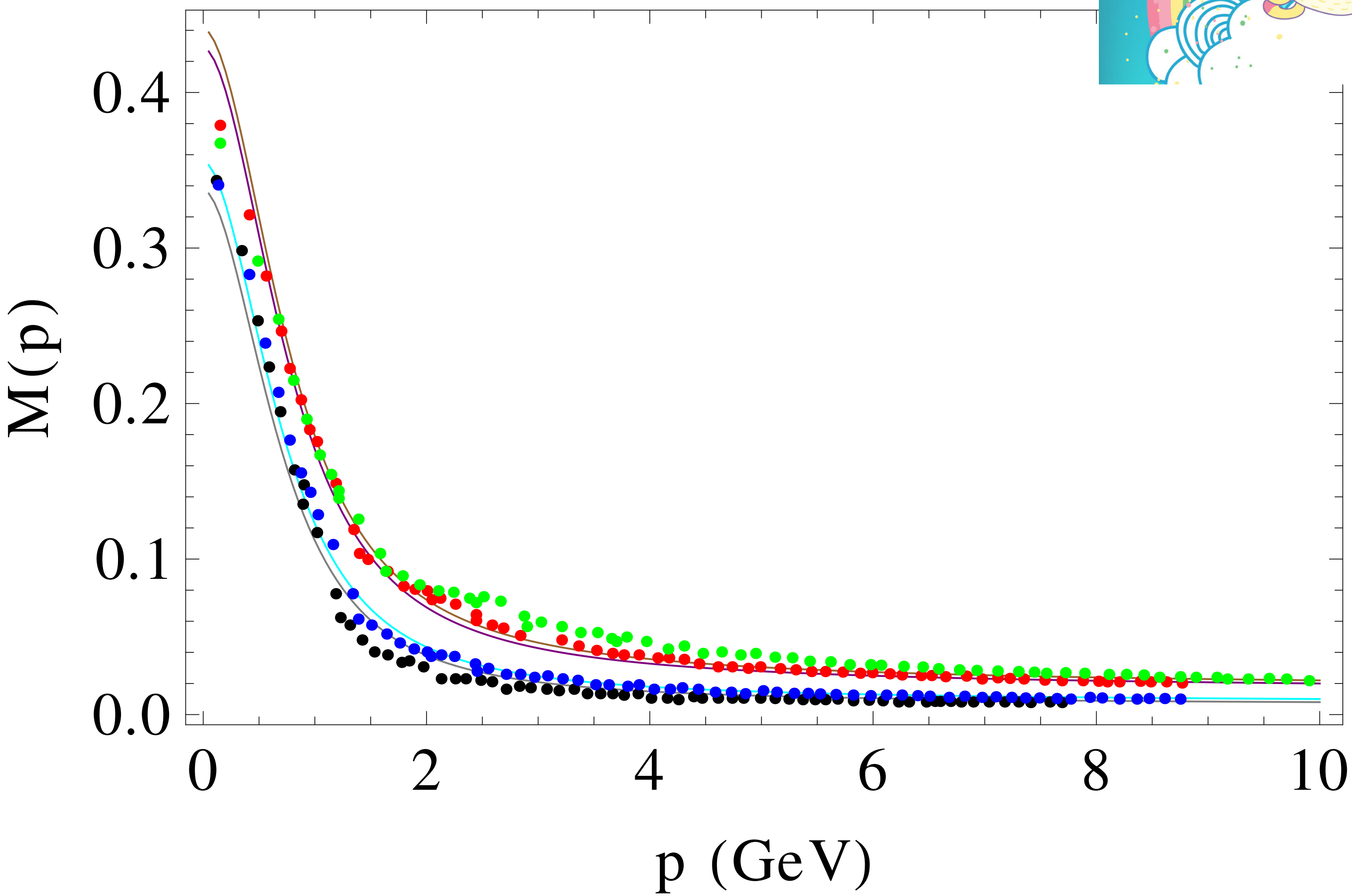
"Rainbow-improved" loop expansion

"Rainbow-improved" loop expansion



"Rainbow-improved" loop expansion




M(p)
0.0
0.1
0.2
0.3
0.4
p (GeV)
0
2
4
6
8
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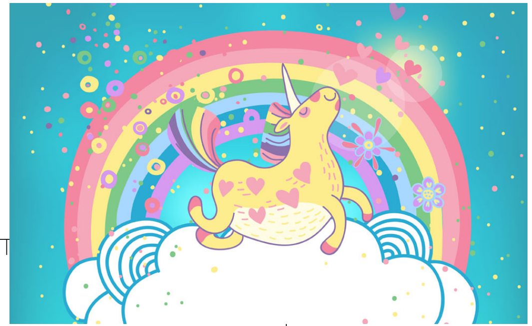


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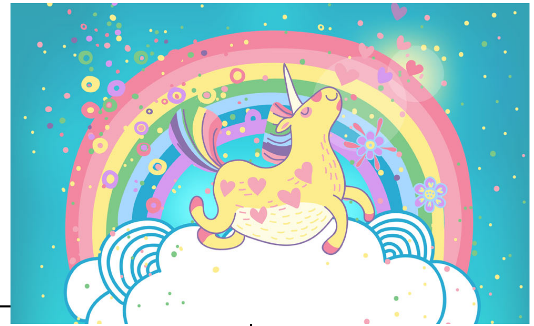

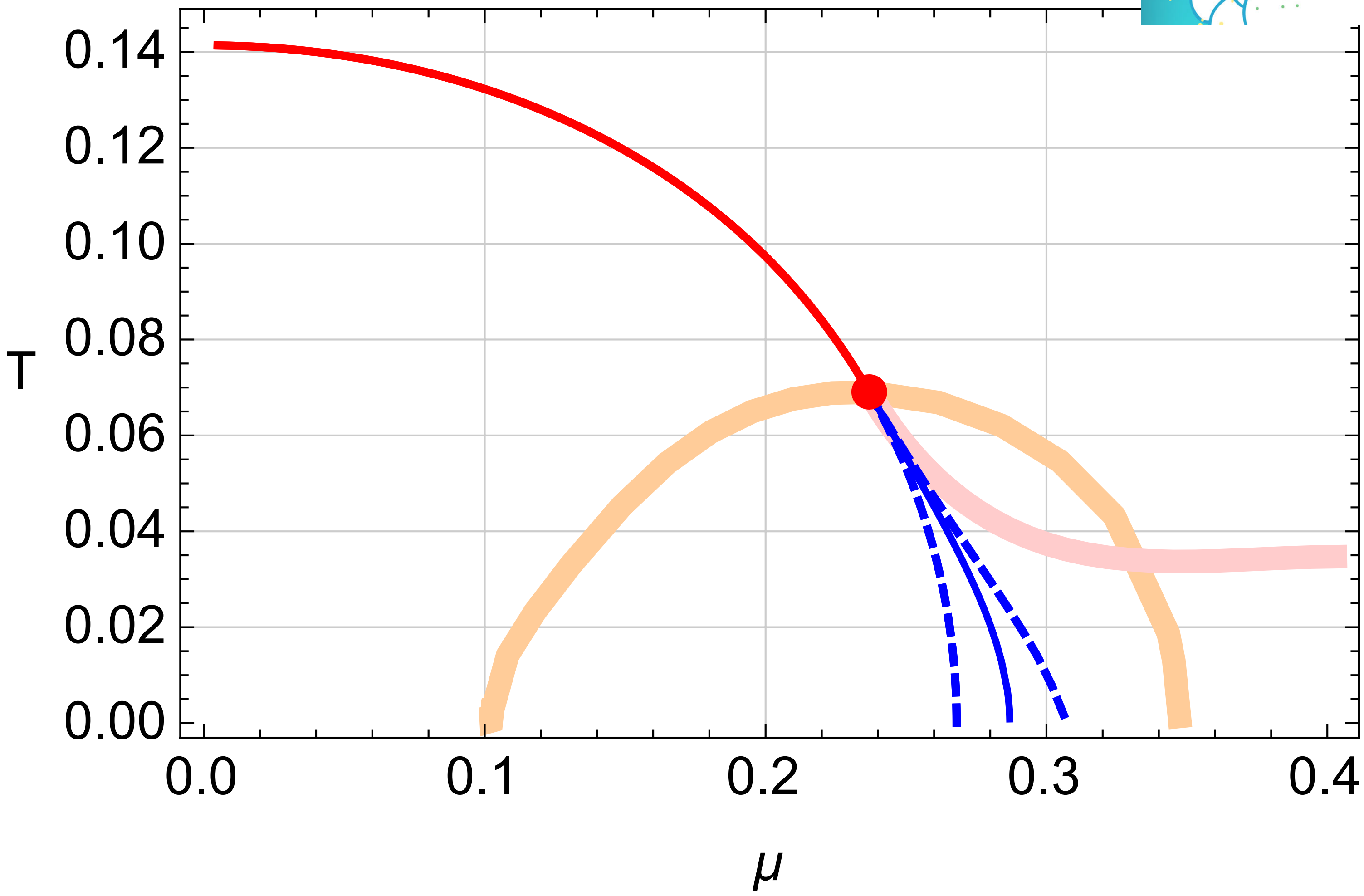
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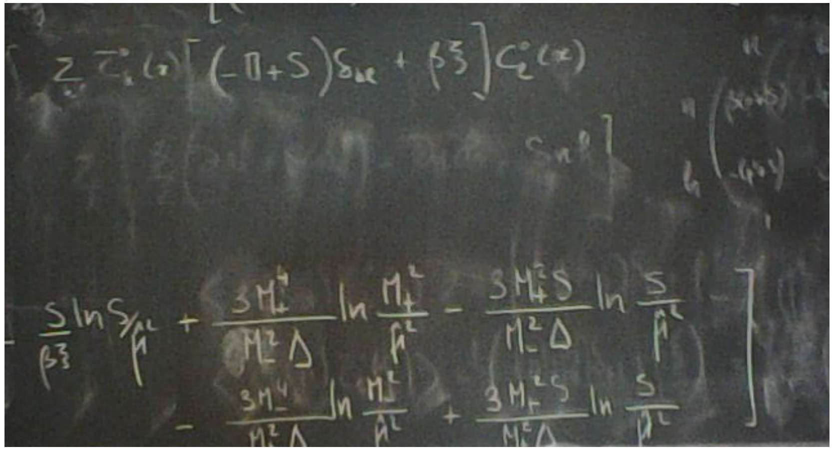
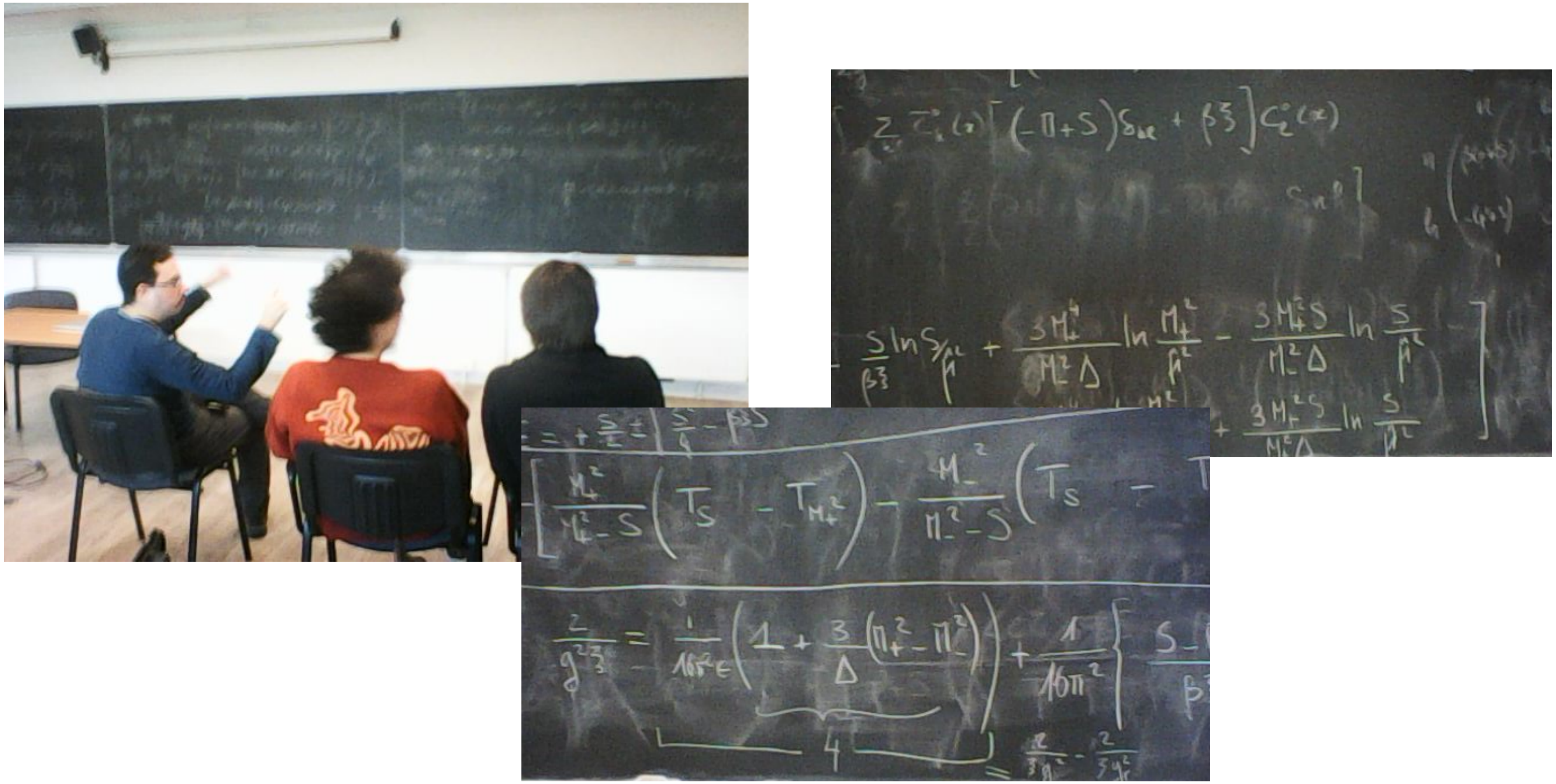
The Team

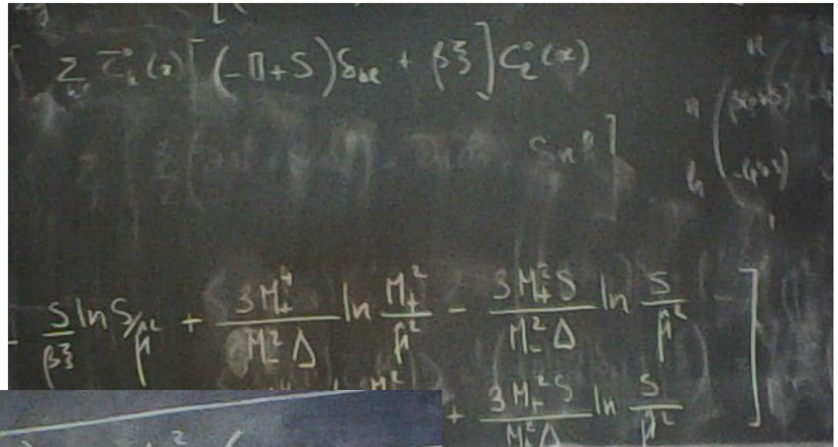


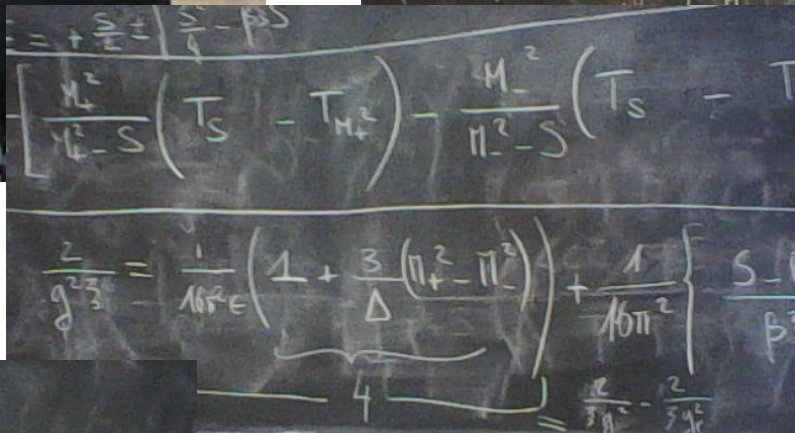


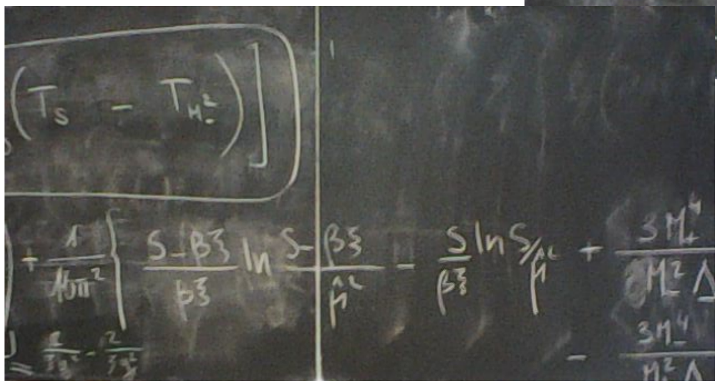


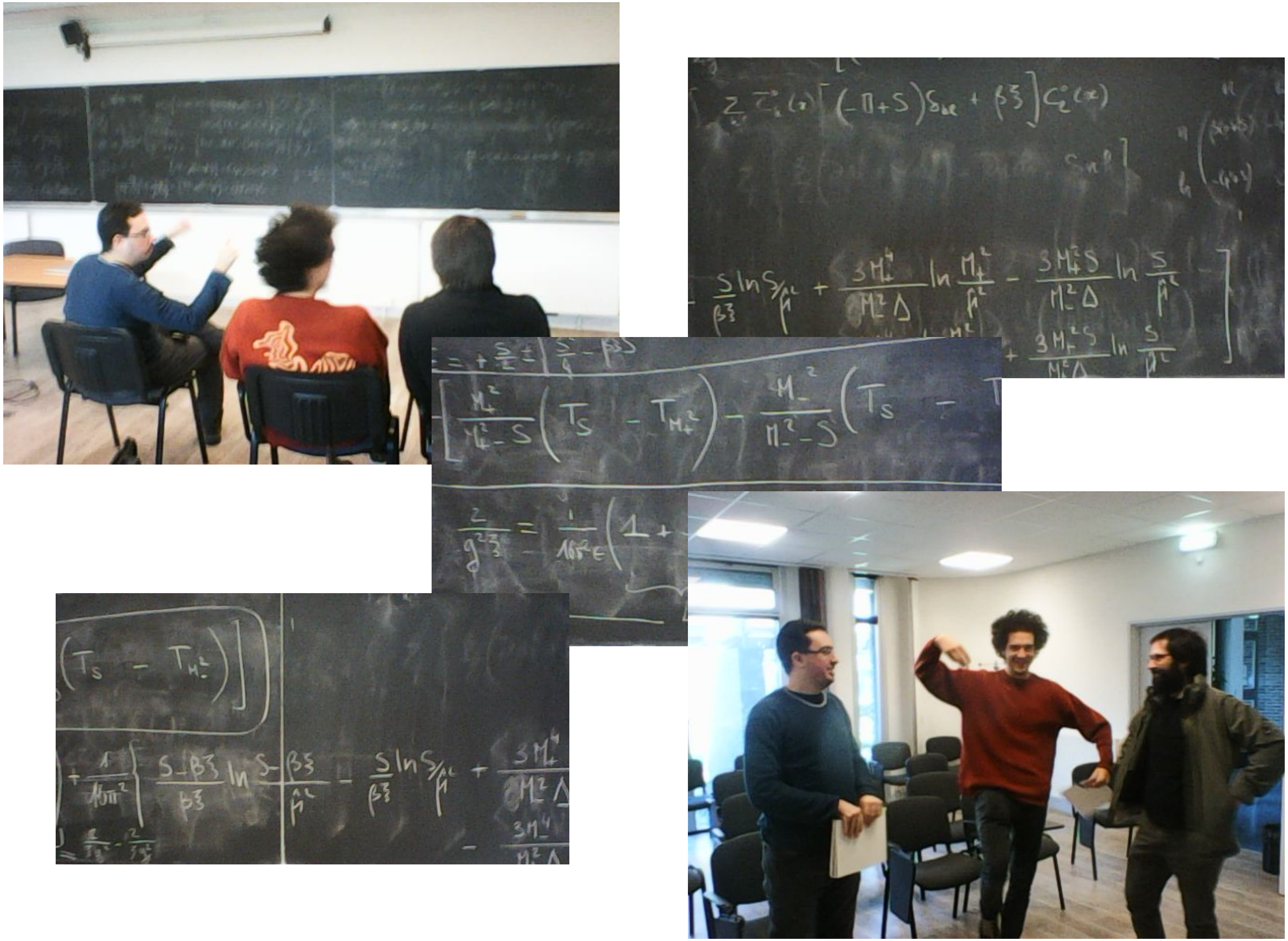


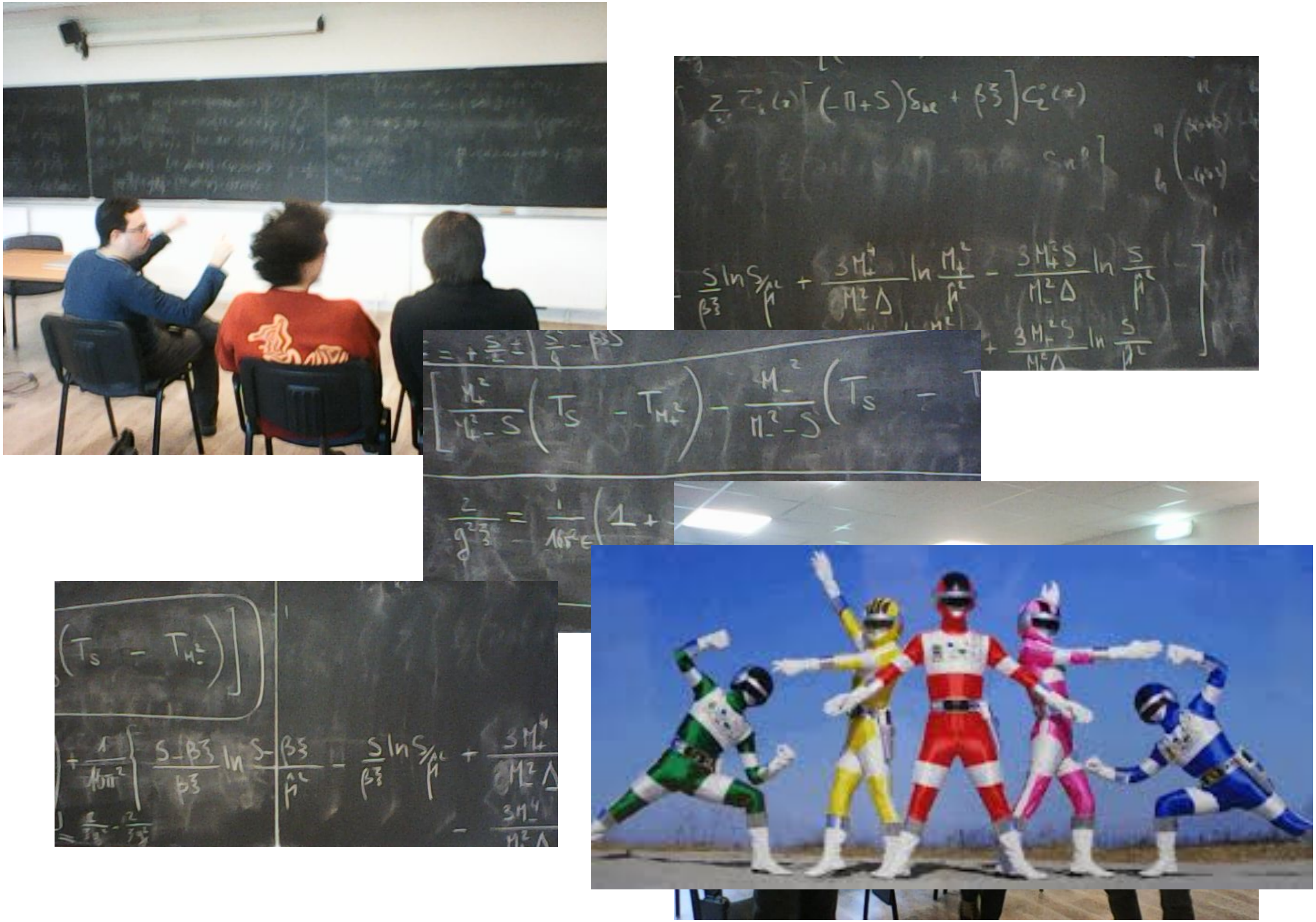








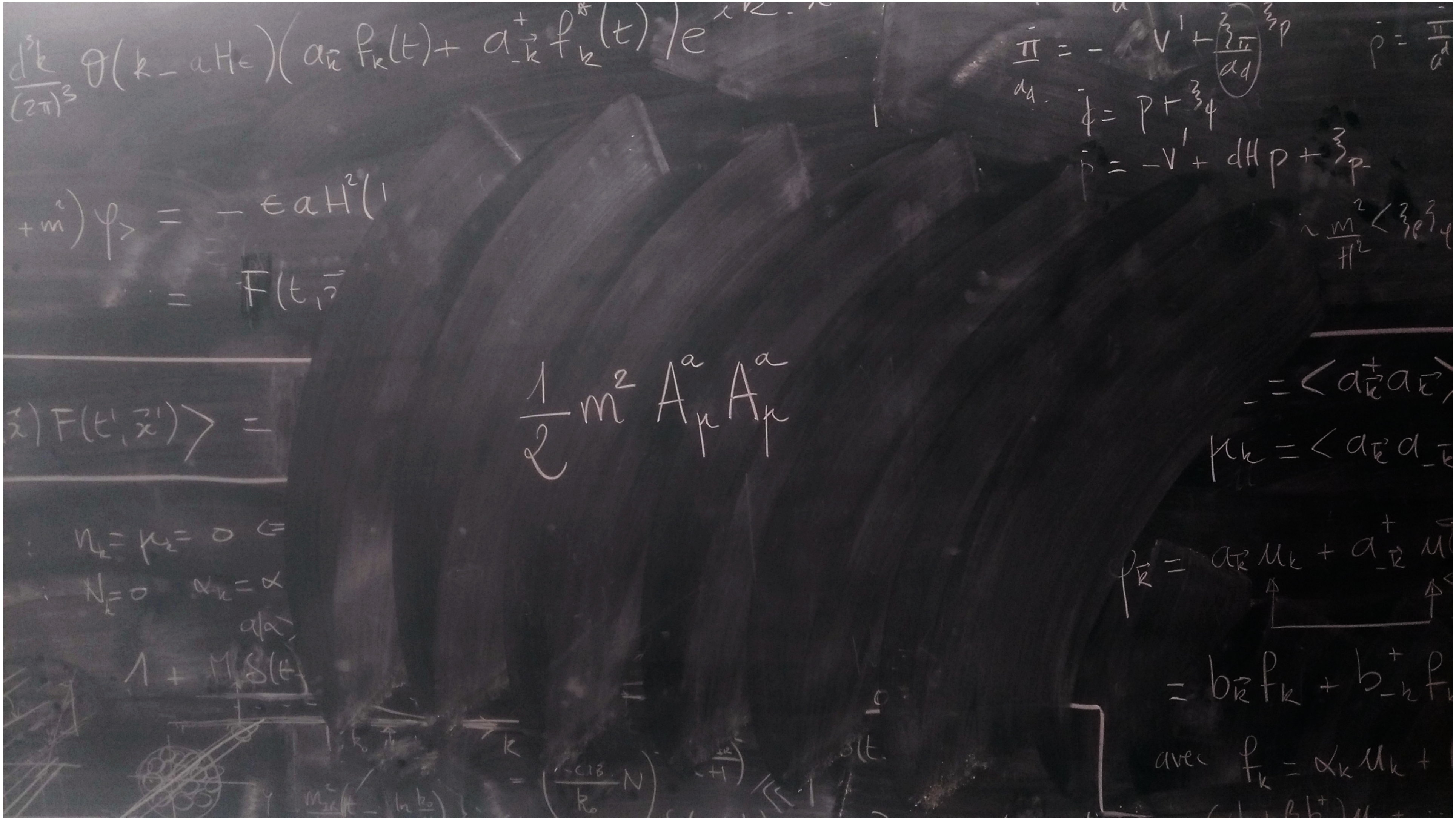




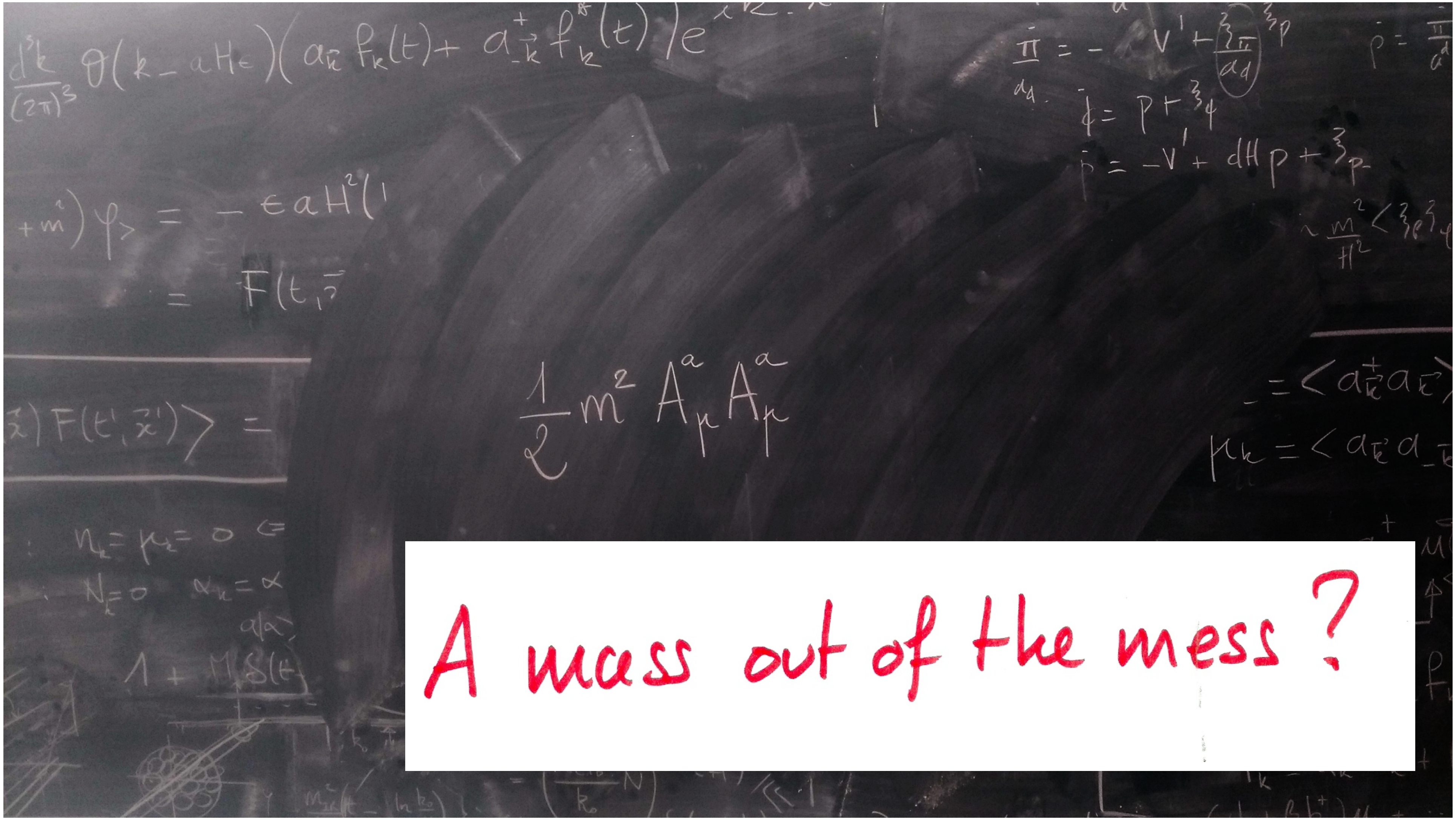
$$= + \frac{S}{2} \pm \sqrt{\frac{S^2}{4} - \beta^3 S}$$

$$\left[\frac{M_+^2}{M_+^2 - S}\left(T_S - T_{M_+^2}\right) - \frac{M_-^2}{M_-^2 - S}\left(T_S - T \right.\right.$$

$$\frac{2}{g^2 Z_3} = \underbrace{\frac{1}{16\pi^2 \epsilon}\Bigg(1 + \underbrace{\frac{3}{\Delta}\left(M_+^2 - M_-^2\right)}\Bigg)}_{4} + \frac{1}{16\pi^2}\left\{ \frac{S - \cdots}{\beta^{\cdots}} \right. = \frac{2}{3g^2} - \frac{2}{3g_r^2}$$



$\frac{1}{2} m^2 A^a_\mu A^a_\mu$


A mass out of the mess?


61
Holiday
Toasts
Friends
Wish
Day
Cake
Happy
Birth
Anniversary
Birthday
Anniversary
Wish
Greetings
Gifts
Invitations
Present
Friends
Age
Gifts
Day
Present
Surprise
Anniversary
Happy
Birthday
Wish
Friends


I AM NOT
61
I AM 18
WITH
43 YEARS OF
EXPERIENCE


61