THE SIGNIFICANCE OF THE

HIGGS MECHANISM

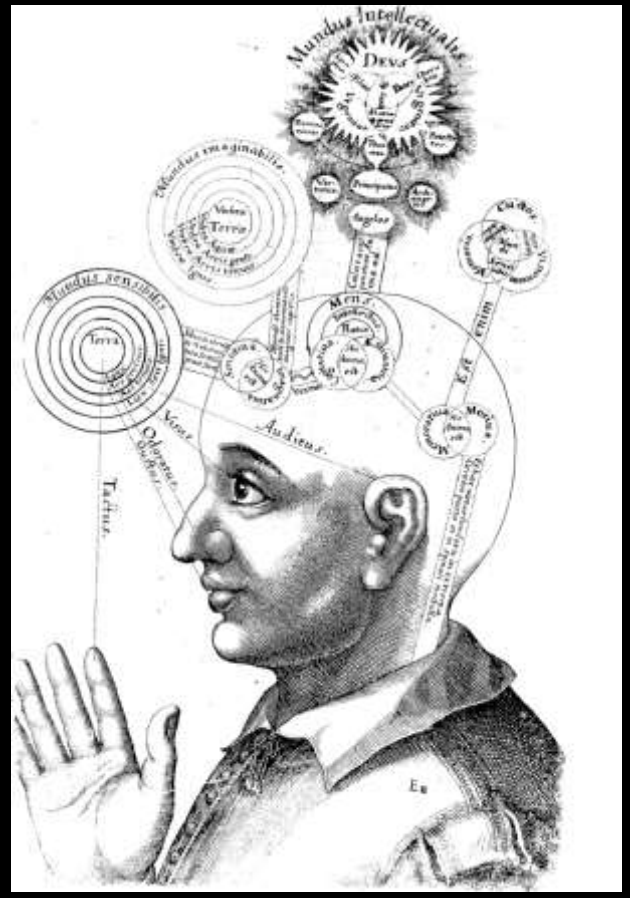
IN

JEWISH THOUGHT AND THEOLOGY

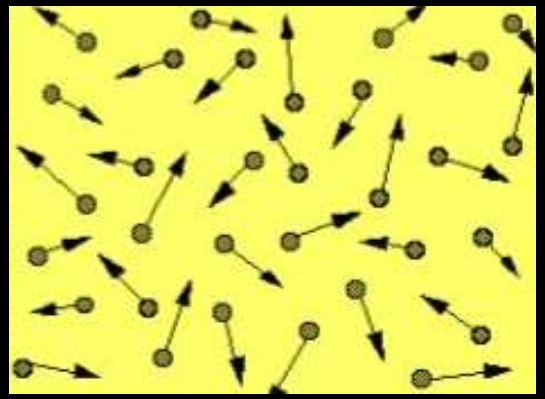
Daniel Turgeman

מכון ויצמן למדע

WEIZMANN INSTITUTE OF SCIENCE



Matter/Spirit
Body/Soul



"In truth, only atoms and the void"

"The common conception is this: The Creator created all out of complete nothingness […] and, so to speak, removed His hand from them. Only if He wishes at some point in time, He changes them, and when not, He governs them with the forces they were given at the time of creation.

Yet, the true belief, in my eyes, is: The blessed Name rejuvenates in his goodness always the acts of genesis. With aimed intent He bestows His abundance, and if, for one moment, He were to withhold - everything would be as if it never were, void of existence. That is the explanation of the verse (Deuteronomy 4, 39) 'Know this day, and lay it to thy heart, that the LORD, He is God in heaven above and upon the earth beneath; there is none else.' **The explanation is not that there is no god other than Him… rather it wishes to state that there is no reality in the world other than His reality**".

Shlah

"The force of He who acts, on he who is acted upon, is perpetual to vitalise and keep in existence. […] This is what the Ari said that **also in the inanimate such as rocks, soil and water is a type of vitality**"

Tanya

"according to the false opinion of eternal matter… there couldn't be a way for the creations to have an internal relation to their Creator, may He be blessed,

because the materialistic basis, according to this mistake, is existent without Him,
and it [materialistic matter] is the internal basis of existence of the creations.

It turns out that he who is wrong with this mistake is similar to one who doesn't have a God, because he cannot elevate his soul to recognise its Owner from its internal existence"

Rav Kook

1KG

Understanding

Believing

Light

Matter

Light	Matter
No Mass	Mass

Light	Matter
No Mass	Mass
Does not occupy space	Occupies space

Light	Matter
No Mass	Mass
Does not occupy space	Occupies space
Created and absorbed	Conservation of matter

Light	Matter
No Mass	Mass
Does not occupy space	Occupies space
Created and absorbed	Conservation of matter

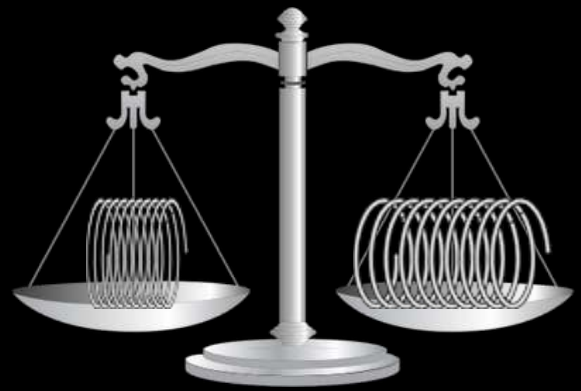
Light	Matter
No Mass	
Does not occupy space	
Created and absorbed	

Light	Matter
No Mass	
Does not occupy space	
Created and absorbed	

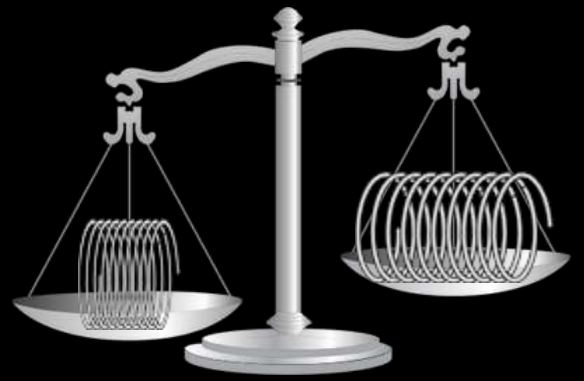
$E=mc^2$

$$m=\frac{E}{c^2}$$

$$m = \frac{E}{c^2}$$



$$m = \frac{E}{c^2}$$



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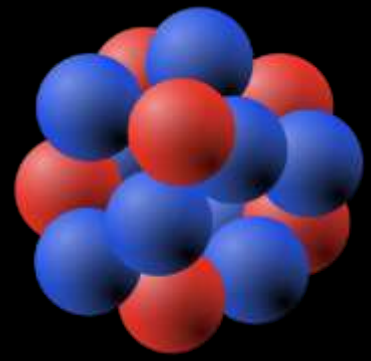

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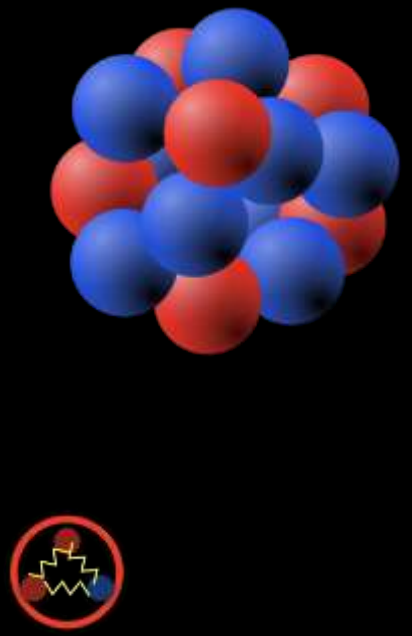

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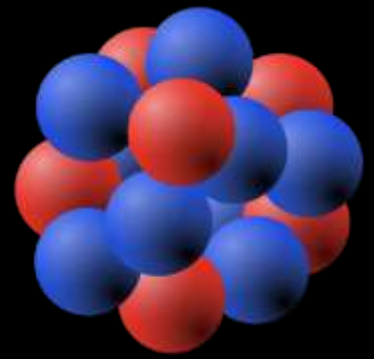

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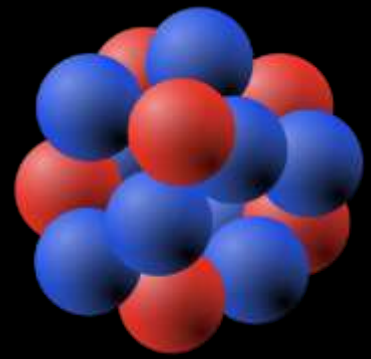

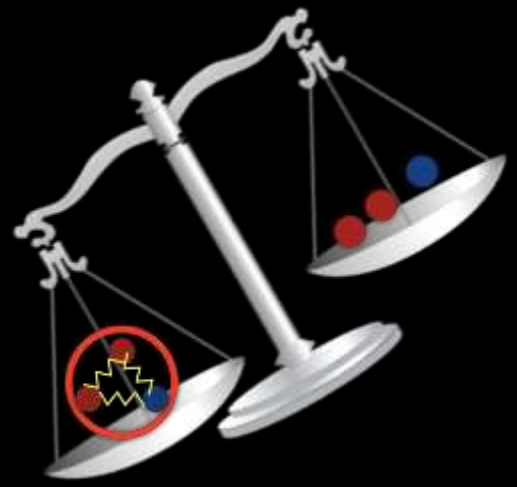

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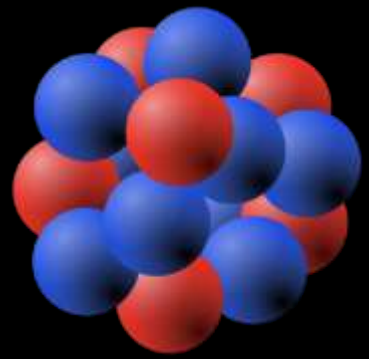

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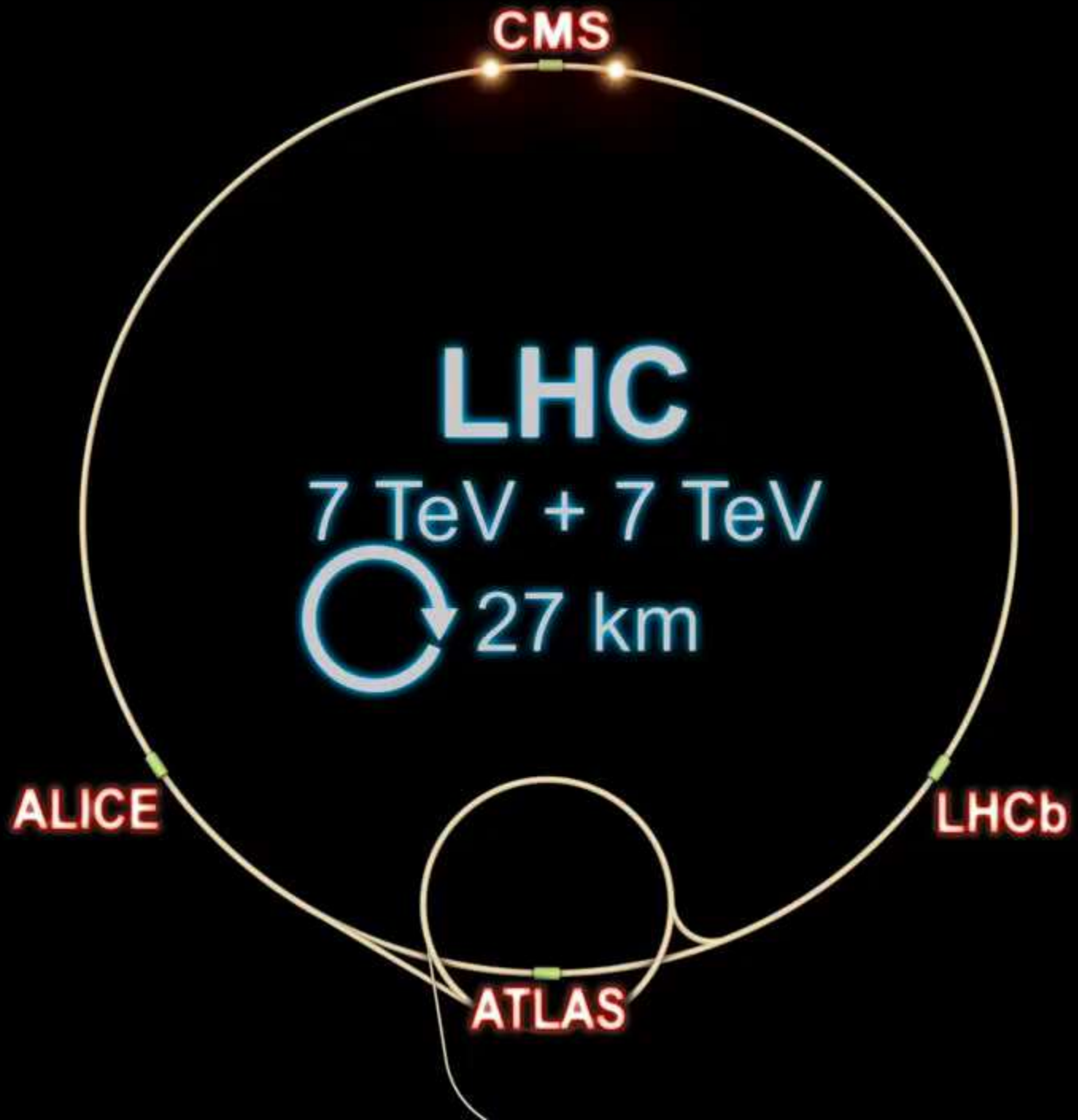
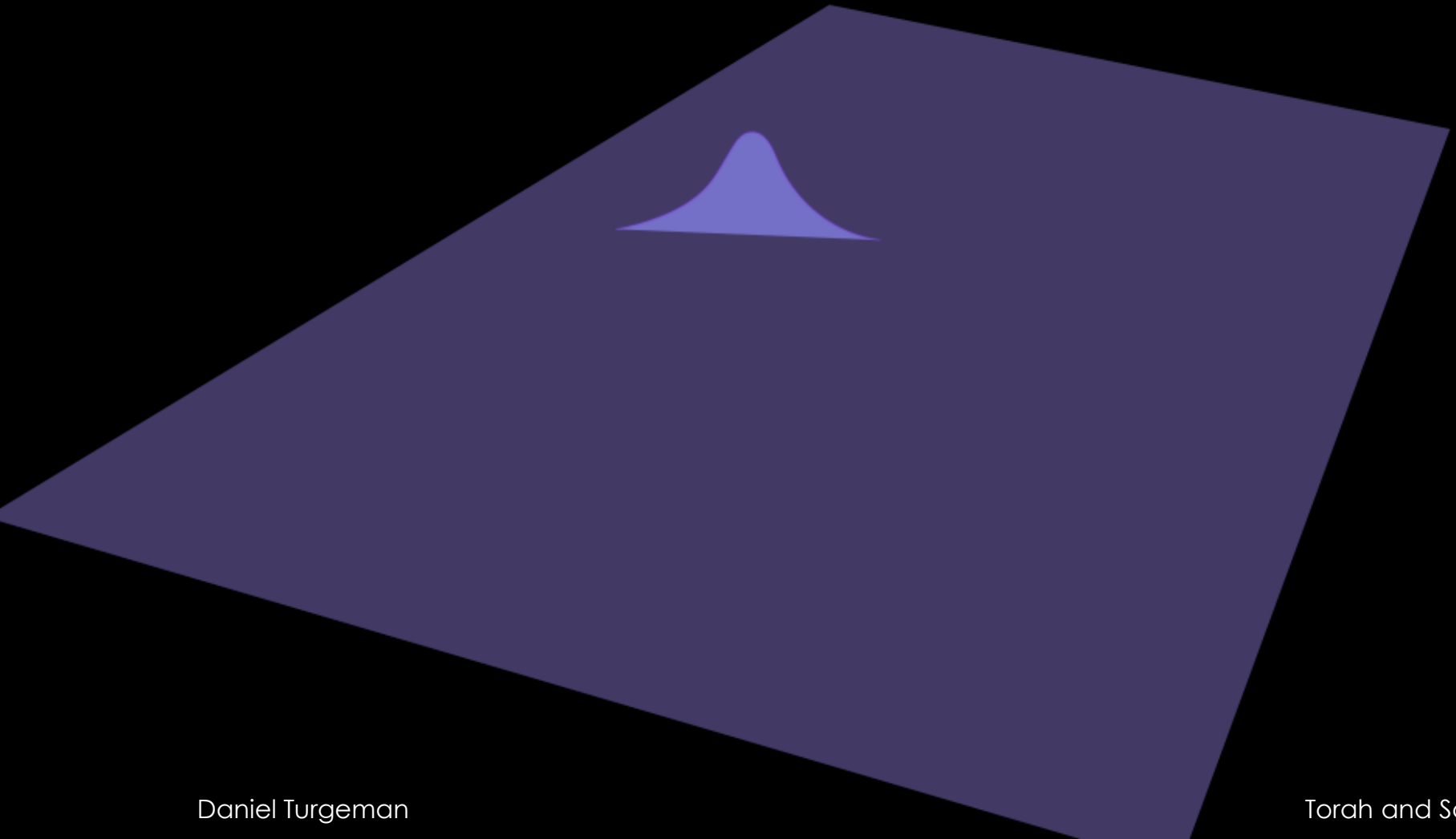
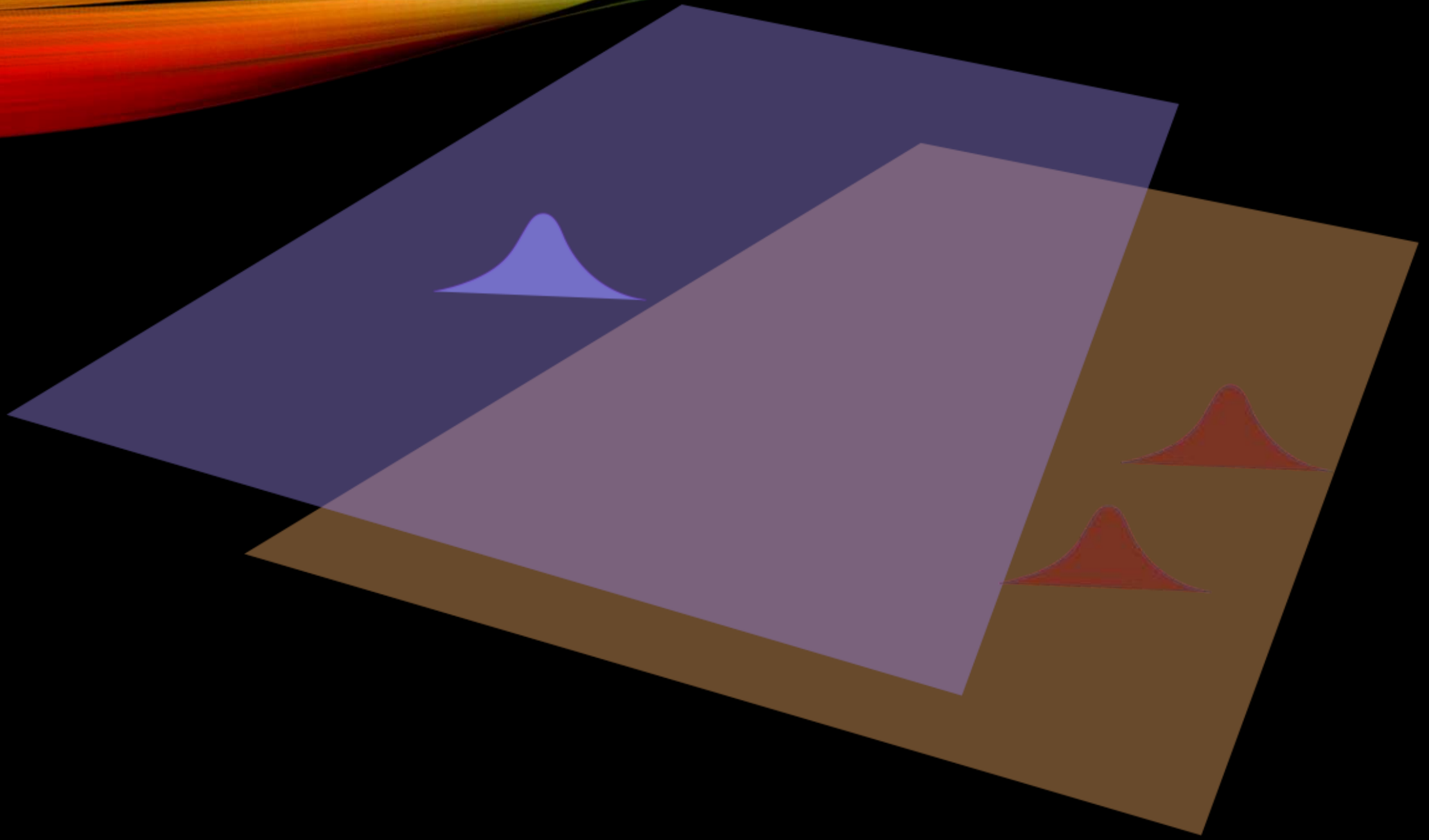
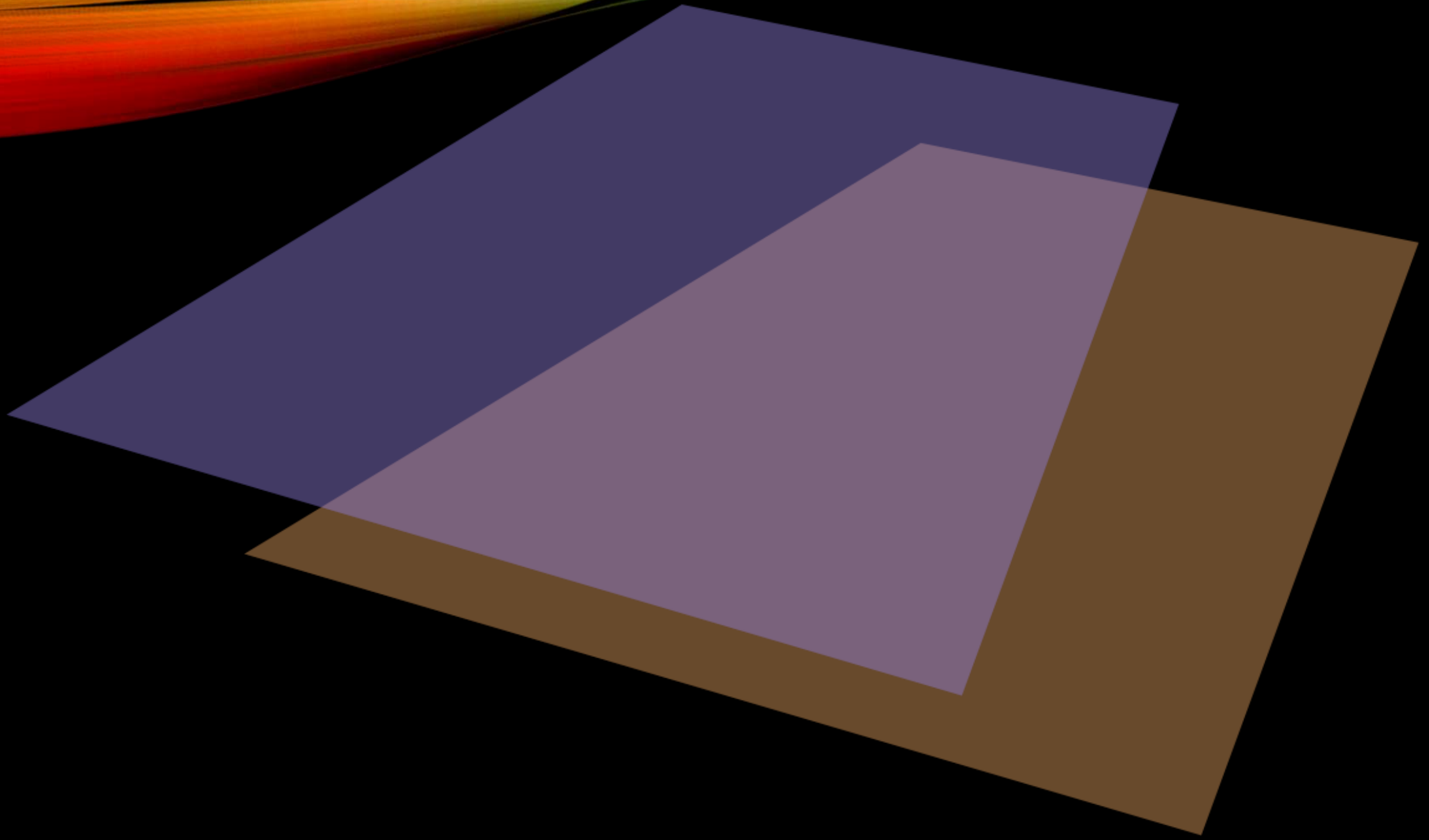
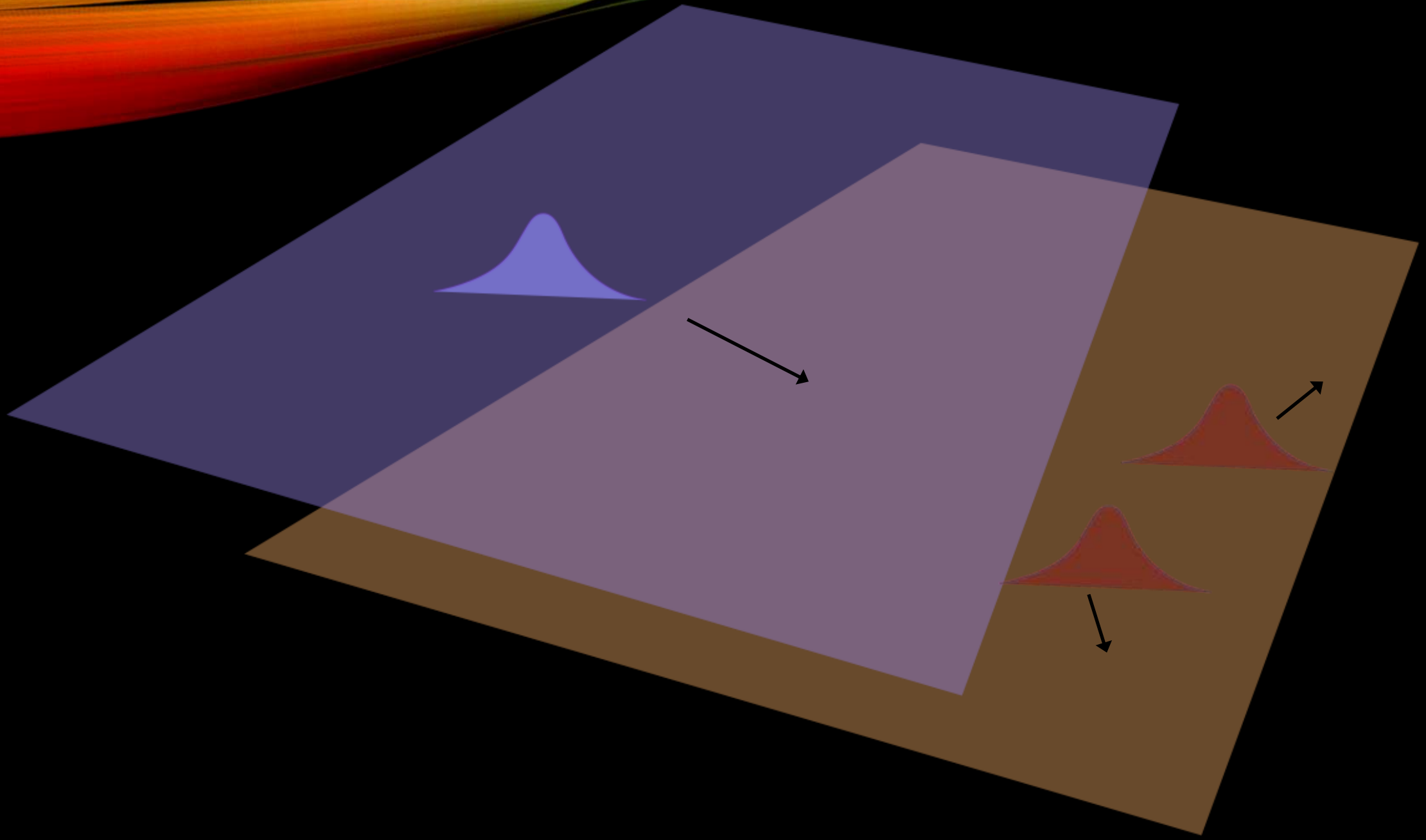

CMS
LHC
7 TeV + 7 TeV
27 km
ALICE
LHCb
ATLAS

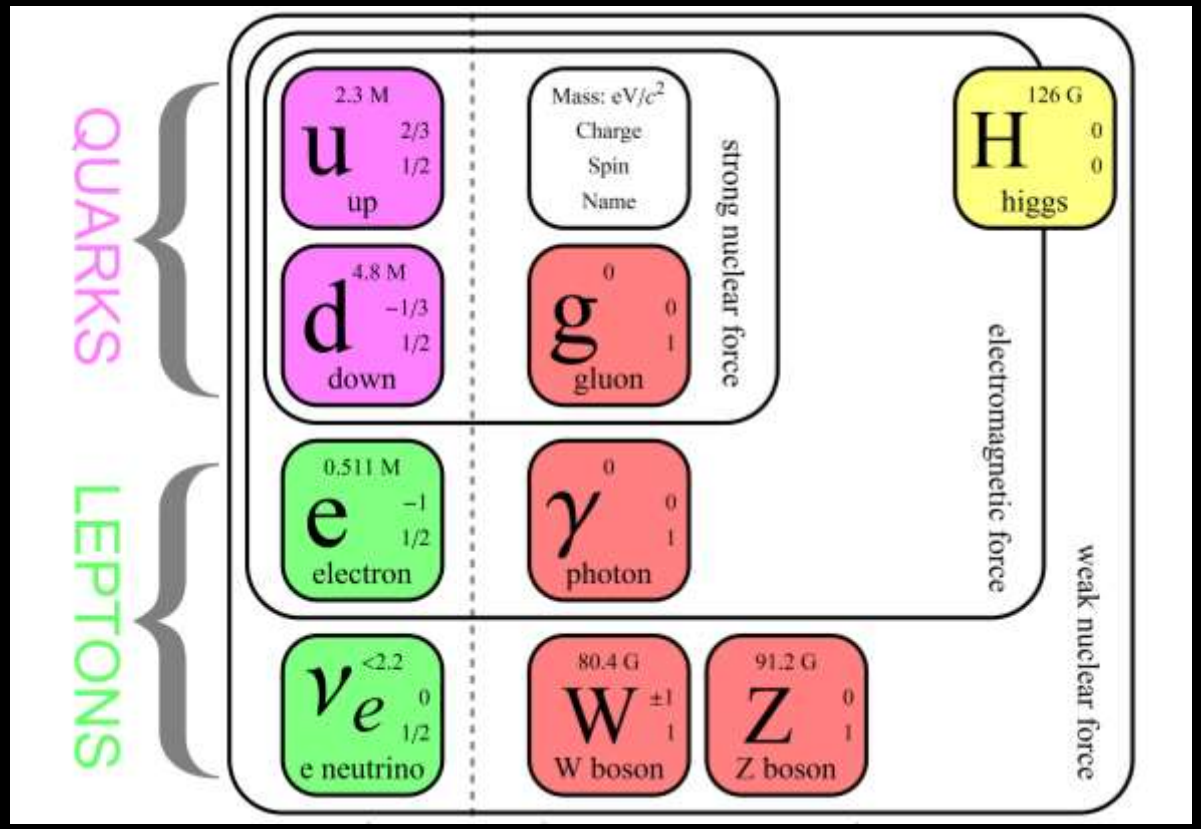
Quantum Fields







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higgs
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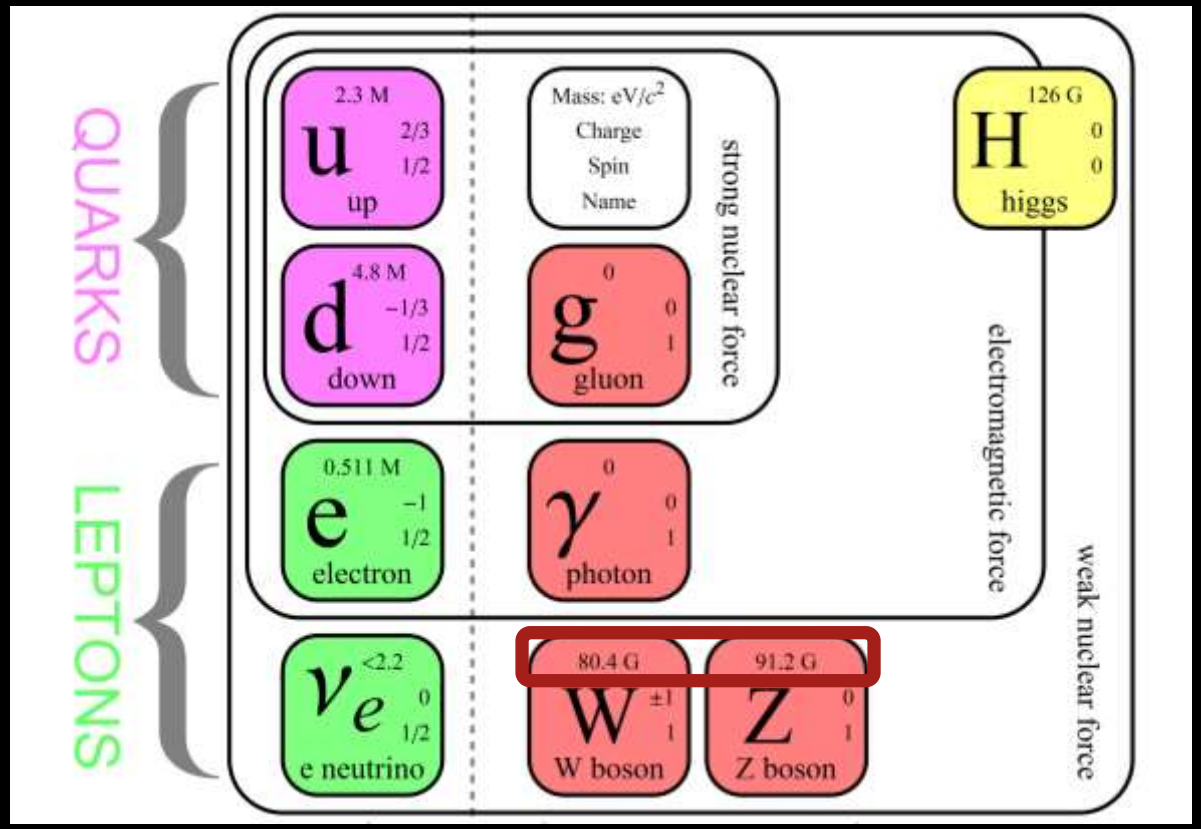
electromagnetic force
weak nuclear force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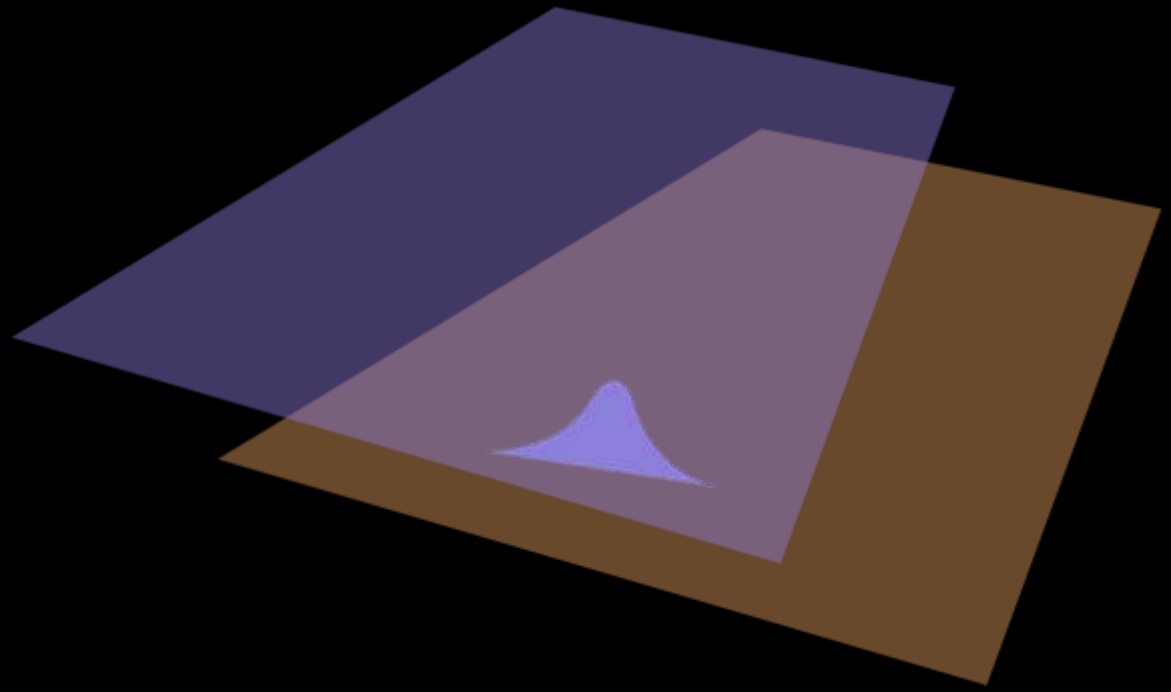

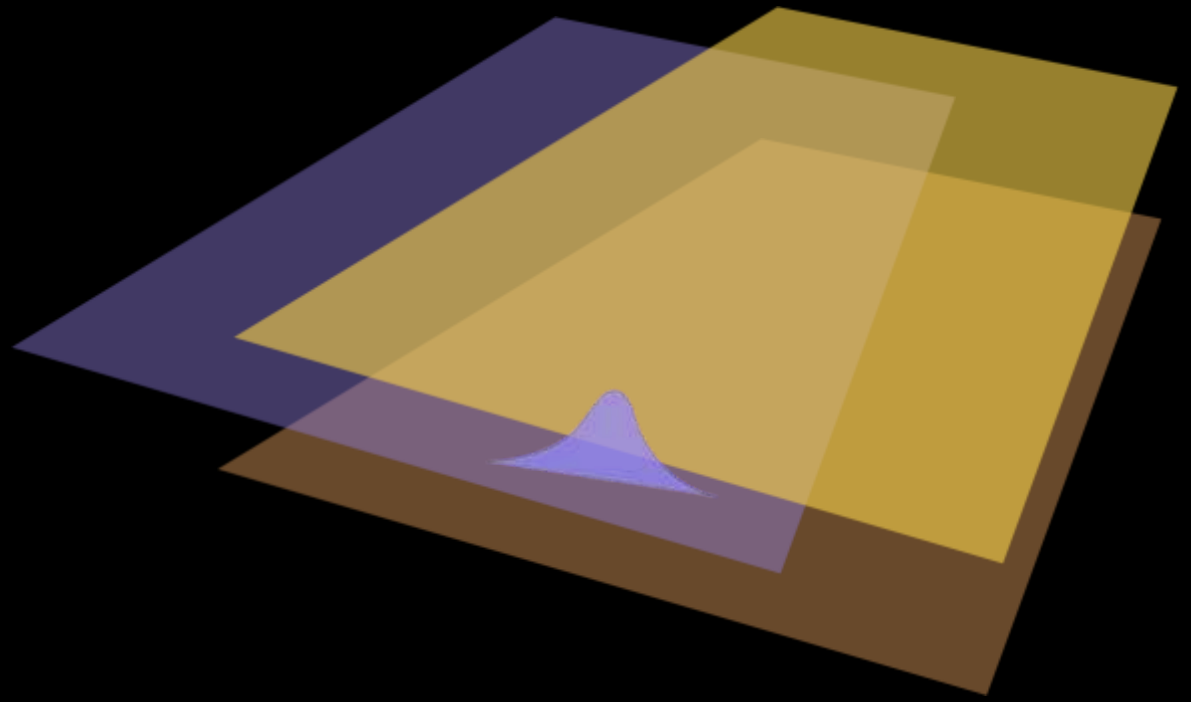

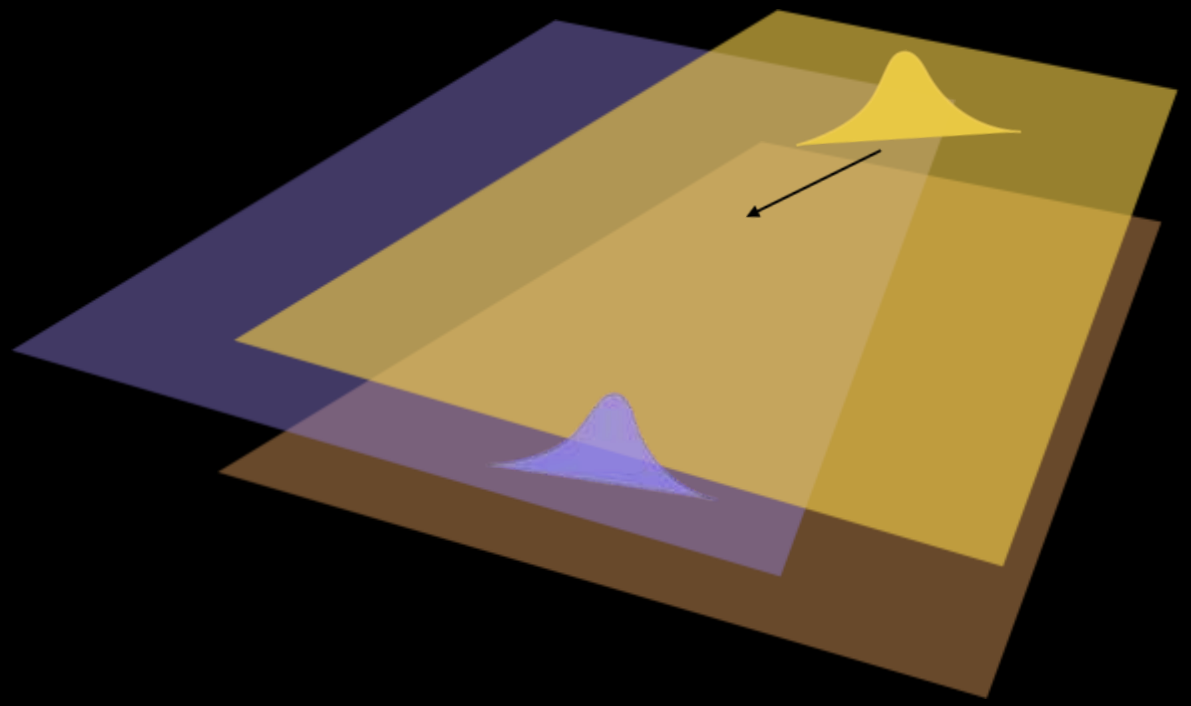

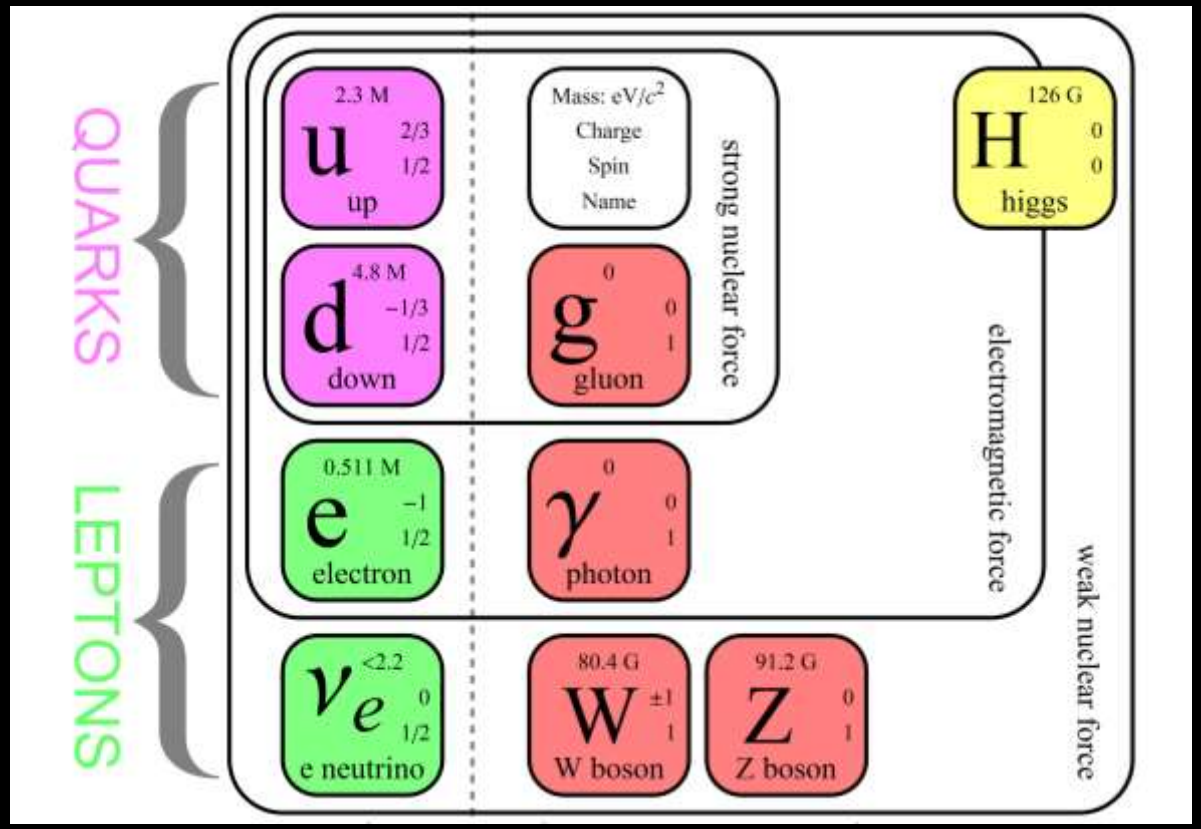
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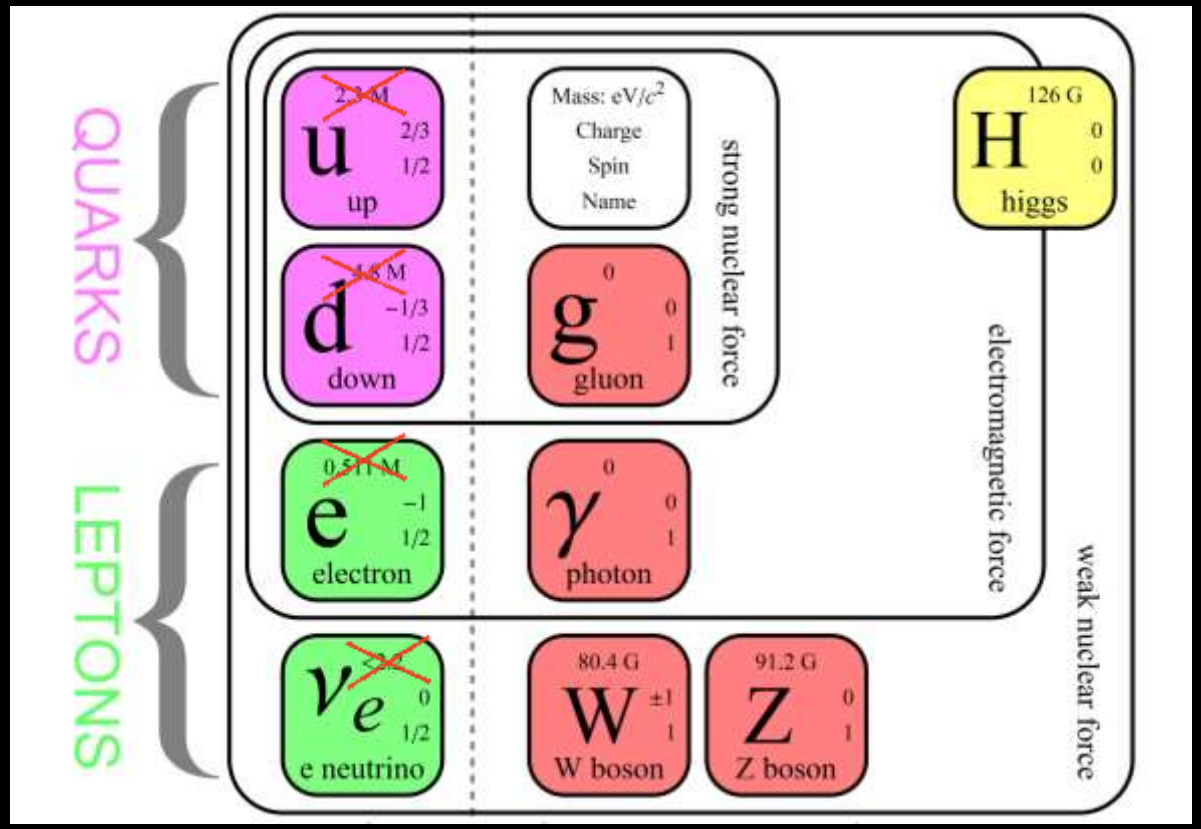
Yang

Wu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[14] L. M. Brown and P. Singer, Phys. Rev. Letters 8, 460 (1962).

A MODEL OF LEPTONS*

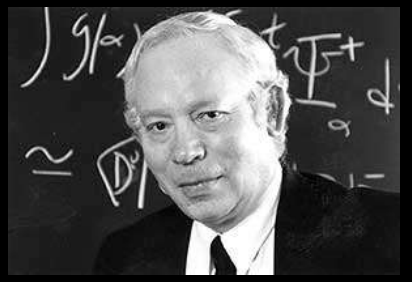
Steven Weinberg†
Laboratory for Nuclear Science and Physics Department,
Massachusetts Institute of Technology, Cambridge, Massachusetts
(Received 17 October 1967)

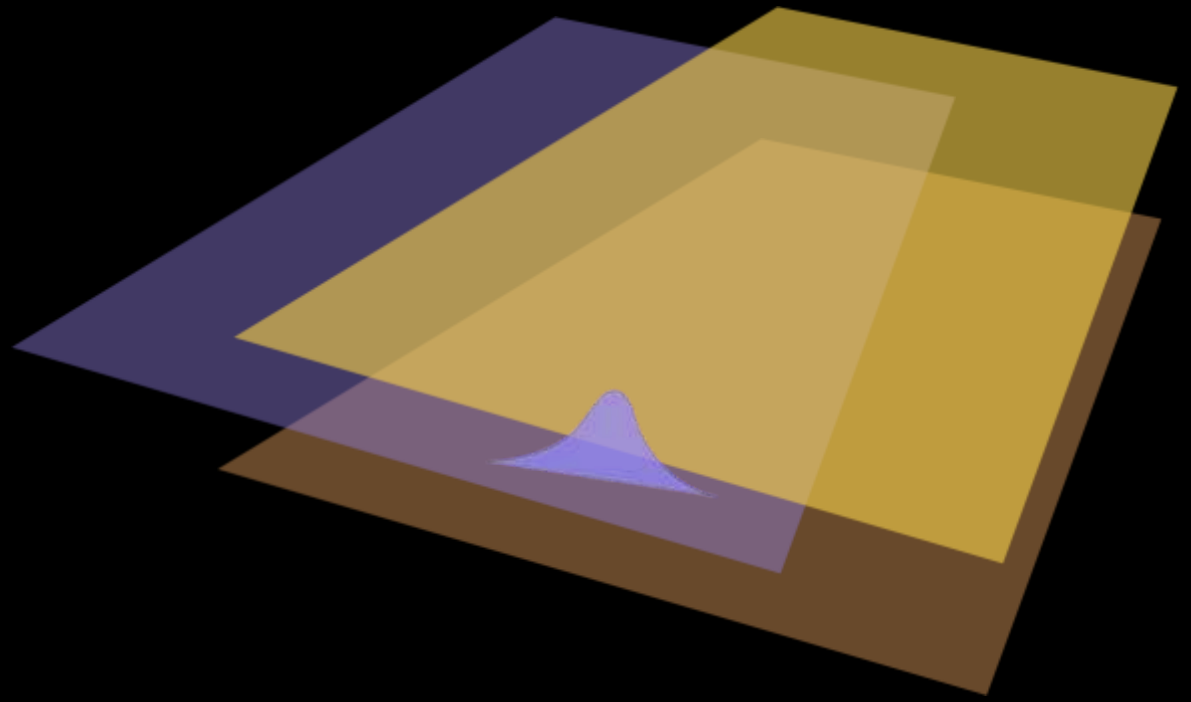
Leptons interact only with photons, and with the intermediate bosons that presumably mediate weak interactions. What could be more natural than to unite[1] these spin-one bosons into a multiplet of gauge fields? Standing in the way of this synthesis are the obvious differences in the masses of the photon and inter-

and on a right-handed singlet

$$R = [\tfrac{1}{2}(1-\gamma_5)]e. \qquad (2)$$

The largest group that leaves invariant the kinematic terms $-\bar{L}\gamma^\mu\partial_\mu L - \bar{R}\gamma^\mu\partial_\mu R$ of the Lagrangian consists of the electronic isospin $\vec{T}$ acting





[Kinetic term] + [Mass Term] +
[Interaction Term]

[Kinetic term] + [m · f] +
[Interaction Term]

[Kinetic term] + [~~m · f~~] +
[Interaction Term]

[Kinetic term] + [~~m · f~~] + [Interaction Term]

Lee

Yang

[Kinetic term] + [~~m · f~~] + [Interaction Term]

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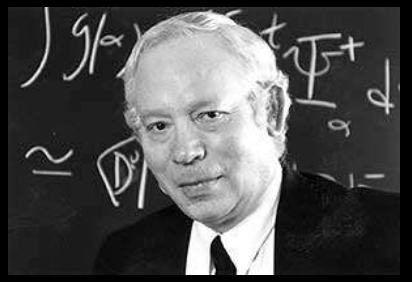
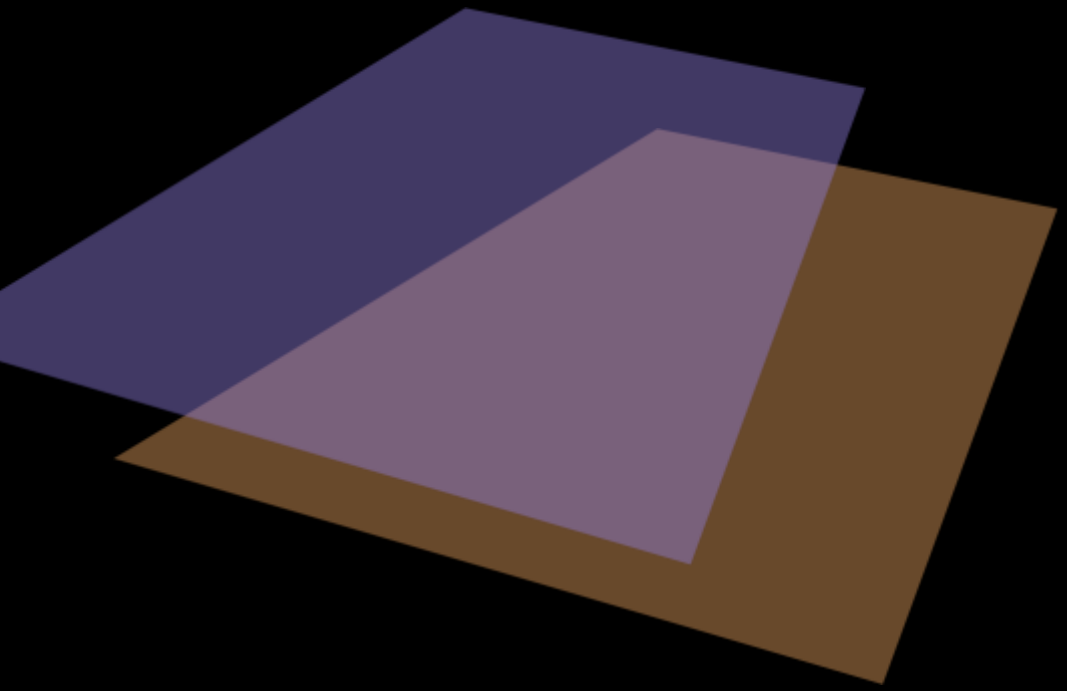
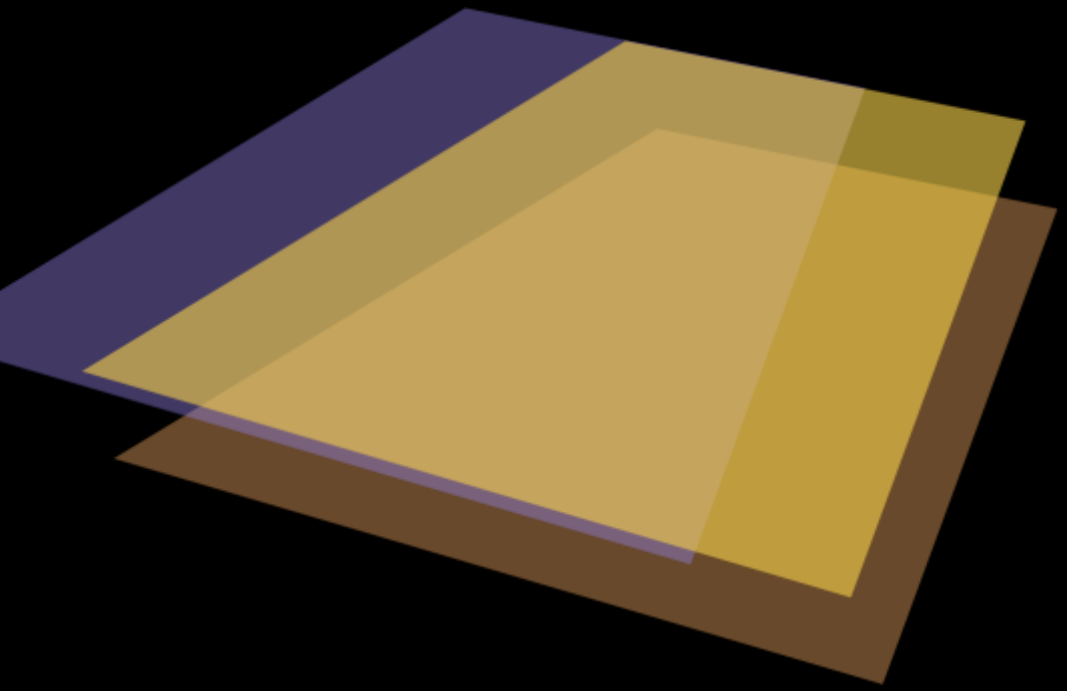


[Kinetic term] + [~~m · f~~] +
[Interaction Term]

$$[\text{ Kinetic term }] + [\ \cancel{m \cdot f}\ ] + [\ g \cdot f_1 \cdot f_2\ ]$$



$$[\text{ Kinetic term }] + [\ \cancel{m \cdot f}\ ] + [\ g \cdot H \cdot f\ ]$$

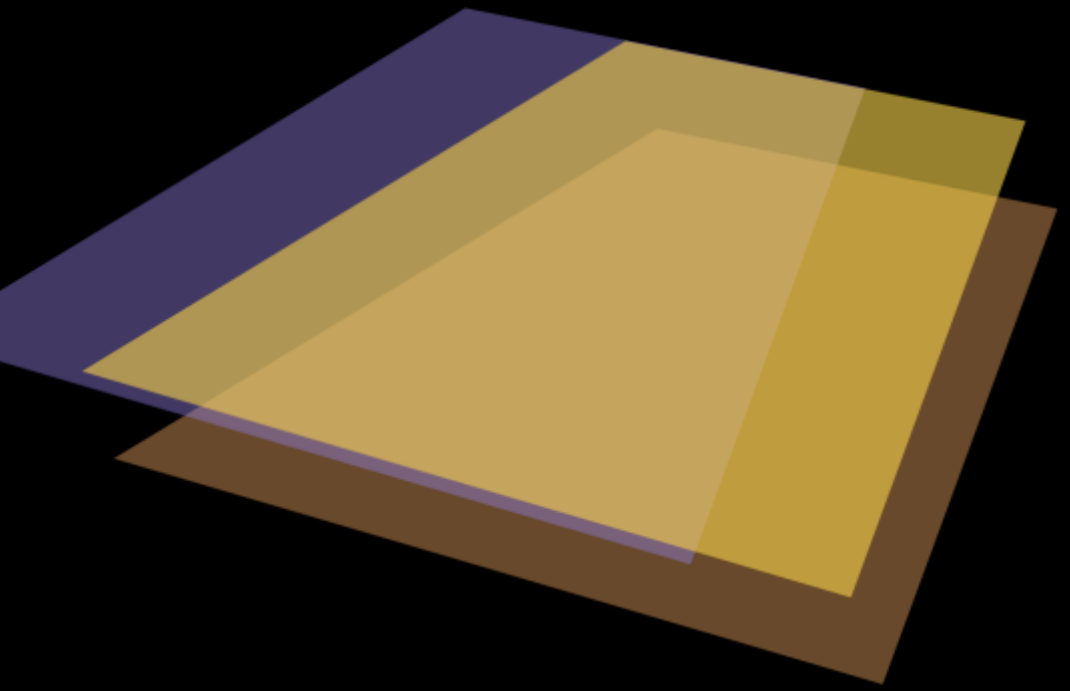


$$g_e \cdot H \cdot f_e$$
$$g_t \cdot H \cdot f_t$$

$$[\text{ Kinetic term }] + [\ \cancel{m \cdot f}\ ] + [\ g \cdot H \cdot f\ ]$$

$$\downarrow$$

$$[g \cdot v \cdot f\ ]$$



$$g_e \cdot H \cdot f_e$$
$$g_t \cdot H \cdot f_t$$

[Kinetic term] + [~~m · f~~] +

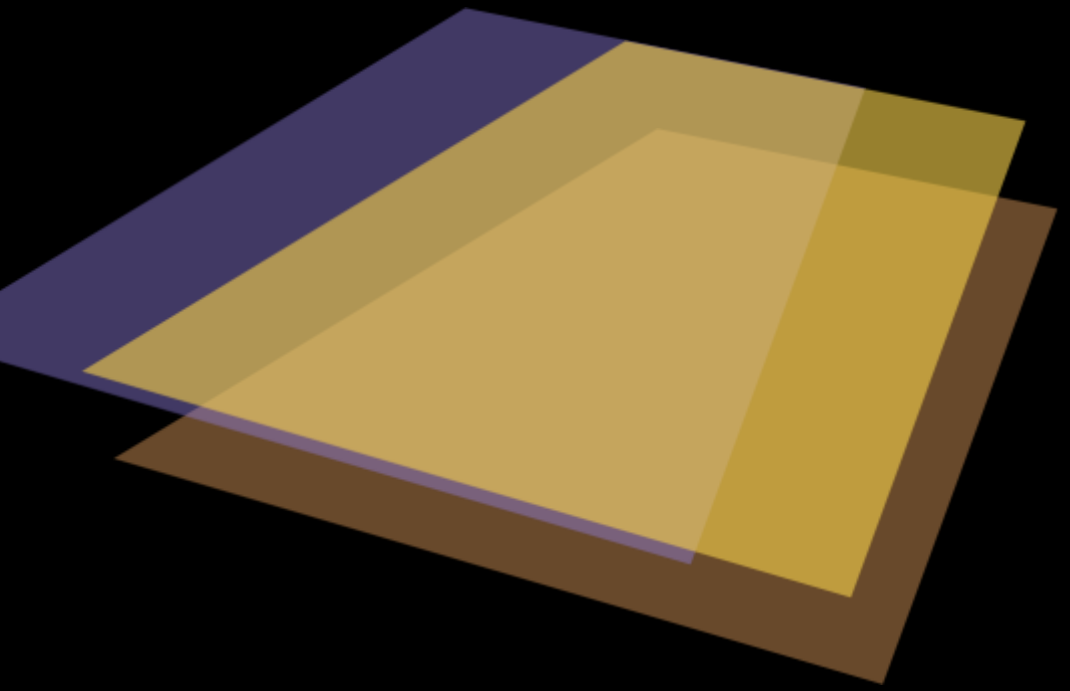
[g · H · f]

↓

[g · v · f]

↓

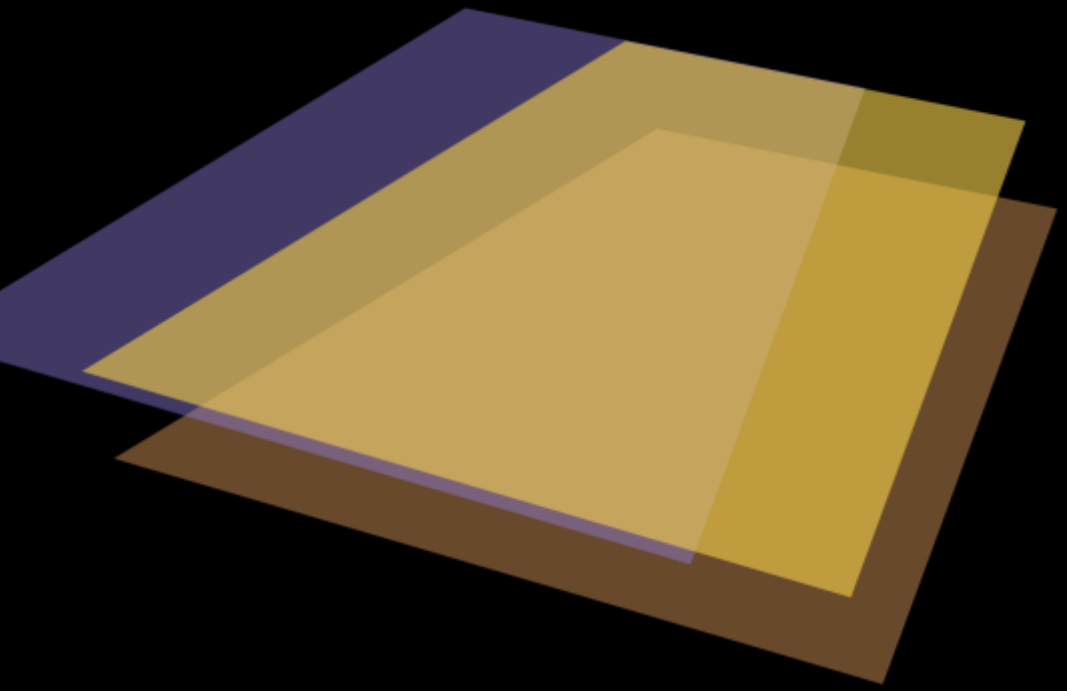
[”**m**” · f]



$g_e \cdot H \cdot f_e$

$g_t \cdot H \cdot f_t$

[Kinetic term] + [~~m · f~~] +
[”**m**” · f]



$g_e \cdot H \cdot f_e$
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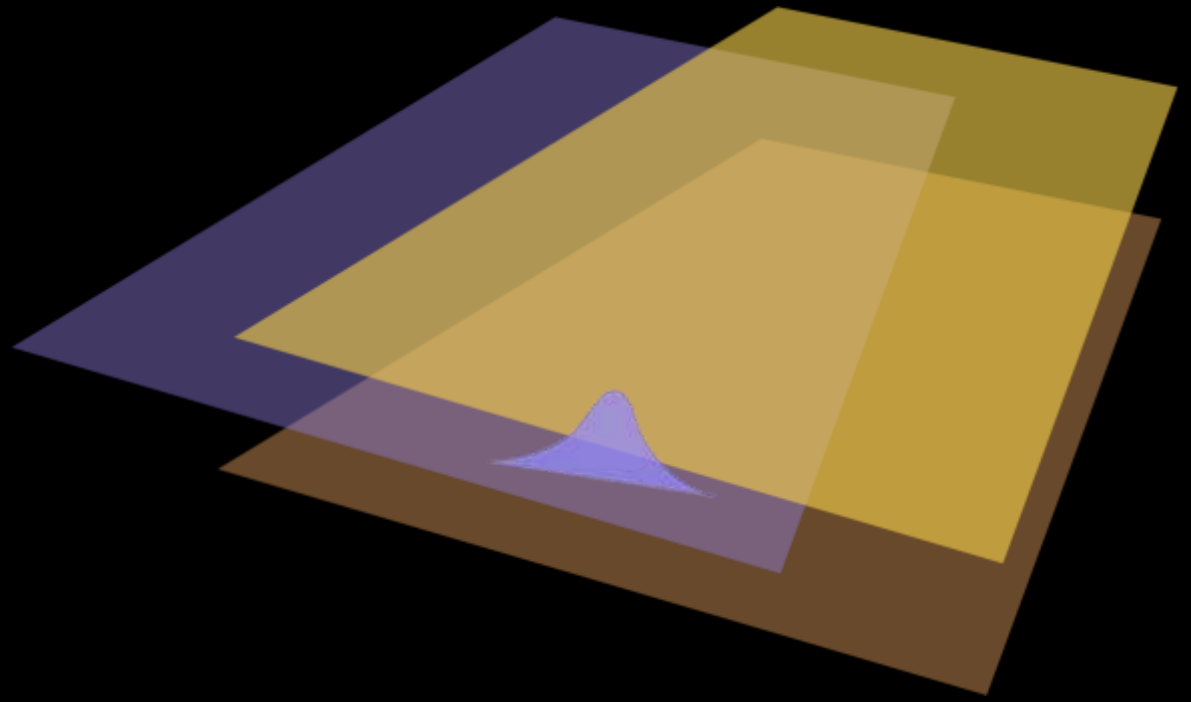

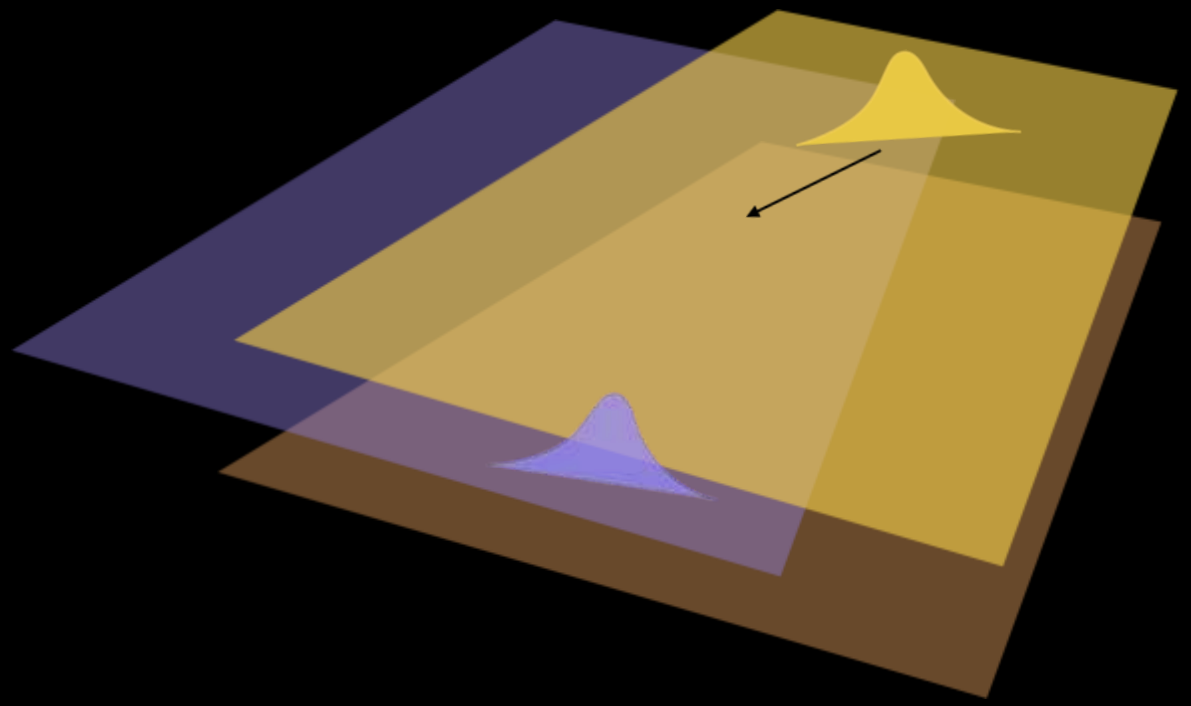

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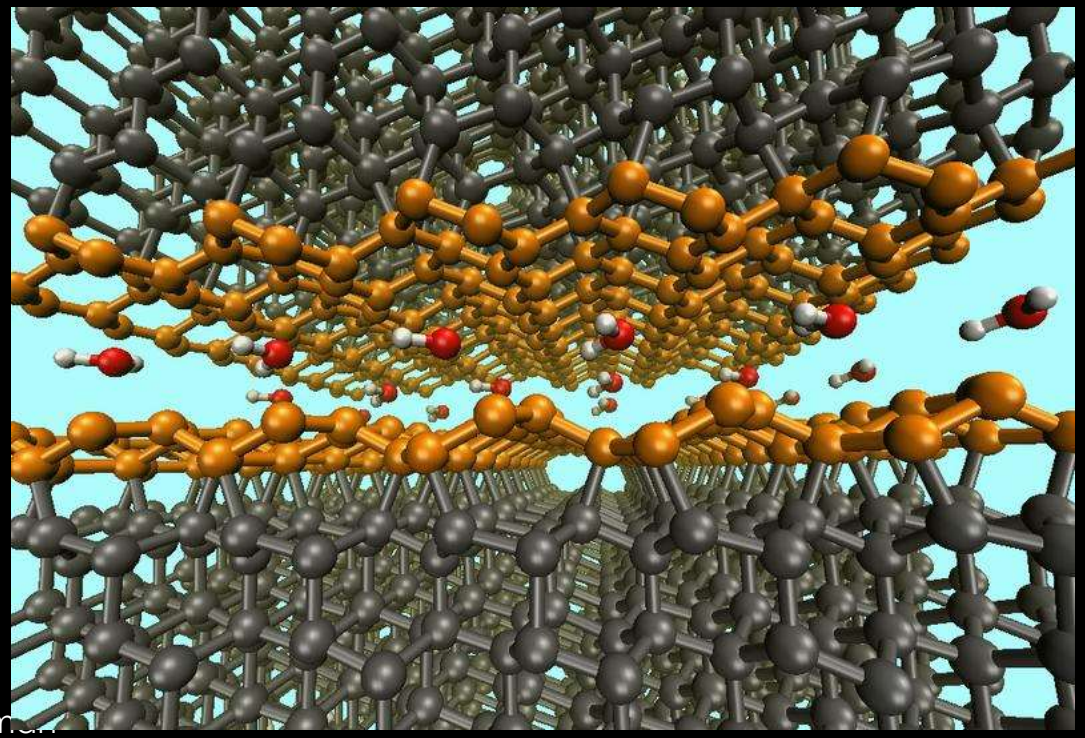

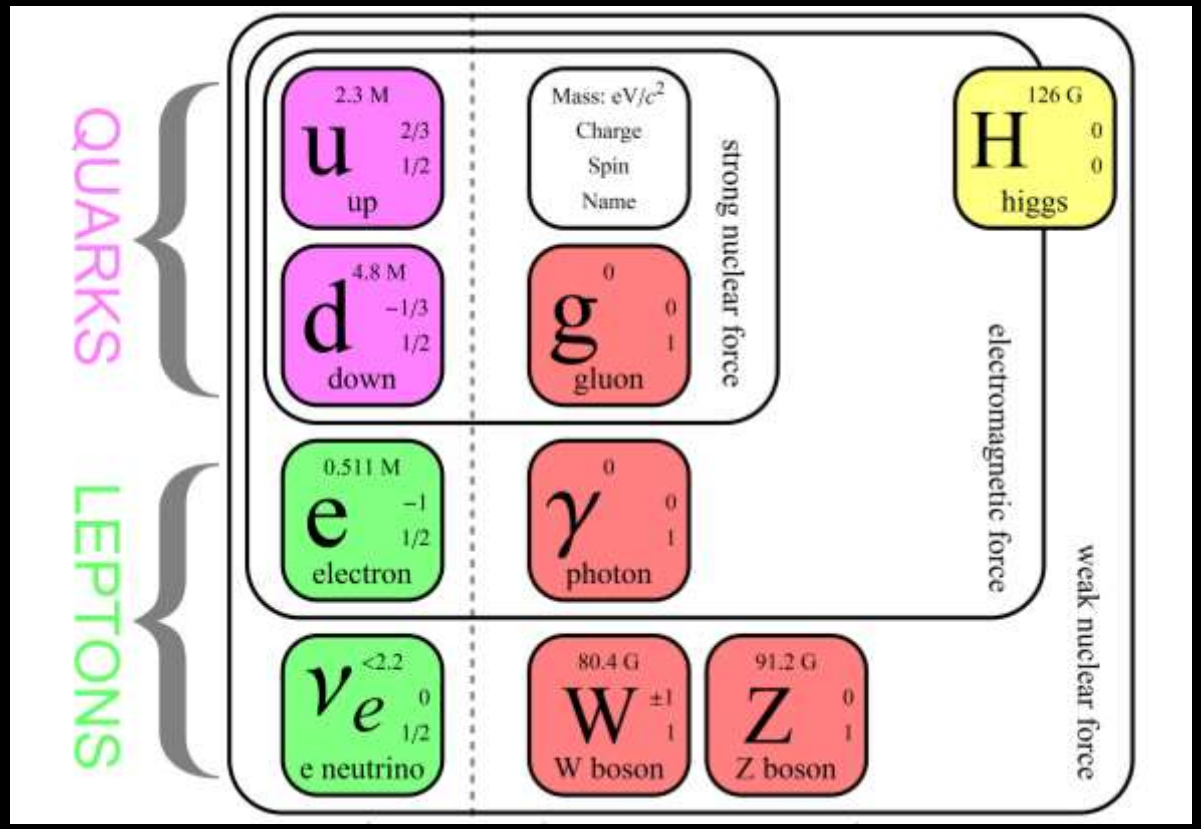
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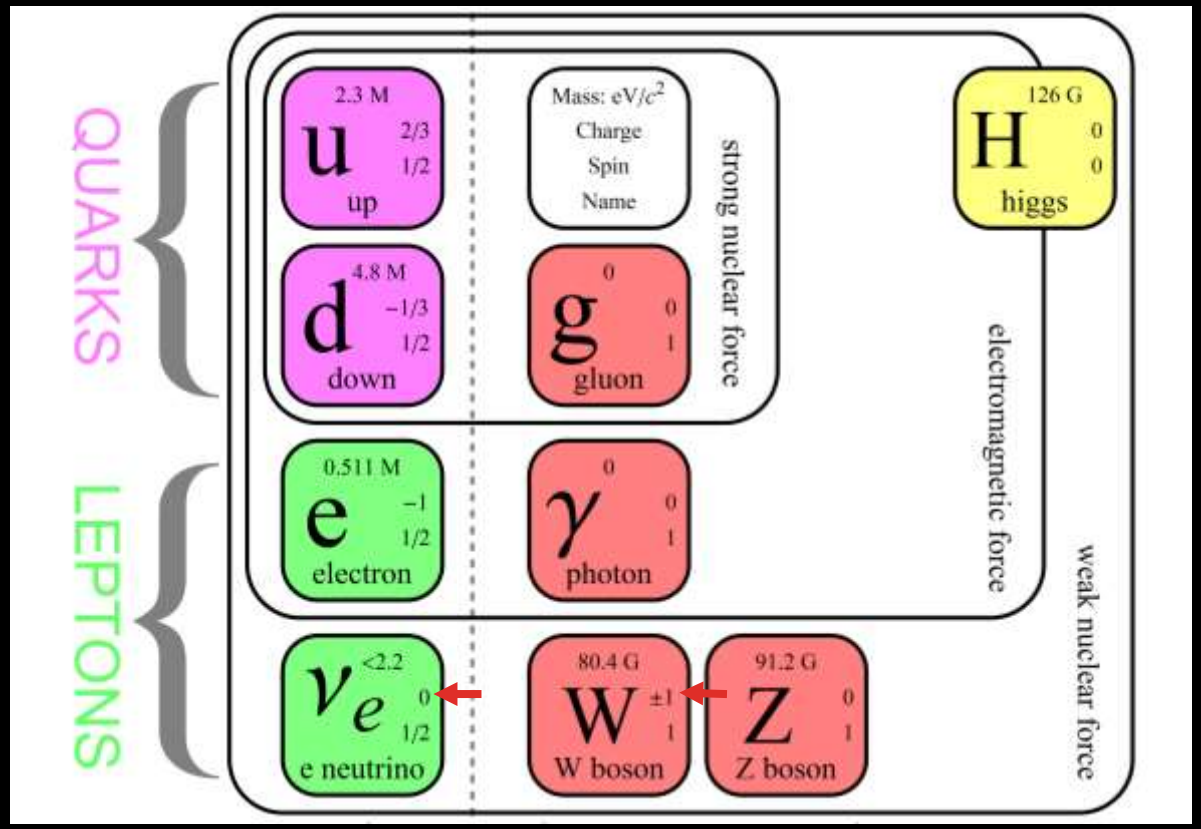
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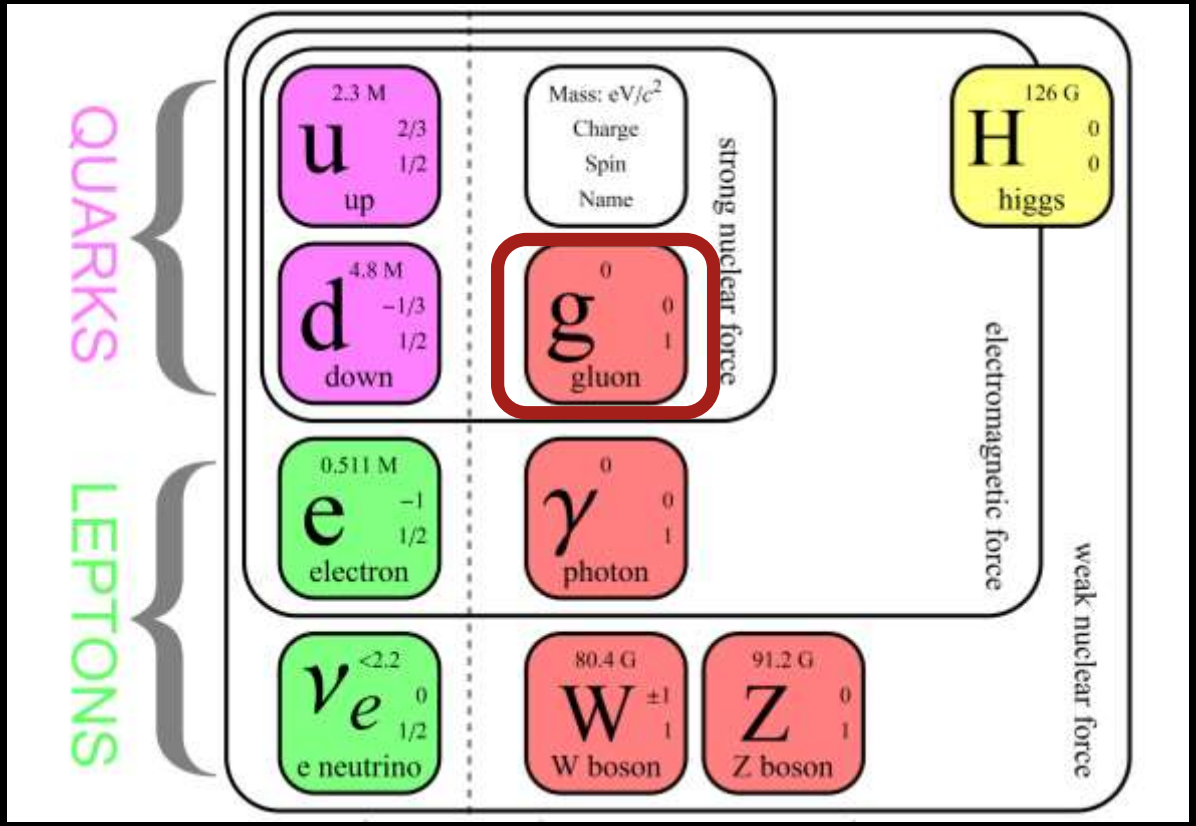
0
1/2
e neutrino
Mass: eV/c^2
Charge
Spin
Name
0
g
0
1
gluon
0
γ
0
1
photon
80.4 G
W
±1
1
W boson
91.2 G
Z
0
1
Z boson
126 G
H
0
0
higgs
strong nuclear force
electromagnetic force
weak nuclear force


QUARKS
LEPTONS
2.3 M
u
2/3
1/2
up
4.8 M
d
−1/3
1/2
down
0.511 M
e
−1
1/2
electron
<2.2
ν_e
0
1/2
e neutrino
Mass: eV/c^2
Charge
Spin
Name
0
g
0
1
gluon
0
γ
0
1
photon
80.4 G
W
±1
1
W boson
91.2 G
Z
0
1
Z boson
126 G
H
0
0
higgs
strong nuclear force
electromagnetic force
weak nuclear force

Light	Matter
No Mass	Mass
Does not occupy space	Occupies space
Created and absorbed	Conservation of matter

Light	Matter
No Mass	~~Mass~~
Does not occupy space	Occupies space
Created and absorbed	Conservation of matter

Light	Matter
No Mass	Mass
Does not occupy space	Occupies space
Created and absorbed	Conservation of matter

Light	Matter
No Mass	Mass
Does not occupy space	Occupies space
Created and absorbed	Conservation of matter

Light Matter

No Mass

Does not occupy space

Created and absorbed

השתלשלות העולמות

In the description of the descending of the worlds by the kabbalists there is no disconnection, rather there are links like links of a chain that connect the chain of creation from up to down

Gottlieb

השתלשלות העולמות

In the description of the descending of the worlds by the kabbalists there is no disconnection, rather there are links like links of a chain that connect the chain of creation from up to down

Gottlieb

The lights hit and strike each other and the vessels are made from the striking of the lights

Ari z"l

נהיָה או נהיֶה?

"It seems to me that the way the blessing is written encapsulates also the present. This is because the Holy One, blessed is He, renews always the acts of creation and creates always and in every moment, that His providence does not pause even for one moment. Therefore we use an expression that encapsulates all tenses…"

Aruch Hashulchan

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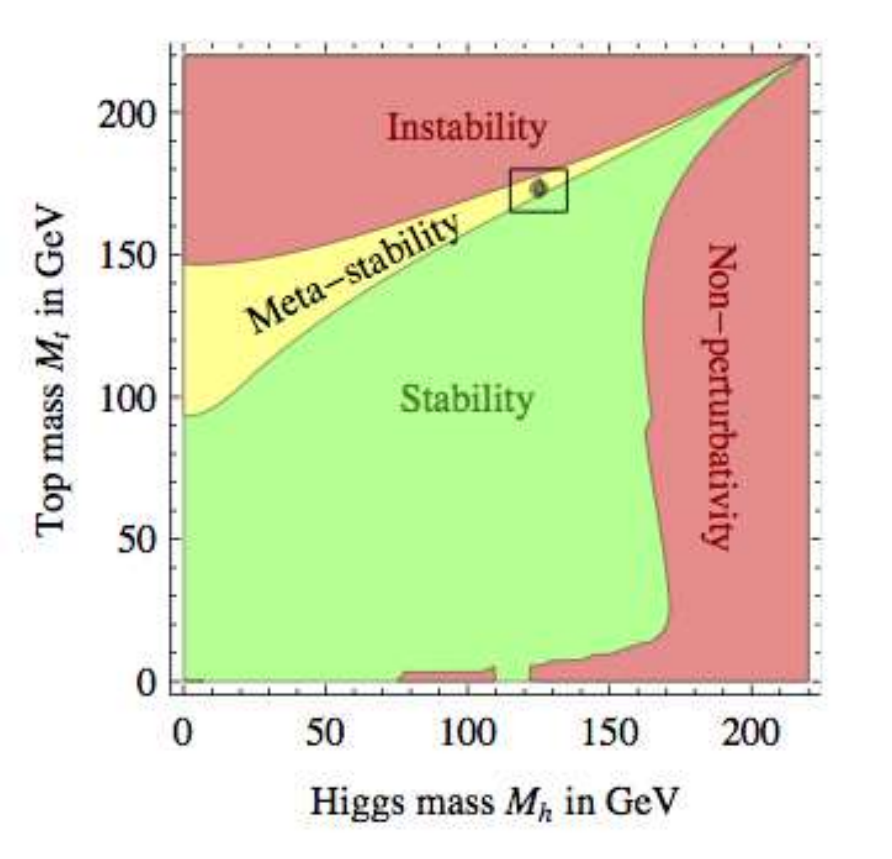
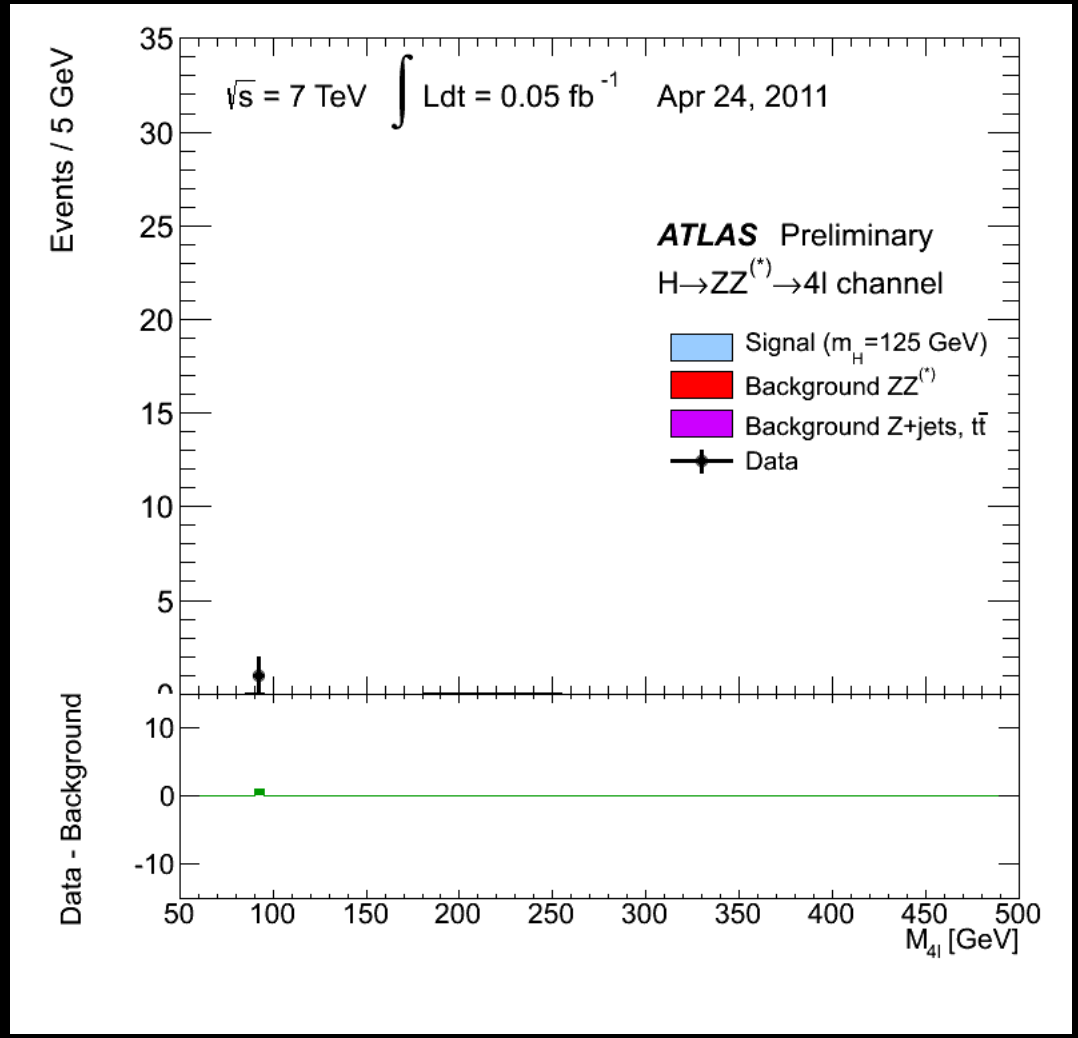
Aruch Hashulchan

Of course they [who use the original vowelization] are correct because this is a blessing for all of existence and **how can one fathom that everything comes to be perpetually in the present** by his word? Behold the entire world was already made in the six days of creation and doesn't receive its existence at present… Therefore, there is no doubt that the correct vowelization is 'came to be' "

Yavetz

Thank You


Instability
Meta−stability
Stability
Non−perturbativity
Top mass M_t in GeV
Higgs mass M_h in GeV
0
50
100
150
200


√s = 7 TeV ∫ Ldt = 0.05 fb⁻¹ Apr 24, 2011
ATLAS Preliminary
H→ZZ(*)→4l channel
Signal (m_H=125 GeV)
Background ZZ(*)
Background Z+jets, tt̄
Data
Events / 5 GeV
Data - Background
M_4l [GeV]