A Simple Visual Model of the Weak Force

Terry Bollinger
2022-08-05.09:45 EDT Fri
https://www.youtube.com/watch?v=esayi49OAk4&lc=Ugzsef5BAiQhvBY1im54AaABAg

Comment on PBS Space Time post:
What If Charge is NOT Fundamental?
https://youtu.be/esayi49OAk4?t=10m46s

10:46 – "Weak isospin is effectively the charge of the weak force, carried by these W bosons." Glashow's 1980 fermion-cube mnemonic helps. Eight "isovectors," all parallel to Maxwell's electric displacement axis, link the corners of the two Glashow cubes to form a hypercube. Point the 8 isovectors up, and you get the positron, ups, anti-downs, and neutrino. Point them down, and you get the anti-neutrino, downs, anti-ups, and electron. Colliding an up and down bridge (e.g., u, e) sometimes flips both (d, nu). That's a W[+,-] exchange. The bridge figure is quite beautiful and an easier way to remember W options.

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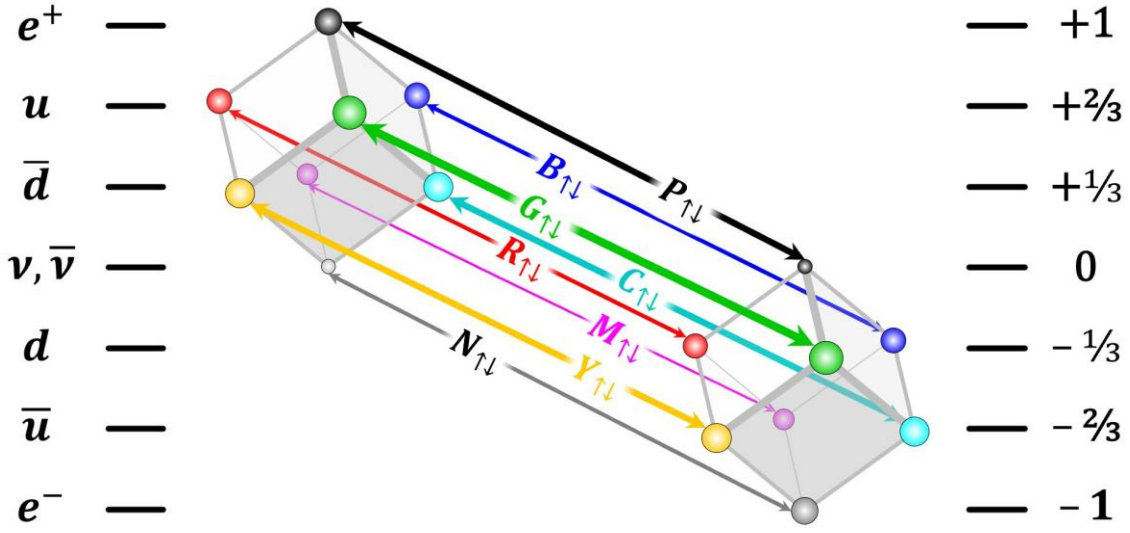
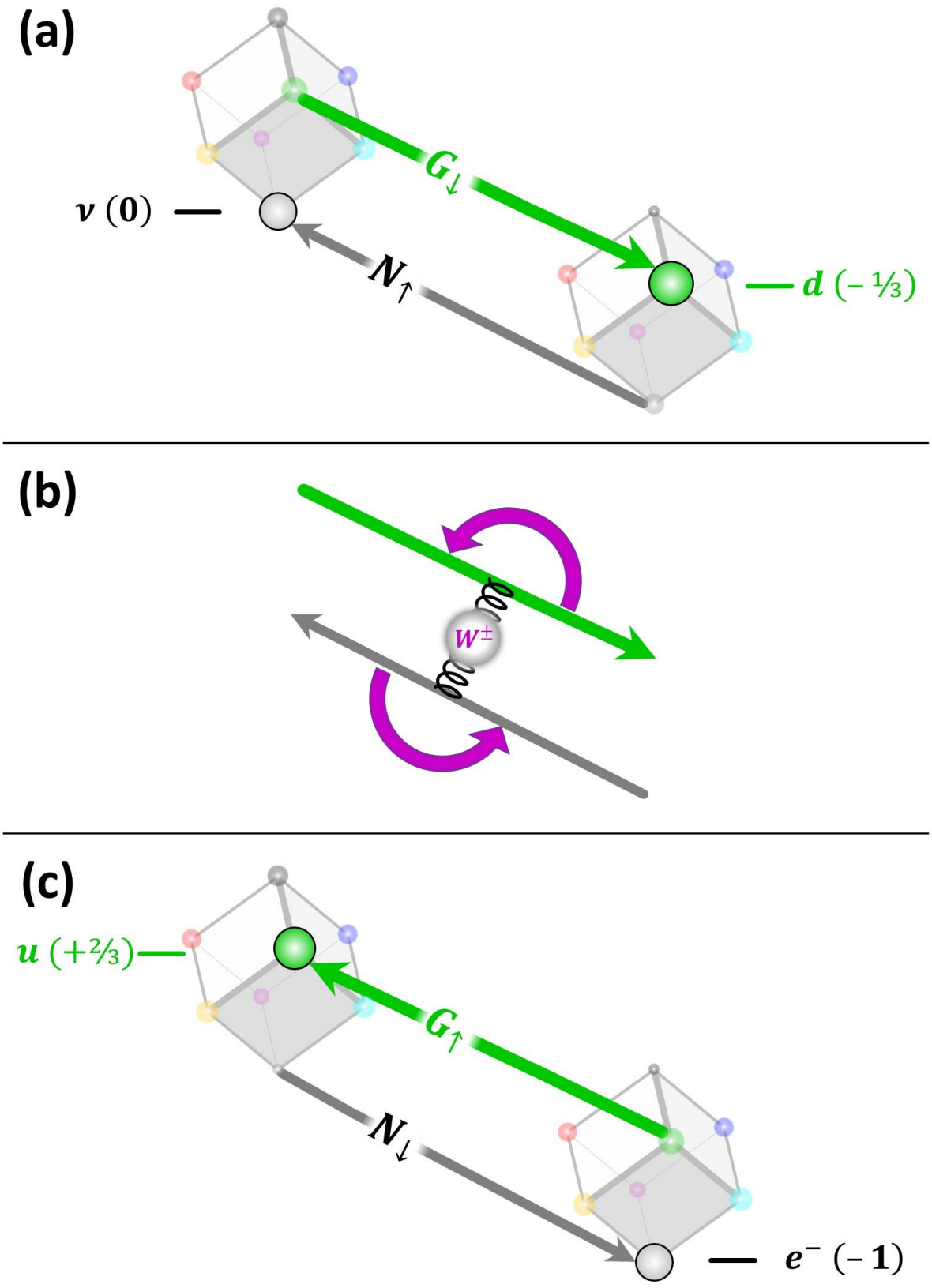
PDF: https://sarxiv.org/apa.2022-08-05.0945.pdf

---------- [Addendum 2022-08-06.00.20 EDT Sat] ----------
The first figure below shows all 8 isospin vectors. The second figure shows the mutual flip interaction in a neutrino-to-down-quark collision. This particular flip is the mechanism whereby a neutron absorbs a neutrino, emits an electron, and converts into a proton.

The isovector vectors fall into two groups: R,G,B,N (matter) and C,M,Y,P (anti-matter). The pronounced names of the matter isovectors are red, green, blue, and negative, and the names of the anti-matter isovectors are cyan, magenta, yellow, and positive. Only the up or down states are stable, so each letter needs an up-or-down subscript such as $R_{\uparrow}$ or Ru for the red up quark and $P_{\downarrow}$ or Pd is the anti-neutrino. The neutrino, amusingly and accidentally, ends up with the nicely mnemonic name Nu.




(a)
ν (0)
$G_{\downarrow}$
$N_{\uparrow}$
d (−⅓)
(b)
$W^{\pm}$
(c)
u (+⅔)
$G_{\uparrow}$
$N_{\downarrow}$
e^{-} (−1)