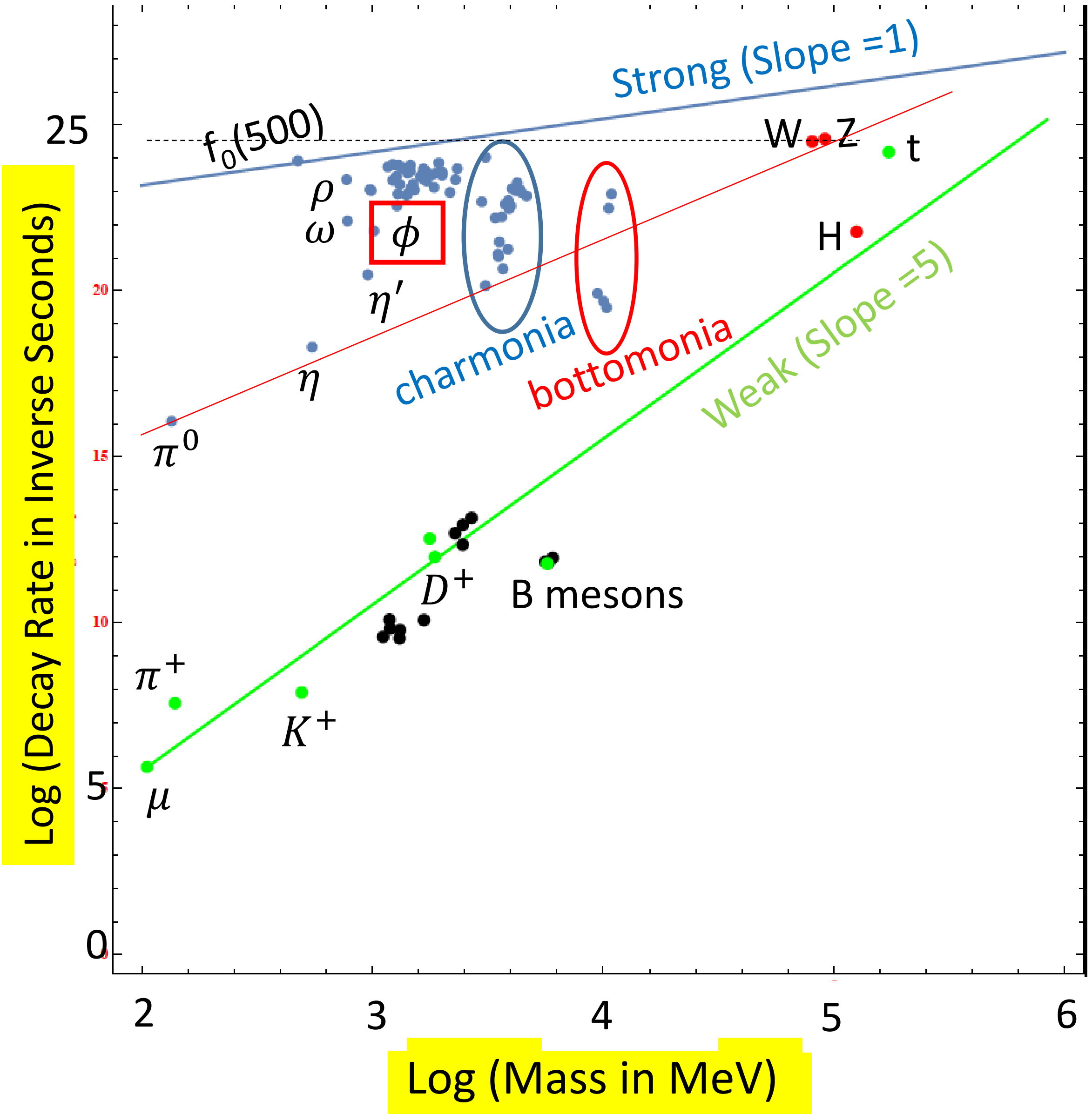
Revisiting Dyons in Particle Physics

To emphasize the fundamental dyad of charges, electric and magnetic, I called such particles "dyons." On this view, fractional electric charge cannot exist without an accompanying large value of magnetic charge. Energetic particles of this type will ionize very strongly, until they have been slowed to a small fraction of the speed of light. I wish to draw attention to this theoretically sound possibility…

In the Han–Nambu scheme the quarks have integer charges and it is only the average over the three colors that is fractional, for example the up quark has f = 0,1,1 so that the average over the three colors is 2/3. Thus if the Han–Nambu assignment was accepted there would be no known particles with fractional charge.

Total Decay Rates Versus Particle Mass



Blue Dots = Light unflavored mesons, $c\bar{c}$ states, $+b\bar{b}$ states from the Meson summary in PDG-2014

Blue Line = Locus of states where decay width = mass

Green dots = weakly decaying mesons

Green Line = Muon Decay Rate Formula

Black Dots = Charm and Bottom Baryons

Red Line = Electromagnetic Slope = 3

Dashed Line = Γ of $Z_0 = 2.50$ GeV $= 4\ x\ 1024$/sec

KLOE2 phi → K-K+ + 120 MeV/c

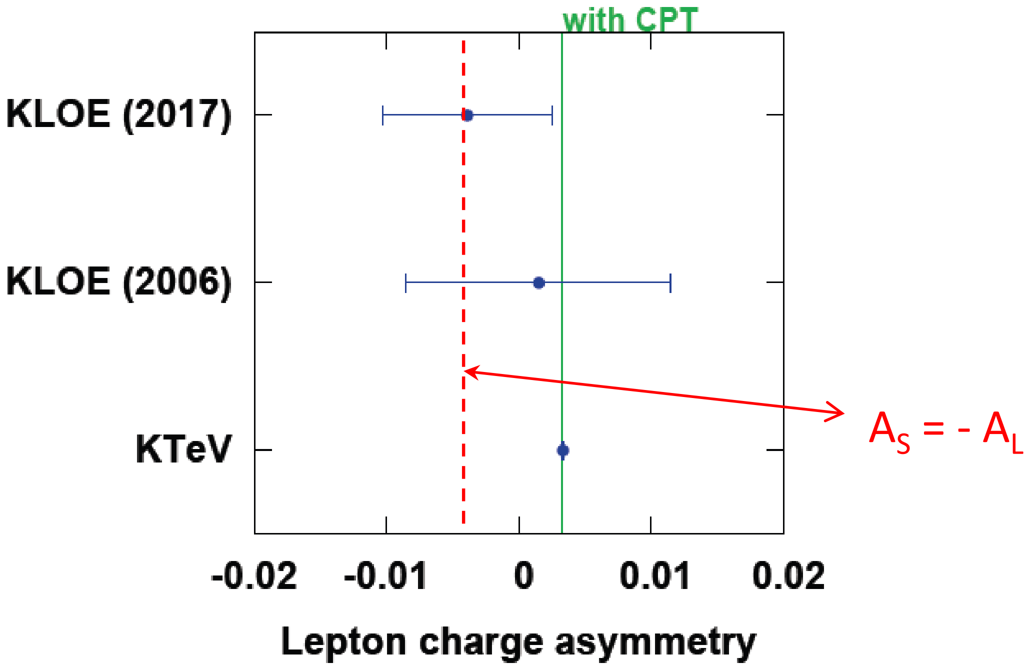
K_S semileptonic charge asymmetry

K_S and K_L semileptonic charge asymmetry

$$A_{S,L} = \frac{\Gamma\left(K_{S,L} \to \pi^- e^+ \nu\right) - \Gamma\left(K_{S,L} \to \pi^+ e^- \overline{\nu}\right)}{\Gamma\left(K_{S,L} \to \pi^- e^+ \nu\right) + \Gamma\left(K_{S,L} \to \pi^+ e^- \overline{\nu}\right)}$$

$A_{S,L} \neq 0$ signals CP violation

$A_S \neq A_L$ signals CPT violation



CP INVARIANCE AND THE 2π DECAY MODE OF THE K_2^0 *

J. BERNSTEIN **, N. CABIBBO and T. D. LEE ***
CERN, Geneva, Switzerland

Received 20 August 1964

In this note we postulate that there is a new long range, extremely weak, field which can be neglected so long as one does not measure energies as small as those measured in the experiment of Christensen et al. This field, we assume, produces a potential energy which is equal in magnitude and opposite in sign for K^0 and $\bar{K}^0$, say $\frac{1}{2}V$ for K^0 but $-\frac{1}{2}V$ for $\bar{K}^0$. This new interaction is CP conserving and if we could maintain a given K^0 and $\bar{K}^0$ system, but transform the environment into its CP conjugate state, then this potential energy would reverse sign †.

Unfavored Solution – is it really ruled out?

Cronin eloquently expressed the case for the favored solution, "At present our experimental understanding of CP violation can be summarized by the statement of a single number. If we state that the mass matrix which couples K and $\overline{K}$ has an imaginary off-diagonal term given by ImM_{12} = - 1.16 x 10^{-8} eV."

The equivalent statement for the unfavored solution is that the decay for the $\overline{K^0}$ exceeds that of the K^0 by an amount

$$(\Gamma_{22} - \Gamma_{11}) = (4/\hbar)(1.16 \times 10^{-8}\mathrm{eV}) = 7.0 \times 10^{7}\mathrm{s}^{-1} = (1/160)\Gamma_S$$