NONSTANDARD PHYSICAL MECHANISM FOR QUARK MASSES AND QUARK *CP* PROPERTIES

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Many-phenomenologically observed properties of standard physics may be naturally explained if, instead of the usual Yukawa coupling, a new neutral vector interaction is employed to distinguish quark generations. In this case the radiative hypothesis of the quark mass hierarchy results in: (a) an automatically arising hierarchy of weak mixing matrix elements; (b) a fine structure of this matrix, that is the difference of hierarchy steps between elements; (c) correct orders for Im/Re ratios in mixing matrix elements, i.e. the physical determination of the CP violation scale; (d) the probable absence of the strong CP violation ("θ-problem") in the scheme.

The Im/Re ratios in the matrix elements of V_{mix} are evaluated analytically. The following simple formulas can be obtained

$$\left|\frac{\mathrm{Im}\, V_{cd}}{\mathrm{Re}\, V_{cd}}\right| \lesssim \frac{1}{2}\left|\frac{m_d}{m_b} - \frac{m_u}{m_c}\right| \simeq 1 \times 10^{-3};$$

$$\left|\frac{\mathrm{Im}\, V_{ts}}{\mathrm{Re}\, V_{ts}}\right| \lesssim \frac{1}{2}\left|\frac{m_d}{m_s} - \frac{m_u}{m_c}\right| \simeq 2.5 \times 10^{-2}.$$

m_f are quark masses. The figures closely approach experimentally acceptable of CP parameters in the observed Cabibbo–Kobayashi–Maskawa matrix:

$$\left|\frac{\mathrm{Im}\ V_{cd}}{\mathrm{Re}\ V_{cd}}\right| \simeq (0,2-2)\cdot 10^{-3}; \qquad \left|\frac{\mathrm{Im} V_{ts}}{\mathrm{Re} V_{ts}}\right| \simeq (0.3-5)\cdot 10^{-2}.$$

These formulas estimate the maximal level of the CP violation which is possible in the considered scheme.

A scenario is suggested to allow the new interaction to dynamically develop required properties. The 4th heavy ($m_Q \gtrsim 1$ TeV) quark generation is considered to be phenomenologically useful.

REFERENCES

1. *Dyatlov I.T.* Phys.Rev., 1993. V.D48. P.5305.