u,d - quarks and Mandelbrot set features

(F.J. Culetto and W. Culetto, Private Research-Associates, Int. Report, dated: Sept. 2015)

Recent quark masses results from lattice QCD calculations (N. Carrasco et al., arXiv:1403.4504v3 [hep-lat] (preprint 2014) have been motivating us in looking for a maybe connection between the u,d-quark mass ratio and special combinatorial features of the Mandelbrot set.

Pursuing our old idea of a maybe robust link between external angles belonging to roots c_k (of the periodic region) of M-set's real c-axis slice and the *relative electric charge* of quantum particles, and a further maybe link between the external angle accessory of special c values from the c axis' chaotic region and *relative mass*, we came across the following empirical relations:

$$\frac{m_u}{m_d} \approx \frac{(2 - \xi_0 - \xi_1)(\xi_0 + \xi_1)}{2} \quad , \quad \xi_0 = 5/12 \text{ and } \xi_1 = 1/3 \, , \qquad \text{Eq.(1)}$$

where the *u,d - quark mass ratio* is expressed by the (upper) external angles ξ_0 of the Misiurewicz point $m_1 = (5/12, 7/12)$ (in G. Pastor et al.'s, preprint 2004 formulation, m_1 separating the period-2^0 and period-2^1 chaotic bands B_0 and B_1) and $\xi_1 = 1/3$ of the first bifurcation of M's main period doubling cascade most likely linked to quarks via duality arguments and is 0.46875 versus N. Carrasco et al.'s m_u/m_d *value* of 0.470(56).

$$\frac{M_P}{2m_i} \approx \frac{(2 - \xi_{0i} - \xi_{1i})^{\,\mathrm{sign}(1/2 - \xi i)}}{\pi^2 2^{\,\mathrm{sign}(1/2 - \xi i)/2 - 1/2}} \exp(\gamma^{1/2} e^{\pi/2+1/2} \pi^{e/2+1/2}) \quad , \quad \text{index } i = d, u \, , \qquad \text{Eq.(2)}$$

the latter Planck mass – quark pair mass ratio approximation, γ being the Euler-Mascheroni constant and ξ_i standing for both upper or both lower external angles, is somewhat similar to the M_P/electron pair mass ratio (see file sciencephilosophy.pdf of our culetto.at website).

For the set $(\xi_{0d}, \xi_{1d}) = (5/12, 1/3)$ the mass ratio result from Eq.(2) is $1.21\underline{4}13\ldots \times 10^{21}$ compared with $1.21362\ldots \times 10^{21}$ gotten using the CODATA 2010 /NIST Planck mass energy equivalent and the LQCD down quark mass value. And for the set $(\xi_{0u}, \xi_{1u}) = (7/12, 2/3)$ the mass ratio's value is $2.5\underline{9}016\ldots \times 10^{21}$ versus $2.58666\ldots \times 10^{21}$ in case of the LQCD up quark mass result. The approximations' accuracy probably still is much less than for our $M_P/2m_e$'s one, but there likely also is going to be room for improvement within the lattice QCD calculations too.

A treatment of the 2nd and 3rd particle family's quark masses along some route resembling that in case of the corresponding charged leptons (see our sciencephilosophy2.pdf too) didn't work in the pursued, comparably simple procedure. More precise results, from ab initio - calculations as well as from precision measurements, may be helpful in checking whether Mandelbrot set features could play any role in the quark mass spectral context.