Short note on a proton-electron mass ratio approximation

F.J. Culetto and W. Culetto*)
Private Research Associates, Stallhofen 59-60, A-9821 Obervellach, Austria
*Electronic address: werner.culetto@inode.at
(Dated: August 18, 2008)

Abstract
Within our heuristic and tentative work tracing the possible role of fractal geometry (in a more general sense) in scaling electrodynamics' fundamentals, an expression was met which, if not purely accidental, might possibly add to etiology of the proton - electron rest mass ratio's numerical value, m_p/m_e=1836.15267247(80) (CODATA 2006). Here, definite answers usually are expected in the QCD, GUTs and strings & membrane theory context.

Contents
In the appearance of e↔π dual terms context (e.g. $\gamma e^{\pi+1}\pi^{e+1}$ in a fine-structure constant α(0) approximation or $\exp(\gamma^{1/2}e^{\pi/2+1/2}\pi^{e/2+1/2})$ within a Planck mass - electron mass ratio fit formula, γ being the Euler-Mascheroni constant) together with quantities characteristic of nonlinear, low-D complex dynamics, an approximation to the m_p/m_e ratio (to 6.4ppm) was found which reads

$$\frac{m_p}{m_e} \approx \frac{P\ln(\delta_{2D})}{|c_D|\ln(\delta)}\, e^{\pi+1}\pi^{e+1}\,, \qquad \text{Eq.(1)}$$

where P is the Thue-Morse constant, c_D the Myrberg-Feigenbaum point's coordinate, δ Feigenbaum's universal number and δ_{2D} Feigenbaum's constant for an area-preserving 2-dimensional map as given by Tabor (Chaos and Integrability in Nonlinear Dynamics: An Introduction, 225, Wiley, New York, 1989). The $-\ln(\delta_{2D})/(c_D\ln(\delta))$ factor already was part of our Planck mass - electron mass ratio approximation (see Culetto & Culetto 2006, http://culetto.at/private_research_associates/sciencephilosophy.pdf). Interestingly, Eq.(1) grants substantial enhancement of fit precision when stopping the period doubling (of the main sequence on the Mandelbrot set's real c-axis) at the 4th bifurcation instead of going to the infinite k-limit of the (upper) external angles $\xi(c_k)$, i.e. P, but keeping the $k\rightarrow\infty$ limit as far as the mentioned factor is concerned. Inserting 106/257, the upper external angle accessory to the 4.bifurcation (n=4, $k=2^n$) instead of P into Eq.(1) yields approximation to the m_p/m_e CODATA 2006 value to 0.12ppm, the fit value got been 1836.152454..). From our working hypothesis, which conjectures period doubling oscillation ↔ particle duality, such behaviour suggested a finite effective quark substructure – at least in acquisition of the *uud* quark composite's rest mass – containing "quinks" (k=4), each of these made of "teens" (k=8), each of which is finally built from say "polies" (k=16) as relevant bifurcation states. Higher bifurcations still might fine-tune the expected values of observables other than mass, or reflect adjoined hidden variables /alternatively simply be there for whatever evolutionary reason. The problem treated could be a subtle one too, thus also require the consideration of finite k convergents to c_D, δ and δ_{2D}, in addition to those to P (= $\xi_u(c_D)$). With the simple approximation used in case of the proton, in the *udd* quark composite's rest mass context a $\xi(c) \approx 0.413023$ reproduced the m_n/m_e ratio, ξ possibly accessory to bifurcations approaching c_D from the left (i.e. $\xi(c_{k'}) \geq P=0.412454\ldots$, but the good-fit angle

not attributable to a specific binary bifurcation n' of the series from Großmann-Thomae's band merging point toward the Myrberg-Feigenbaum point).

A quite accurate Planck mass - proton mass ratio approximation can be given (always keeping in mind that period doubling oscillation ↔ particle duality should possibly catch the main features of highly nonlinear systems in 1-2D but not all of the details, just like a harmonic oscillator model performs in the linearized case), combining Eq.(1) of this note and Eq.(2) of the sciencephilosophy.pdf file cited:

$$\frac{M_P}{m_p} \approx \frac{1}{\sqrt{\pi P^3/8}} \exp\left(\gamma^{1/2} e^{\pi/2+1/2} \pi^{e/2+1/2} - (\pi+1+(e+1)\ln(\pi)) \right) , \qquad \text{Eq.(2)}$$

where the $M_P/2m_e$ ratio approximation formula (Eq.(2) of file sciencephilosophy.pdf) was rewritten to yield $2(M_P/(2m_e)).(m_e/m_p)$, and the M_P/m_p ratio calculated from the CODATA 2006 Planck mass and proton rest mass values is reproduced to within 4.3ppm. Infinite k limit bifurcation root and -root distance ratio bearing quantities reduce in Eq.(2). Although the (meta)stable *uud* quark composite's mass spectral level nominally should not be this especially fundamental, aggregate's period 2^0-oscillation nature (this accessory to integer charged states) requiring exact collection of all contributions to electric charge and mass-energy content from fractional fluxes $\Phi_{2n}(n\geq1)$ and their generating collective phenomena in order to end up with the long-range /infinite distance properties of electromagnetism as observed likely made it something special after all. Our efforts been restricted to *binary bifurcations* of Mandelbrot set's main series, the physical significance of such belonging to other of M's series, let alone the role of tri- and higher order furcations is an open task.

Conclusion

If there is something in Eq.(1), low-D nonlinear complex dynamics likely co-tuned the rest mass spectrum accessory to bonded states belonging to the strong interaction (and even stronger forces too). This perspective raises our (modest) confidence in results got in the electrodynamics' fundamentals' context, and it necessarily had to occur from a unification of forces' point of view.