

Experimental evidence for an α -dependence in the lifetimes and masses of the pseudoscalar mesons

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The nonet of pseudoscalar (PS) mesons are the lowest-mass, and hence in some sense the most "fundamental", hadronic elementary particles. When the lifetimes of the non-strange π^\pm , π^0 , η , η' PS mesons are plotted together on a logarithmic scale, they are seen to exhibit an accurate scaling in powers of the fine structure constant $\alpha = e^2/\hbar c$. This scaling extends over 6 powers of α , or more than 12 orders of magnitude. When the lifetimes of the strange K^\pm , K_S^0 , K_L^0 PS mesons are added in, they fit this same lifetime scaling, but with an accurate factor-of-2 hyperfine structure superimposed. Quantum mechanically, time and energy are conjugate variables, so it is relevant to examine the PS mass values for evidence of a reciprocal $\alpha^{-1} \cong 137$ dependence. A plot of the π^\pm , π^0 , η , η' mass values on a 137 MeV/c² mass grid shows a clear-cut mass quantization at an accuracy level of 1 per cent. The reason the 137 MeV/c² mass grid works out so fortuitously can be attributed to the fact that an electron-positron pair, which plays the role of "ground state" for an α^{-1} scaling of the PS masses, has a mass of almost unity in these units. These conjugate α -dependences, which are clearly in evidence in the PS mesons, actually span the whole hadronic spectrum. In particular, the lifetime α -scaling extends across the regions of the weak and electromagnetic decays. The presence of the QED coupling constant α in these domains suggests that the short-ranged hadronic forces associated with fractionally charged quarks may have an electromagnetic origin.

- [1] M. H. Mac Gregor, "Electron Generation of Leptons and Hadrons with Conjugate α -Quantized Lifetimes and Masses", International Journal of Modern Physics A, Vol. 20, No. 4, 719-798 (2005); Addendum Vol. 20, No. 13, 2893-2894 (2005).
- [2] M. H. Mac Gregor, "The Power of α : Electron Elementary Particle Generation with α -Quantized Lifetimes and Masses", World Scientific (in press).

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