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WHAT ARE QUARKS?

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ABSTRACT:*IN THIS NOTE WE INVOKE THE HESSIAN POLYHEDRON WITH 3 REAL AND IMAGINARY AXES THAT YIELD THE 27 APICES OF THE GRAPH OF E6 SHOWN IN FIG.1. IN PARTICULAR WE WILL IDENTIFY THE QUARKS AS BELONGING TO THE COMPLEX SPACE IN THE OUTER RING,WHICH ACCOUNTS FOR THEIR TINY MASSES THAT CAN ONLY BE ESTIMATED.*
Keywords:*E6 Theta Functions, Quarks, Hessian Polyhedron, EquiharmonicLattice*

I. Introduction

The 27 apices of the graphof E6 were originally suggested by Slansky [6] for quarks and leptonsillustrated by the torus of Fig.1with the quarks confined to the outer ring and the leptons housed on the inner ring.However recently [3] it has become possible to verify this figure by analysis of the relative Theta Function that is essentially a rotation, in a space with one real coordinate K and one complex coordinateiKIt is defined by the exponential nome q of the ratio iK/Kwhich are quarter periods on the real and imaginary axes particularly if these are equiharmonic or a common multiples of a common frequency f,then [3]

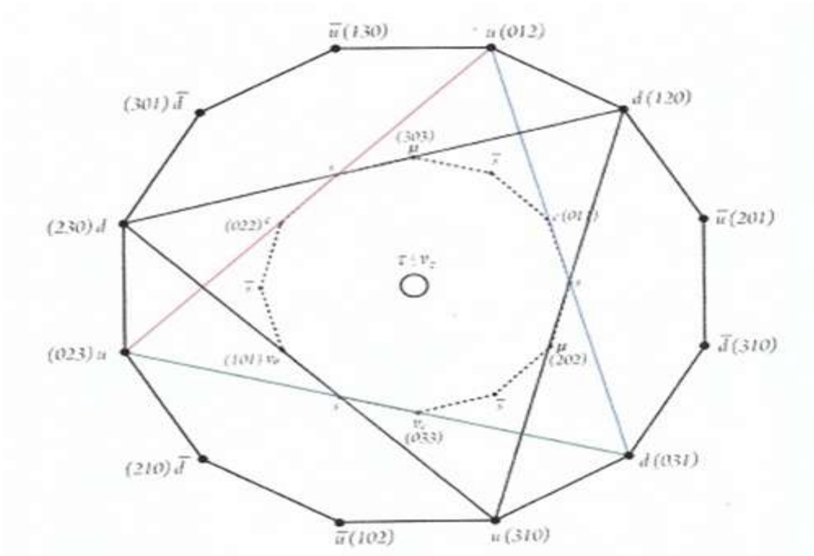
$$q=0.06583=\exp(\pi iK/K) \text{ or } iK/K=\sqrt{\tfrac{3}{2}}=\sin 120 \text{ or } \sin 60 \qquad (1)$$

which is precisely the angle in Fig.1 of the tritangent that defines quarks and anti-quarks in an equiharmonic lattice ([5] Ch.4). I this way the E6 lattice defines a coupling constant uniting up and down quarks and the fundamental constant f could be electromagnetic occupying all of space [3].

Having demonstrated the validity of E6 for modelling elementary particle physics,we can now study the quarks in more detail in the other 2 complex coordinates j,k.

2. Possible Quarks

We now propose to identify the 6 quarks with the axes of i,j,k of E6 (labelled by red, green and blue in QCD) that belong to the outer ring of Fig.1.



Actually this Figure is a cubic surface according to Hunt ([5], Ch.4). It is also a Hessian polyhedron with 3 complex coordinates i,j,k (Coxeter [2],Section 12.3,Fig.12.3 A) originally found by the same Author in 1940 [1] so we propose that the quarks and anti-quarks belong to this complex plane which accounts for their tiny masses that are only estimated.When E6 is blown down to 3 real axes x,y,z we encounter the massive baryons ,protons and neutrons described in [4]. Leptons are not composed of quarks and so all appear on the inner ring of Fig.1 Also the Big Bang took place in $(CP)^3$ where quarks existed in imaginary space which was blown down to $P^3$with cosmic inflation leading to nucleons.

Conclusion

There are 15 Synthemes, or sets of 3 commuting Dirac matrices γ_ν . Three namely

{E_{23} ,E_{14},E_{05} }, { E_{13},E_{24},E_{05} } and{ E_{12}, E_{12},E_{05} },(where $\gamma_\nu = E_{0\nu}$, $\nu = 1,\cdots,5$) describe nucleons with spin E_{23},parity E_{14} and charge E_{05} [4], and each member is the product of the other two. While another set{ E_{14},E_{25},E_{05} }, { E_{24},E_{35}, E_{01} } ,{ E_{34},E_{15},E_{02} } have spin rotations on the imaginary axes in 4-, 5-, and 6- space ,but have no charge and could represent Dark Matter.

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