Quantum-Interference Phenomena in the Femtometer Scale of Baryons. Inclusion of all Baryon Octet and Decuplet Particles

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Abstract

Evidence for quantum interference due to internal currents is presented for all baryons of the octet and decuplet, through the joint analysis of their rest energy and magnetic moments data. This work supplements the paper vixra: 1706.0040, and corrects the approximate equation used to fit data in a Figure in that paper(and in vixra:1706.0287). The fully correct expression, plotted here in a new Figure, clearly displays instability and the tendency of the number of flux quanta *n* to "reach for" integer values whenever the magnetic moment of a particle (in nuclear magneton units) becomes an integer number. The overall conclusion of this set of papers in vixra is that mass is essentially determined by kinetic(and magnetic) energies associated with angular momentum. The fine details, however, depend upon the magnetic moments (consistent with SU(3) symmetry), their self-magnetic fields, and the resulting currents whose intereference will determine the correct energies that consitute the so-called rest masses.

This new short letter supplements the data analysis in vixra: 1706.0040. In that paper we argued that a number of flux quanta *n* might be directly defined from the product of the observed rest mass times the magnetic moment of each baryon. The plot of such number against the magnetic moment can make evident the interference effects between currents in the nuclear scale. Baryons contain constituents widely regarded as moving in asymptotic freedom inside something comparable to a bag. We take this concept to the limit and show that the motion of such charged constituents is subject to quantum interference similar to that observed in Josephson Junctions between superconductors. With such a picture it is possible to simultaneously fit with a single expression the masses of all baryons to their respective magnetic moments.

For details of the theory the reader should consult vixra: 1706.0040. Figure 1 displays all data for the baryon octet and decuplet particles, fitted by a single theoretical curve. The decuplet masses(open triangles) (note: masses are part of the definition of the number of flux quanta *n*)in this plot are divided by 1.2 since this 20% difference- related to the difference in angular momenta - accounts for the displacement of the averaged values of the rest energies of the decuplet in comparison to those for the octet particles(solid triangles), so that the same diagonal (base)line applies to both families of baryons. Considering the same diagonal baseline, a single curve fits all data, which shows the common origin of the undulations for all particles. There is also a clear tendency of several particles towards adopting integer (3 !!) values of *n*, which displays the dominance of coherent currents inside some baryons, as compared to phase-displaced incoherent currents involving several charged constituents in other baryons.

The overall conclusion of this set of papers in vixra is that mass is essentially determined by kinetic and magnetic energies associated with angular momentum. The fine details treated in this paper, however, depend upon the magnetic moments (consistent with the SU(3) group representations applicable to each particle), their self-magnetic fields, and the resulting currents whose interference will depend on *n* and will determine the correct energies that consitute the so-called rest masses. Previous articles by the author in vixra should be consulted for details. A forthcoming publication in the *Annales de la Fondation Louis de Broglie* is due to appear later this year.

Figure 1:

The vertical scale *n* in this plot is the product of the rest energy of baryons multiplied times the respective moments. The undulations can therefore be interpreted in the same way as in the theory of shunted Josephson Junctions. For such Junctions the undulations are related to a potential energy variation associated to changes of phase across Junctions, i.e., coherence-breaking regions across the current motion. The variations of mass across the whole baryons families are thus related to the internal effects of interference of currents across charged constituents boundaries. The diagonal line is a common baseline for all particles. In Barut´s interpretation, such diagonal line corresponds to the proton mass, and is a consequence of the proton being a common constituent of all baryons. The **solid arrows** indicate jumps in *n* at integer values of μ. (In previous papers such jumps did not appear in view of the approximation made of replacing μ for *n* in the sinusoidal term in the theoretical formula for *n*, which is not adopted in the present analysis).

Open triangles: decuplet part.

Solid triangles: octet part.