Quantum Gravity and Its GUT Extension Explaining Neutrino Parities, the Particle Spectrum and the Detailed Slopes of Resonances

C. Birkholz

presented at the joint DPG Spring Conf. on Gravitation, the Mathematics of Physics, and the Philosophy of Physics, Berlin/Germany, MP 5.1 (2015) [1],
Covering text (filed under www.q-grav.com) to a powerpoint presentation

Abstract:

Parity is a function of generators of a U(2,2), the covering group of fully quantized General Relativity in bent space-time.

A review of the hydrogen atom demonstrates how a non-valence part is generated by orbital excitations carrying parity. Asymptotically, for great accelerations, the non-valence term will converge to a 50:50 mixture of both parities – thus explaining the "maximal parity violation" by neutrinos.

The "standard" model denies the existence of a non-valence part. Hence, it defines parity exclusively by valence parts. As, by irreducibility, both parts are inseparable, the SM is inconsistent.

Its ban on hadrons to consist of more than 3 quarks is giving rise to additional inconsistencies preventing us from understanding the existence of 1) nuclei, 2) hadronic flavours.

In the GUT, there are exactly 64 stable states. They are expected to explain the entire particle spectrum of all resonances and nuclei by Clebsch-Gordon technique.

For more information on QG and GUT see www.q-grav.com .

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It is well known, meanwhile [2] [3] [4] [5] that, by the actual state of the experimental art, our world has to be represented in 8^2 dimensions. Its first factor 8 describes **Quantum Gravity** (QG), the other one the **"internal" interactions**, both together the **Grand Unification** (GUT). **Finite representations** have to be applied [7]. By Dirac's split of QG according to 2 spinors ψ and ψ^+ we obtain some SU(2,2) subgroup which is the covering group of fully **quantized General Relativity** on Einstein's fully quantized, background-independent bent space-time:

$$\mathbf{U(32,32) \supset U(4,4)_1 \oplus \ldots \oplus U(4,4)_8 \supset U(4,4)_{QG} \supset SU(2,2)_{GR}}\,.$$

The yellow split [3] [6] [8] into 8 chiral groups $U(4,4)_a$ is representing the 3 labels j,k,l of its $8=2^3$ basic spinors

$$\mathbf{a}_{i211}^{+}\ \mathbf{a}_{i111}^{+}\quad \mathbf{a}_{i222}^{+}\ \mathbf{a}_{i122}^{+}\quad \mathbf{a}_{i212}^{+}\ \mathbf{a}_{i112}^{+}\quad \mathbf{a}_{i221}^{+}\ \mathbf{a}_{i121}^{+}$$

where i denotes spin. *(Its colours do not represent the quantum number "colour" of the "standard" model !)* I had shown [8] that our GUT is automatically giving rise to the experimentally observed **quark confinement**.

In another lecture, last year in Mainz [9], I presented the **lepton system** with its generation pattern (e^-, μ^-, τ^-). Its characteristic, new feature is the existence of a "**lepto-nucleus**"

$$\mathbf{b_{\bullet 112}^{+}\ b_{\bullet 212}^{+}}$$

made of the two *("blue")* leptonic quanta $b_{i'112}^{+}$ and $b_{i''212}^{+}$ [6] [8]. The fat dot refers to spin and the additional 3 labels to electromagnetism, strong, and weak interaction. Leptons, then, revealed as antiparticles, antileptons as particles.

"Triality *(strong)* force" is saturated by adding a third *("green")* quark of type b_{ij22}^{+} giving a **charged lepton** and its related **neutrino**. The detailed quantum numbers can be looked up in the internet under

www.q-grav.com .

But what about **parity**? Parity cannot be represented as a function of generators of the Lorentz group. Hence, the "standard" model had been free to distribute *arbitrary* values to the various chains of fermions which, there, appeared to be uncorrelated to each other. The leptons and the simple-flavoured Σ-resonances, thus, had been assigned arbitrarily to have the same parity as the proton, e.g.

In QG, however, parity Π *can* be represented by its SU(2,2) group generators [3]**:**

$$\Pi = \exp[i\pi(L_{3000} + Q_{3000})]$$

is such an operator. It is assigning the positive parity to all fundamental quanta $a^{\pm}_{ijkl}$ and the negative parity to the $b^{\pm}_{ijkl}$. Hence, the compact group generators are fitted with positive, and the non-compact ones with negative parity. The quantized, non-linear space-time operator [3] [4]

$$X_\mu \equiv Q_\mu / M_0,$$

then, is providing just the correct parities for space and time [3].

This Π, in addition, is assigning the positive parity to the nucleons. For the leptons and for the simple-flavoured hadrons, however, it is inverting the parities which had been *arbitrarily* assigned to them by the "standard" model [3]. We could fit that arbitrary assignment by letting Π depend on the "internal" quantum numbers as well. But this would darken the simple above construction which is demonstrating that lucidly that parity is a pure property of QG only – its GUT extension is not needed. Therefore, I am sticking to the above definition in order to present all argumentation more transparently than it is done by the "standard" model.

Contrary to the **leptonic flavours**, which may be explained [9] as mere reorganizations of the lepto-nucleus among the lepton constituents, a **hadronic flavour** had been identified [10] to replace a simple quant a^{+}_{ijkl} by some 3-quant structure $a^{+}(a^{+}b^{+})$ whose "rucksack" (in parenthesis) does not change its *linear* quantum numbers. This rucksack explains those various types of hadronic flavours. (Hence, there is **no correlation** between **leptonic** and **hadronic flavours** as the "standard" model is pretending.)

This transition from a 1- to a 3-quant structure is giving rise to a parity reversal in QG when proceeding from a nucleon to a Σ-resonance, e.g. In Gell-Mann's times in the 1960's, people had to explain the rapid growth of spin values in the particle tables, while the isospin values, simultaneously, were stagnating at small values. By those first old, simple SU(6) models, however, both values should grow similarly. For an excuse, mathematicians at that time had invented an

orbital excitation $\mathbf{O}^{+}_{i'i''} \equiv \sum_{jkl} \mathbf{a}^{+}_{i'jkl} \mathbf{b}^{+}_{i''jkl}$.

This was a straight-forward development from the hydrogen atom, which, in atomic physics, is treated as some compound consisting of a proton and an electron valence. "Excited" states, there, are obtained by successively adding "orbital excitations". In atomic physics, this model is giving rise to all those well-known intermediate results in accord with experiment**:** a "principle quantum number", an orbital angular momentum, and its 3-component – with every excitation factor carrying negative parity.

Those ideas, when applied to subnuclear physics, are able to explain the rapid growth of ordinary spin values in the tables of elementary particles by assigning them to corresponding S-, P-, D-waves, etc.

I copied the simple idea behind**:** If a *separate* particle – like a proton or an electron – each is consisting of a valence part times some *non*-valence part, then a **bound** hydrogen atom should consist of some double valence part connected by some ***common*** **non-valence part**. By adding sufficiently many of the above orbital excitations, the electron, step by step, is enabled to build up some new, additional – i.e., its own – non-valence part. At a certain level, then, that electron, finally, will brake off from its proton**:**

$$(a^+a^+a^+)(b^+b^+b^+) \quad \rightarrow \quad (a^+a^+a^+) \otimes (b^+b^+b^+).$$

This promising development, however, had been stopped abruptly, when the “standard” model began imposing its **think bans:** There should exist

- *no meson states exceeding 2 quarks* and *no baryon states exceeding 3 quarks*

– a **dogma** strikingly contradicting those ideas of orbital excitations and dipping the “standard” model into severe inconsistencies [7] because, among its immediate implications, there are

- *the non-existence of nuclei consisting of more than 1 nucleon, of atoms, molecules, “objects” in general,*
- *and the non-existence of a non-valence part (made of quanta) within a particle.*

This is leading to the absurdity of searching for a “**Theory of Everything**” (ToE) beyond our GUT, which long since is well established.

The parity definition by QG, above, yields some well-defined quantum number Π. And – again in strict contradiction to the case in the "standard" model –

In QG, there are ***no*** **"broken" quantum numbers:**
All quantum numbers are **absolutely conserved !**

Also in "weak" interactions [10].

And a "flavour" is no "quantum number"**:**

A "flavour" is some non-linear property
that simple that it can occur more than once within a particle.
A (linear) **"flavour"** is **counting** those occurrances.

Now, a moving state is generated from a state at rest by applying the Lorentz boost operator

$$\exp\left[i\zeta \mathbf{M}_{3000}\right] .$$

As a non-compact generator, M_3 has negative parity. With increasing parameter ζ , then, the original rest state of some definite parity will proceed more and more towards a state of mixed parities**:**

$([P_0,\Pi] = 0)$ **A moving state is a *mixture* of parities !!!** $([\vec{P},\Pi] \neq 0)$

Asymptotically, the accelerated state will converge towards a state of 50% positive and 50% negative parity. This is what we are facing with the **neutrinos**. Thus, our model is correct, it is reproducing nature !

The **"standard" model** is **ignoring** the fact that particle states have a **non-valence** part.

Parity, there, is treated as a property of the pure valence part. This, however, only is working in the case that the non-valence parts can be factored off the product of valence parts. This might, approximately, work for "strong" and electromagnetic interactions. In general, however,

A complete **particle** is a **superposition** of ***combination*s** of its **non-valence part** with its **valence part !**

And Young adds**:**

By irreducibility, this combination is ***inseparable*** !!

Well, in our 8^2-dimensional GUT we have 64 linearly independent basic quanta. Daily life, however, is playing *inside* the electromagnetic horizon – we *do* observe electric charges! – but *outside* the triality horizon. For particles, the "quark confinement" holds [8]. Hence, we have to identify an

Assembly of **64** absolutely **stable states.**

(64 independent parameters)

All the rest will decay into them – if need be (for nuclei, e.g.) by thermodynamic scattering processes.

Thus, we have to proceed to identify only the spectrum of those 64 *stable* states. We know**:**

16 states of **Dark Matter** [6] [8]**,**
8 states **electron/positron** ($a^{\pm}_i$, $b^{\pm}_i$)**,**
8 states **proton/antiproton,**
(8 states still to be identified of some massive **„exotic" fermion/antifermion** pair),
12 states of **3 neutrinos/antineutrinos,**
4 states of the **photon** (2 values for helicity and energy, each)**,**
4 states of the **graviton,**
4 states of **Pauli's ω(0)** [9]**.**
64 states.

Stability, here, is to be considered asymptotically and *after* all thermodynamic processes *(split of nuclei, e.g.)* having taken place *(i.e., spin directions are considered as independent of each other, and so do the 3 neutrino types)*.

The 1-handedness of the neutrinos, then, is a consistency condition of only 64 states to exist as stable ones. The special choice of those 64 states should be attributed to an external, larger system our universe is embedded in [11]. The method how, then, to calculate scattering amplitudes, the decay modes of non-stable states, and the detailed slopes of all that had already been thoroughly discussed last year [12]**:** Arbitrary coupling constants and form factors are replaced by well-defined Clebsch-Gordon coefficients. And, as the number of quanta is finite,

All **calculations** can be submitted to the **computer.**

It could be a task for mathematicians to design its frame and the most promising strategy.

[1] C. Birkholz, Verhandl. DPG (VI) **50,3**/MP 5.1 (Berlin, 2015).
[2] C. Birkholz, Verhandl. DPG (VI) **46,3**/T 25.1 (Karlsruhe, 2011). This is based on [3].
[3] C. Birkholz, "Weltbild *nach Vereinheitlichung aller Kräfte der Natur* im 3. Jahrtausend", ISBN 978-3-00-030847-5 (2010).
Since 2010, new, additional relations have been uncovered allowing the old discoveries to be founded more stringently.
[4] C. Birkholz, Verhandl. DPG (VI) **47,1**/GR 10.1 (Göttingen, 2012).
[5] C. Birkholz, Verhandl. DPG (VI) **48,1**/GR 20.1 (Jena, 2013),
[6] C. Birkholz, Verhandl. DPG (VI) **48,1**/AGPhil 10.3 (Jena, 2013).
[7] C. Birkholz, Verhandl. DPG (VI) **48,1**/MP 1.3 (Jena, 2013).
[8] C. Birkholz, Verhandl. DPG (VI) **48,2**/T 25.3 (Dresden, 2013).
[9] C. Birkholz, Verhandl. DPG (VI) **49,3**/T 99.5 (Mainz, 2014).
[10] C. Birkholz, Verhandl. DPG (VI) **50,2**/T 97.5 (Wuppertal, 2015).
[11] C. Birkholz, www.q-grav.com, "Die Weltformel, Strategiepapier zur 'Neuen Physik' …" (May, 2013), p. 94/95, 98.
[12] C. Birkholz, Verhandl. DPG (VI) **49,2**/MP 12.2 (Berlin, 2014).

All talks, together with additional information on QG and GUT, are collected in **www.**q-grav.com .