Positron and electron catalysis of neutrino hadronization: How our universe was made: Part III

openaccessgovernment.org/article/positron-and-electron-catalysis-of-neutrino-hadronization-how-our-universe-was-made-part-iii/199113

Emily Warrender October 1, 2025

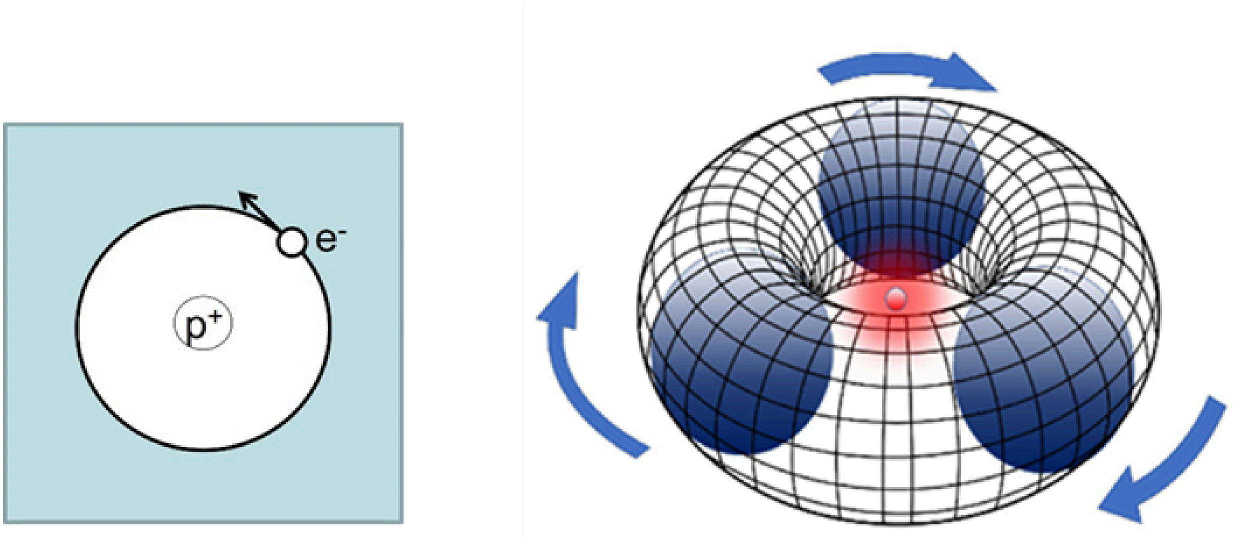

Figure 1: Rotating Lepton Models in Chemistry (Hydrogen atom, left) and in Physics (three gravitationally attracted relativistic neutrinos rotating around a positron and forming the proton, right).

Constantinos G. Vayenas[1], Dionysios Tsousis[1,2] and Eftychia Martino[1] examine positron and electron catalysis of neutrino hadronization, as they continue to explore how our Universe was made

The development of the Bohr model for the H atom (Fig. 1) has played a central role in reaching our current level of understanding of chemical synthesis.

In recent years, the development of the Rotating Lepton Model (RLM) of hadrons and bosons (1-4) provided an equally effective approach for modeling the structure and accurately computing the masses of subatomic particles, such as hadrons and bosons, nuclei and even cosmic rays. (4)

The RLM bears an important similarity with the Bohr model of the H atom, i.e., it comprises one or more rotating leptons on a circular orbit gravitationally attracting themselves and not electrostatically as is the case for the Bohr model. In the case of the RLM the rotating leptons are mostly neutrinos, which have extremely small (~1-5 eV/c^2) rest masses. However, due to their lightness, these rotating neutrinos easily reach highly relativistic speeds, extremely close to the speed of light.

Thus, according to Einstein's Special Relativity, their relativistic and gravitational masses of γm_o and $\gamma^3 m_o$, respectively, increase dramatically and reach values of the order of 10^9 eV/c^2 and 10^{28} eV/c^2, respectively. This implies that the intraparticle gravitational forces reach the Strong Force value of $\hbar c/r^2$ which is 10^{30} times stronger than the normal gravitational attraction at the same distance.

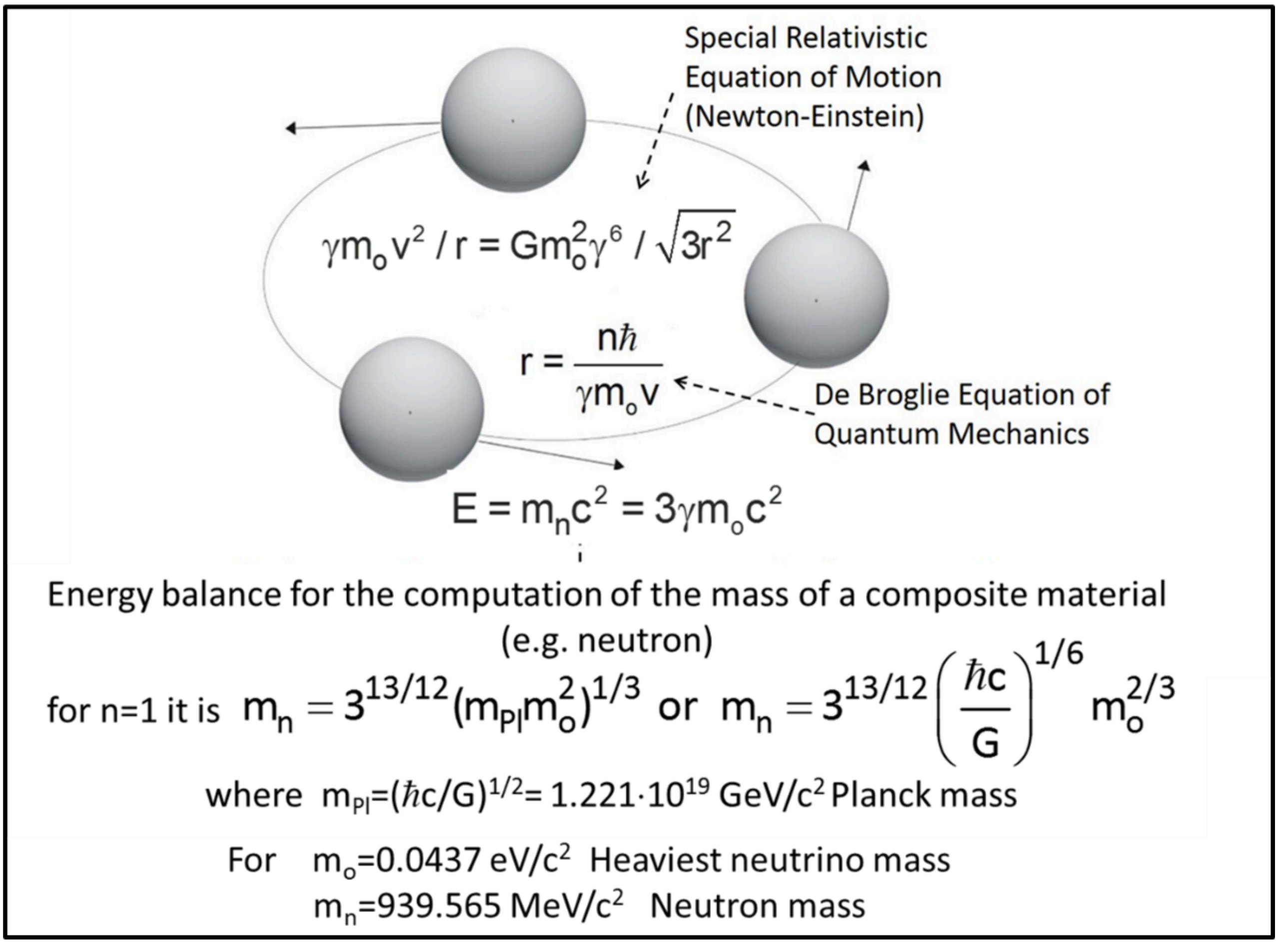

Figure 2. Combining Special Relativity (SR) (5,6) and quantum mechanics in the RLM for computing the neutron mass [1-3].

The mechanism of hadronization (or baryogenesis)

Careful examination of the decay products of several hundreds of composite particles, such as of hadrons (including baryons and bosons) [4, 7-8] has shown that the ultimate decay products of all composite particles are only the following five leptons: The electron (e^-), the positron (e^+) and the three neutrinos (v_1, v_2 and v_3), the masses of which were first measured by Kajita [9] and McDonald [10] in their pioneering work. These masses are of the order of 3 to 50 meV/c^2 i.e., 12 orders of magnitude (a million million times) smaller than the masses of protons/ neutrons (10^9 eV/c^2).

A first question arising from these extremely demanding to measure and dramatically different mass values of neutrinos vs those of the basic constituents of atoms (i.e., protons, neutrons and electrons), is how the tiny masses of neutrinos are related to the huge (by neutrino standards) masses of our familiar electrons and protons which are typically 11 orders of magnitude bigger than those of neutrinos.

The answer to this question is obtained by the ingenious 1905 masterpiece of Einstein, i.e., by Special Relativity (SR) which, in simple words, dictates that what is really important in this world is not what we measure about ourselves but instead what others observe about us.

Thus, the measured relativistic mass, γm_o, of a particle, e.g., a neutrino, of rest mass m_o, travelling with a Lorentz factor of 10^{10} is of the order of 10^9 eV/c^2, i.e., 1 GeV/c^2, i.e., of the order of proton and neutrino masses. (11) At the same time, its gravitational mass, $\gamma 3m_o$ (5) reaches the Planck mass. (1-4) This provides the key idea of the RLM of composite particles, which is a simple Bohr-type model of three gravitating rotating neutrinos moving with speeds very close to the speed of light. (1-4) This appears to be how the matter of our Universe has been made (or is being made even today, according to the pioneering CERN experiments). (12)

The three basic equations of the RLM are given in Figure 2. They represent Newton's gravitational Law, coupled with Einstein's special relativity, and the de Broglie equation of quantum mechanics.

In addition to these three scientific giants, there are two more exceptional scientists-philosophers worth mentioning: Plato, with his famous phrase "Everything consists of triangles," and his student Aristotle, with his equally prophetic statement "The cyclic motion is the origin of everything." Both are exactly confirmed today by the RLM geometry.

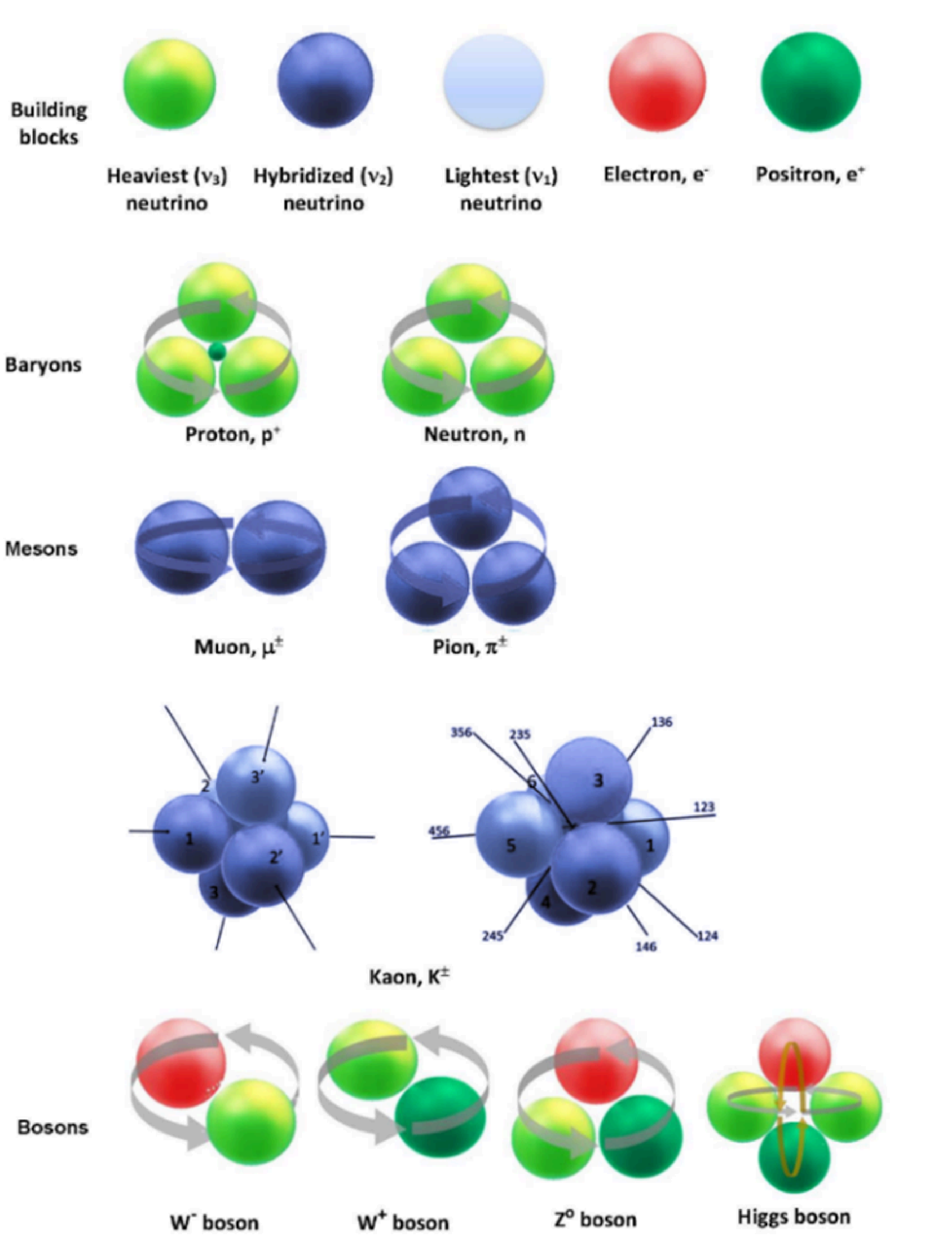

Figure 3. The elementary particles of the RLM. (top line) and the RLM structures and composition of baryons, muons, pions, kaons and bosons. [6] Figure 3 shows the geometries of the most common hadrons and bosons used to compute their masses via the RLM, while Figure 4 compares these computed masses with the experimental ones. [4] Agreement is typically better than 2%.

Gravitational catalysis

A basic question since the conception of the RLM is how the neutrinos reach or have reached the highly relativistic speeds which, via Einstein's SR [5], bring their masses from rest masses ($\sim10^{-2}$ eV/c^2) [4,13] to the highly relativistic masses ($\sim10^9$ eV/c^2) of those rotating in protons and neutrons. [4] The answer has been provided by some recent works [1-4] as shown in Figure 5. It results from an initial catalytic gravitational acceleration of neutrinos by positrons (and/or) electrons to highly relativistic velocities, followed by the steady-state gravitational attraction by the other co-rotating neutrinos (Fig. 6). This two-step gravitational catalysis concept appears to be quite effective. [4]

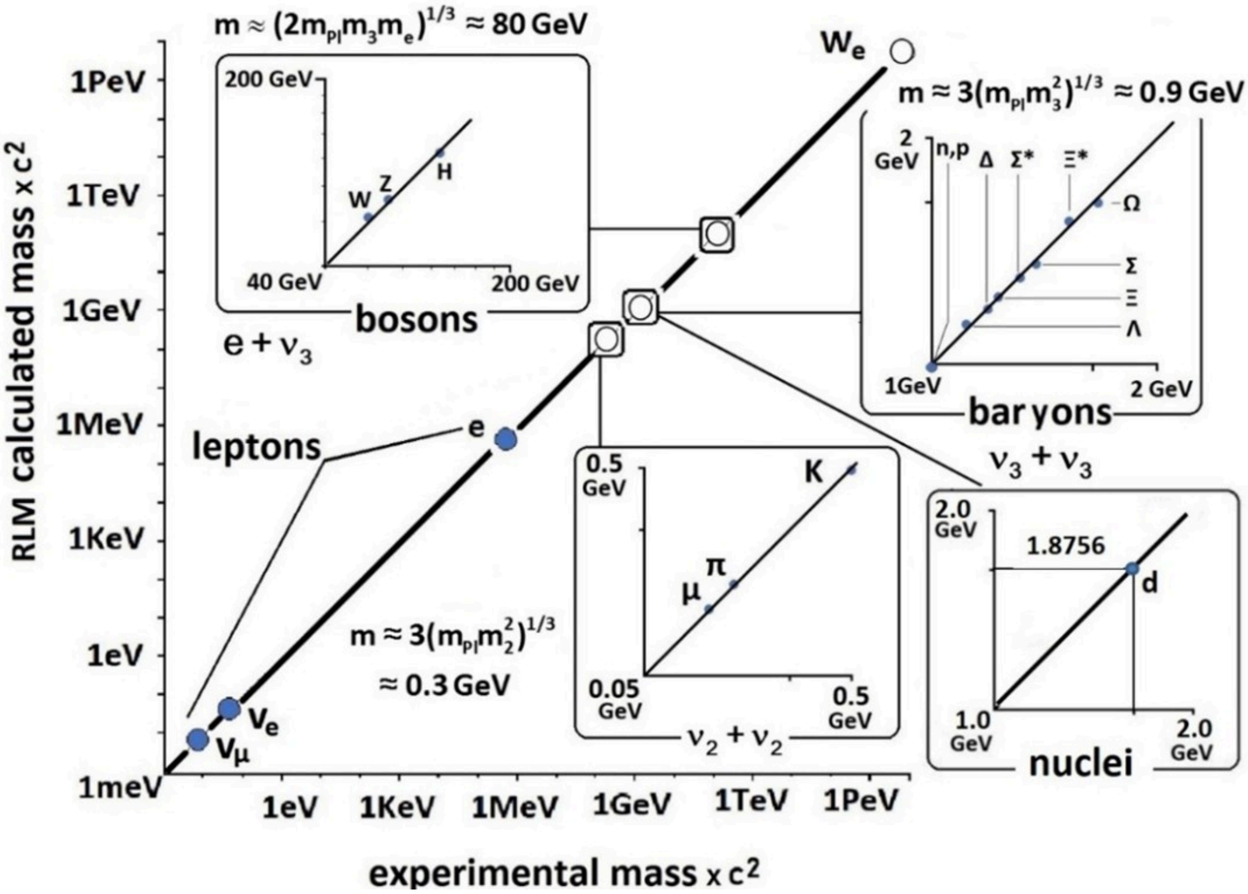

Figure 4. Comparison of the RLM computed masses of composite particles with the experimental values. Agreement is better than 2% without any adjustable parameters. The three approximate mass expressions shown in the Figure provide the order of magnitude of hadron and boson masses. [4]

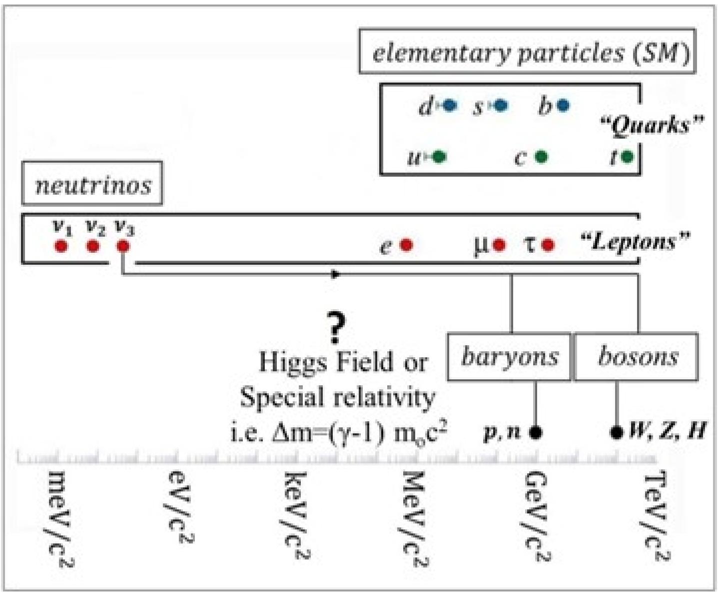

Figure 5. Rest masses of the Elementary Particles of the Standard Model (SM) and of the three neutrino eigenstates.[3,9] The arrow shows how the RLM via SR increases the heaviest neutrino mass from the rest eigenstate mass value m^3(~45meV/c^2) to the relativistic mass value, $\gamma m^3 \approx 313$ MeV/c^2 of the s quark, which corresponds to one third of the mass of the neutron formed.[4]

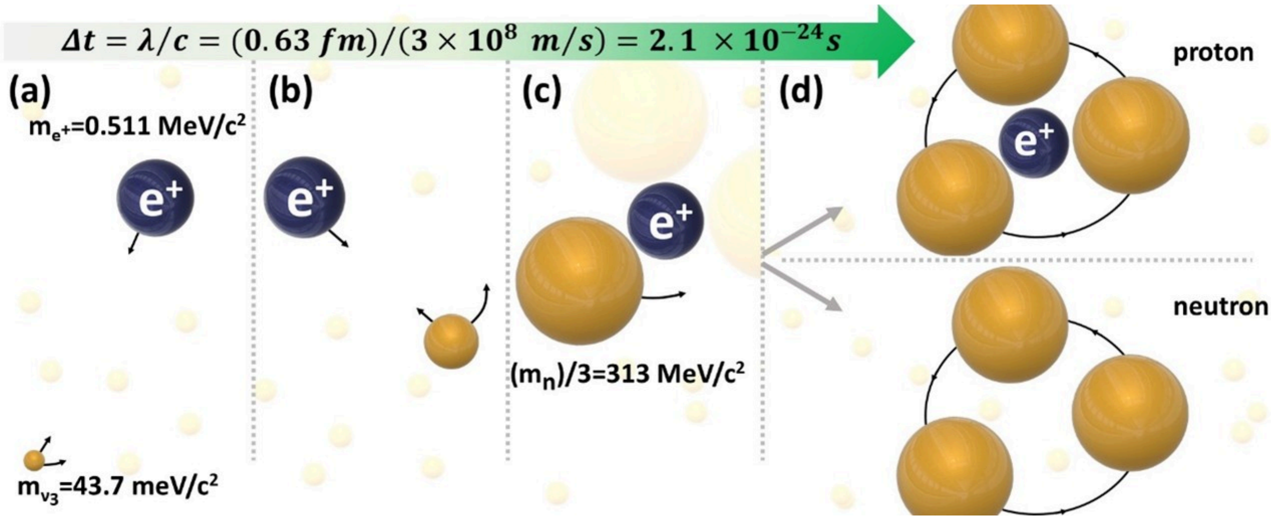

Figure 6. Gravitational catalysis of hadronization by positrons (or electrons). (a) A tiny neutrino at rest is attracted and accelerated by an ambient positron to relativistic (γ>>1) velocities. Its gravitational mass, $\gamma^3 m_o$, thus increases dramatically (reaching the Planck mass), as it also starts rotating around the positron (b). Eventually, it joins two similar relativistic neutrinos forming a proton or a neutron; is the heaviest neutrino mass, and mn is the neutron mass.

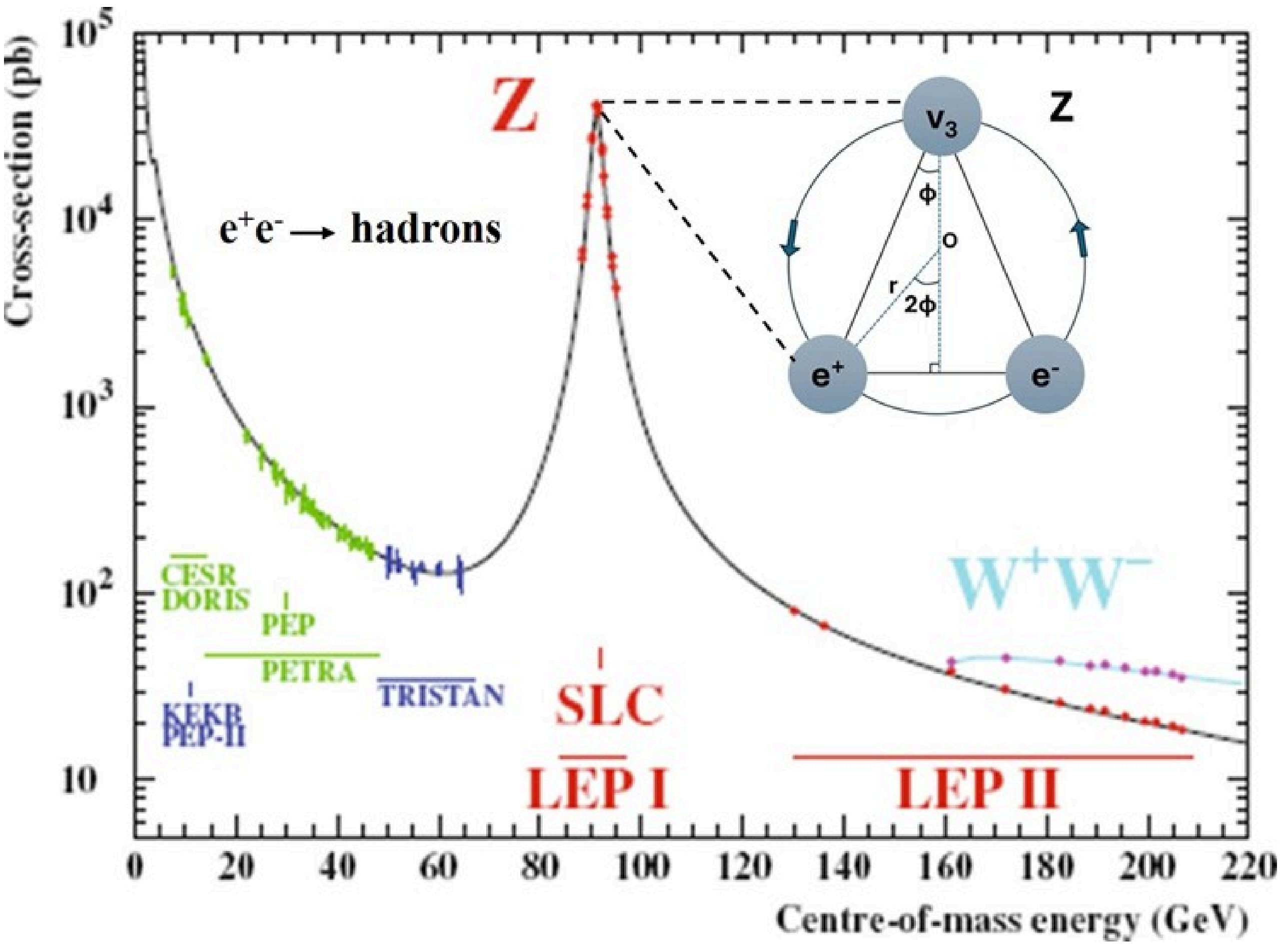

Figure 7: Validation of the RLM via key CERN experiment.

The validity of the RLM is confirmed emphatically by a recent, important, and, until recently, unexplained CERN experiment, as shown in Figure 7, in which electrons and positrons are confined in a "vacuum" chamber that unavoidably contains trillions of neutrinos. Thus, the Z boson peak in Figure 7 can be immediately understood by the fact that, as shown recently [13,14], the Z boson is a rotating electron-positron-neutrino structure.

In conclusion, the most recent review (2024) of work on the RLM has been summarised in a Springer book [4] as well as in a reference. [14] These works emphasise that the RLM is a generalization of the Bohr model of the H atom, which combines Newtonian mechanics, quantum mechanics, and SR to provide, without any unknown parameters, a quantitative description of the composite particles of our Universe using the heaviest neutrino type.

Acknowledgements

This research has been co-financed by the Foundation for Education and European Culture (IPEP) and by the A.G. Leventis Foundation.

Authors

References

1. C.G. Vayenas & S. Souentie, Gravity, Special Relativity, and the Strong Force: A Bohr-Einstein-de-Broglie model for the formation of hadrons. Springer, New York (2012).

2. C.G. Vayenas, S. Souentie, A. Fokas. A Bohr-type model of a composite particle using gravity as the attractive force, Physica A, 405, 360-379 (2014).
3. C.G. Vayenas, D. Tsousis and D. Grigoriou, Computation of the masses, energies and internal pressures of hadrons, mesons and bosons via the Rotating Lepton Model, Physica A, 545 (2020) 123679.
4. C.G. Vayenas, D.G. Tsousis, E.H. Martino, "Catalysis in Chemistry and Physics: The Roles of Leptons, Special Relativity and Quantum Mechanics", Springer Nature, Switzerland AG, (2024). ISBN978-3-031-68121-9.
5. A. Einstein (1905) Zür Elektrodynamik bewegter Körper. Ann. der Physik., Bd. XVII, S. 17:891-921; English translation On the Electrodynamics of Moving Bodies (http://fourmilab.ch/etexts/einstein/specrel/www/) by G.B. Jeffery and W. Perrett (1923).
6. A.P. French (1968) Special relativity. W.W. Norton and Co., New York.
7. R.L. Workman et al. (Particle Data Group) (2022) The review of particle physics. Prog. Theor. Exp. Phys., 083C01 (2022).
8. The rotating lepton model: Electron and positron catalysis of chemical and nuclear synthesis, Open Access Government, October 2023.
9. Takaaki Kajita, Nobel Lecture (2016): Discovery of Atmospheric Neutrino Oscillations. Rep. Prog. Phys. 69, 1607 – 1635 (2006).
10. A.B. McDonald, Nobel Lecture: The Sudbury Neutrino Observatory: Observation of flavor change for solar neutrinos. Rev. Mod. Phys. 88, 030502 (1-9) (2016).
11. D. Griffiths (2008) Introduction to Elementary Particles. 2nd ed. Wiley-VCH Verlag GmbH & Co. KgaA, Weinheim.
12. Precision electroweak measurements on the Z resonance, Physics Reports, 427, (5–6), 257-454, 2006, https://doi.org/10.1016/j.physrep.2005.12.006
13. A.S. Fokas, C.G. Vayenas. On the structure, mass and thermodynamics of the Zo bosons. Physica A, 464, 231-240 (2016).
14. C.G. Vayenas, D.G. Tsousis, & E. Martino, Gravitational catalysis of nuclear synthesis from positrons, electrons and neutrinos. Scientific Reports 15, 25232 (2025). https://doi.org/10.1038/s41598-025-10229-1

Primary Contributor

Constantinos G. Vayenas
University of Patras Academy of Athens