

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

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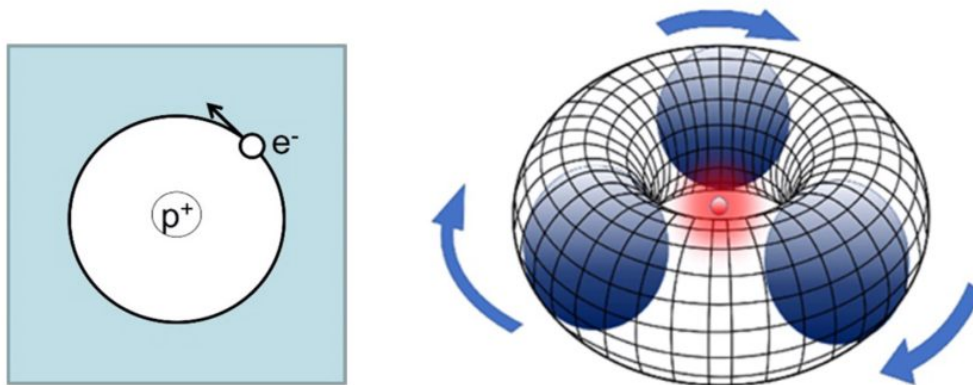


Figure 1: Rotating Lepton Models in Chemistry (Hydrogen atom, left) and in Physics (three gravitationally attracted relativistic neutrinos rotating around a positron and forming the proton, right).

Constantinos G. Vayenas, Dionysios Tsousis and Eftychia Martino discuss advancements in understanding particle physics through the development of the Rotating Lepton Model (RLM)

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 to the Bohr model of the H atom; it comprises one or more rotating leptons on a circular orbit, gravitationally attracting themselves, rather than electrostatically, as is the case with the Bohr model. In the case of the RLM, the [rotating leptons are mostly neutrinos](#), which have extremely small ($\sim 1-5 \text{ eV}/c^2$) rest masses. However, due to their lightness, these rotating neutrinos easily reach highly relativistic speeds, approaching the speed of light. Thus, according to Einstein's Special Relativity, their relativistic and gravitational masses of γm_0 and $\gamma^3 m_0$, respectively, increase dramatically and reach values of the order of $10^9 \text{ eV}/c^2$ and $10^{28} \text{ eV}/c^2$,

respectively. This implies that the intraparticle gravitational forces reach the Strong Force value of $\hbar c/r^2$, which is 1030 times stronger than the normal gravitational attraction at the same distance.

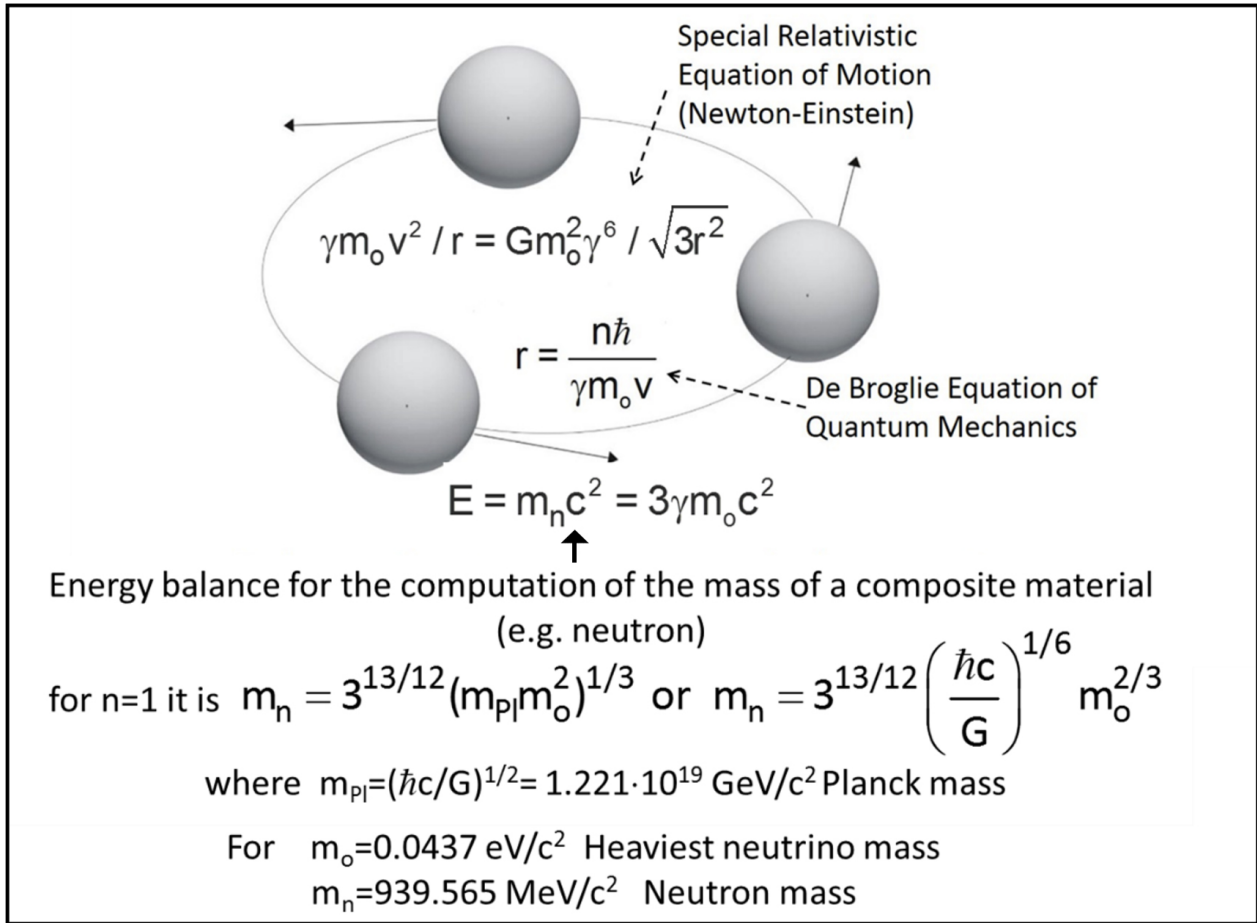
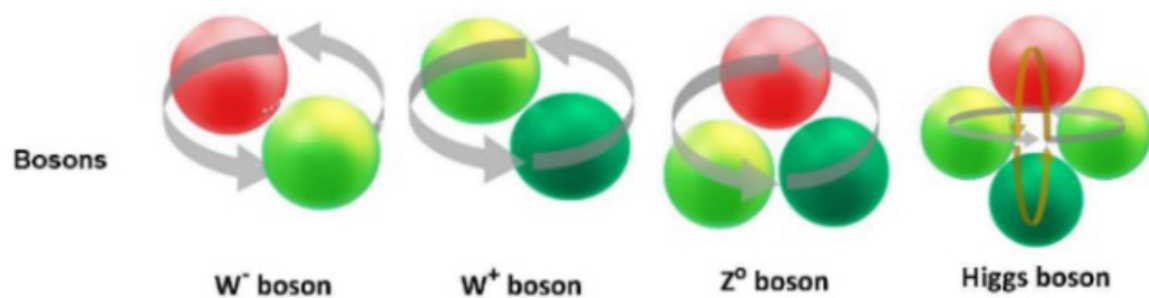
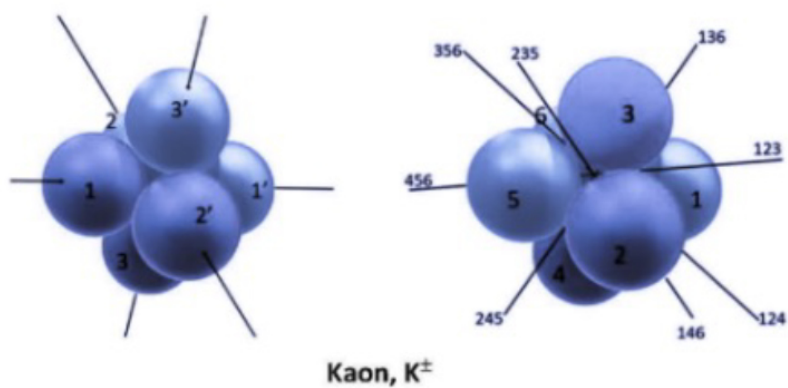
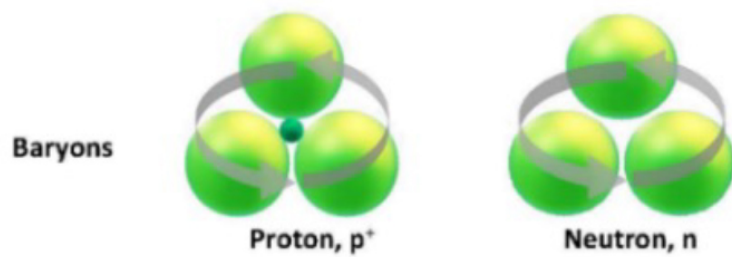
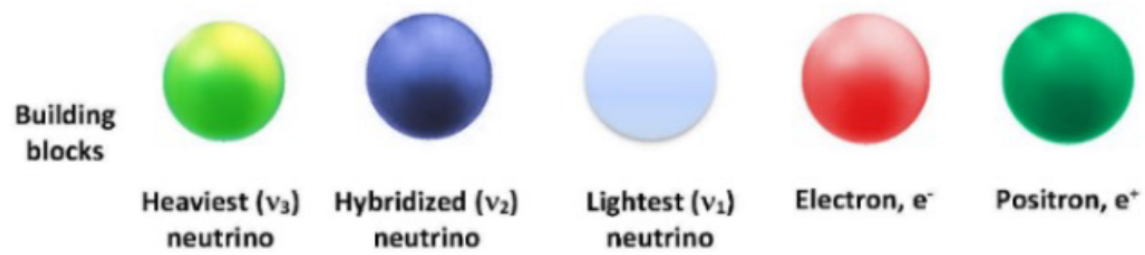


Figure 2. Combining Special Relativity ^(5,6) and Quantum Mechanics in the RLM for computing the neutron mass. ⁽¹⁻³⁾

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 (ν_1 , ν_2 and ν_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 ($10^9 \text{ eV}/c^2$). 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.



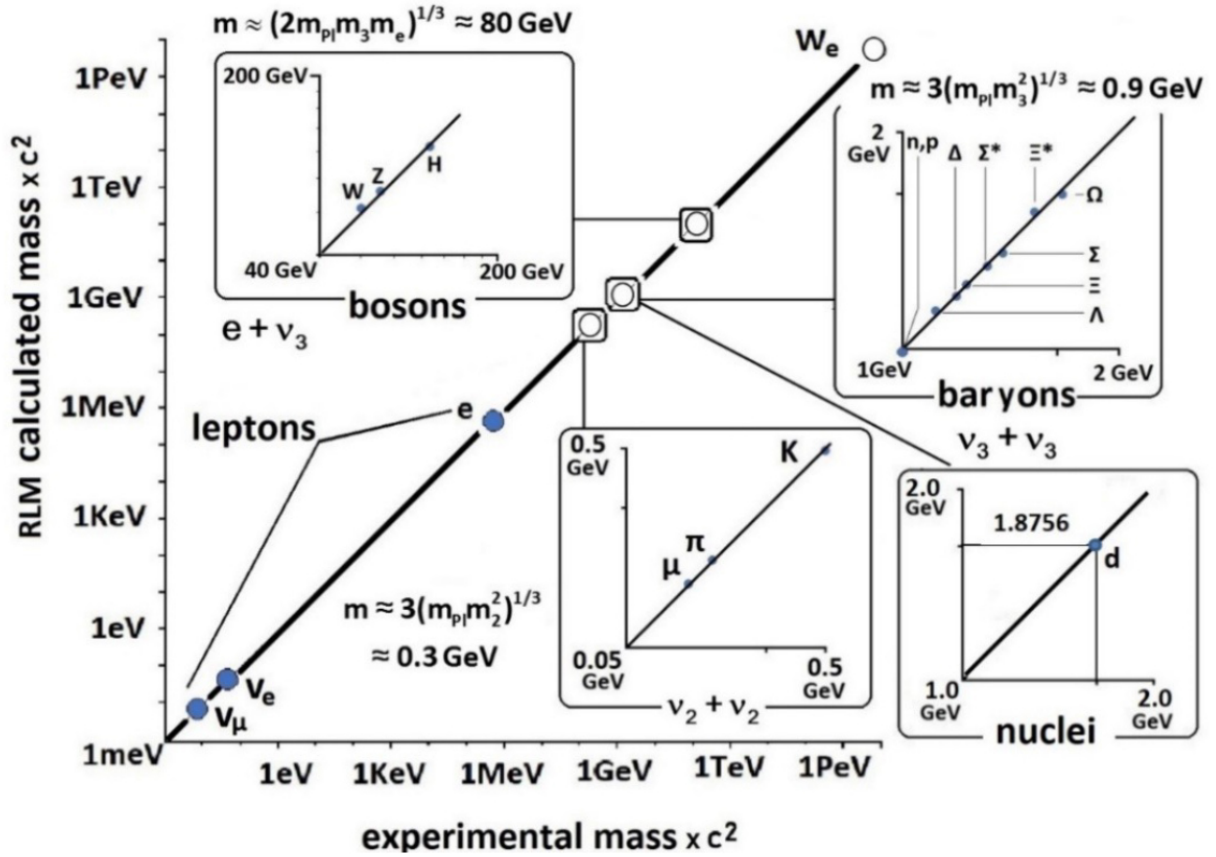


Figure 4. Comparison of the RLM computed masses of composite particles with the experimental values. An agreement is preferable to a 2% rate without adjustable parameters. The three approximate mass expressions shown in the Figure provide the order of magnitude of hadron and boson masses. ⁽⁴⁾

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 who are worth mentioning, i.e. Plato with his famous phrase '*Everything consists of triangles*' and his student Aristotle with his equally prophetic '*The cyclic motion is the origin of everything*,' both exactly confirmed today by the RLM geometry.

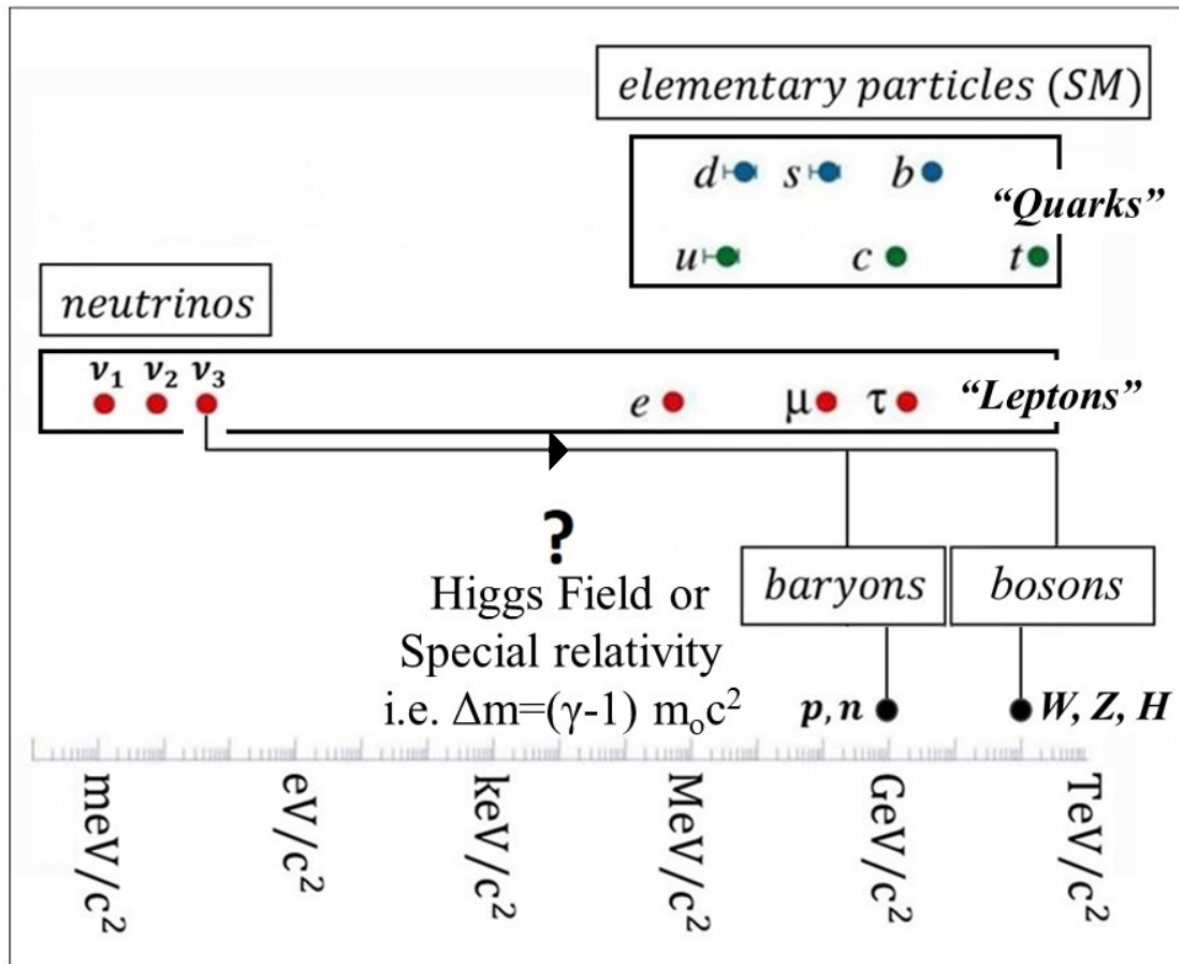


Figure 5. Rest masses of the Elementary Particles of the Standard Model (SM) and the three neutrino eigenstates. ^(3,9) The arrow shows how the Rotating Lepton Model (RLM) via Special Relativity increases the heaviest neutrino mass from the rest eigenstate mass value m_3 ($\sim 45 \text{ meV}/c^2$) to the relativistic mass value, $\gamma m_3 \approx 313 \text{ MeV}/c^2$ of the s quark, which corresponds to one-third of the mass of the neutron formed. ⁽⁴⁾

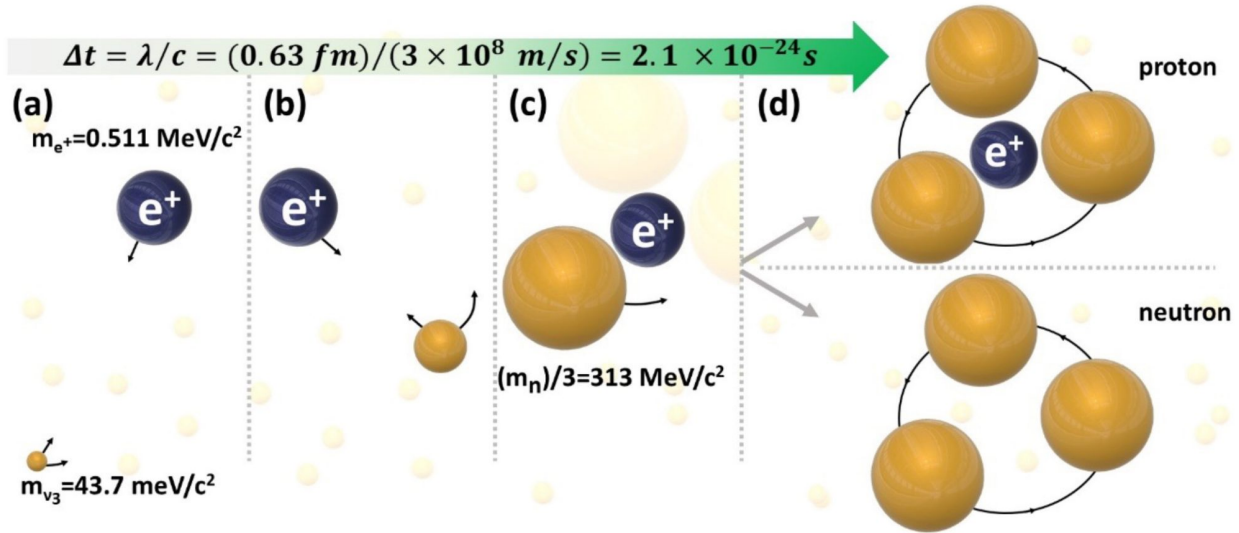


Figure 6. Gravitational catalysis of hadronization by positrons (or electrons). (a) A tiny neutrino at rest is attracted and accelerated by an ambient positron to relativistic ($\gamma \gg 1$) velocities. Its gravitational mass, $\gamma^3 m_0$, thus increases dramatically (reaching the Planck mass), as it also starts rotating around the positron (b). Eventually, it joins two similar relativistic neutrinos forming a proton or a neutron; m_{ν_3} is the heaviest neutrino mass, and m_n is the neutron mass.

Gravitational catalysis

A fundamental question since the conception of the RLM is how the neutrinos reach or have reached the highly relativistic speeds which, via Einstein's special relativity⁽⁵⁾ bring their masses from rest masses ($\sim 10^{-2} \text{ eV}/c^2$)^(4, 13) to the highly relativistic masses ($\sim 10^9 \text{ eV}/c^2$) 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⁾

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⁾ the Z boson is a rotating electron-positron-neutrino structure.

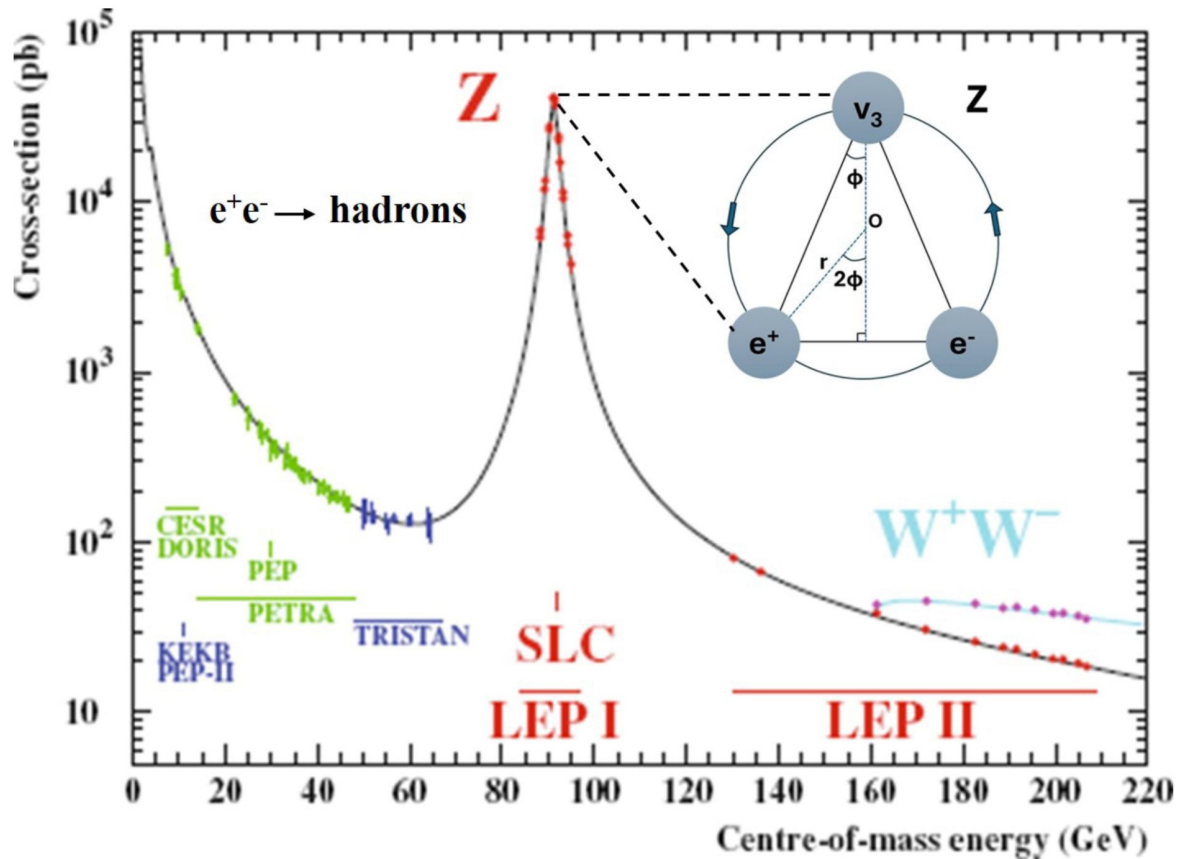


Figure 7: Validation of the RLM via key CERN experiment.

Acknowledgments

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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, Introduction to Elementary Particles, 2nd edn. (Wiley-VCH Verlag GmbH & Co. KgaA, Weinheim, 2008).
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).

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