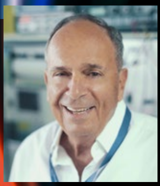

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The rotating lepton model: Combining fundamental theories

Research Objectives

Costas Vayenas has research interests in physical chemistry and gravity, and particle physics.

Detail

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Bio

Costas Vayenas was born in Athens in 1950. He completed his Diploma (NTU, Athens, 1973), and PhD from University of Rochester, 1976. He was Assistant Professor at Yale (1976-77), Associate Professor at MIT (1977-82). He returned voluntarily as Professor to the University of Patras, Greece (1981-present). He is a Member, Academy of Athens, International Member, National Academy of Engineering, USA, Honorary Professor, Aristotle University of Thessaloniki. He has supervised 41 PhD students, 18 in academia.

Dimitrios Grigoriou was born in Athens in 1982. He has a Chemical Engineering degree (UPatras 2006), an MBA (HEC Paris 2012), and PhD (UPatras 2018). He holds several patents, has published research in catalysis and particle physics, and published two novels. Dimitrios is a member of the Technical Chamber of Greece, and the Triple Nine Society.

Dionysios G. Tsousis was born in Patras in 1998. He is a senior student of Chemical Engineering at the University of Patras (Greece). He is doing his thesis under the supervision of Professor Vayenas and already has two publications. He has the highest ranking among his class and he is planning to pursue doctoral studies.

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Collaborators

University of Patras team: Dr D. Grigoriou and Mr D. Tsousis, supported by Dr Eftychia Martino (computing) and Ms Chryssa Pilisi (technical support).
Other current collaborators: Professor Marek Gazdzicki, Institut für Kernphysik Johann-Wolfgang-Goethe- Universität, Germany, and Professor Szymon Pulawski, University of Silesia, Poland (Energy Balances of pp collisions at CERN); Professor Yannis Yortsos, USC, USA (mathematical modelling); Professor E. Aifantis and Mr K. Parisis, Aristotle University of Thessaloniki, Greece (Kaon and deuteron mass computations).

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Personal Response

How do you hope to gather experimental evidence for your theories in the future?

" We plan to expand the experimental evidence for the validity of the Rotating Lepton Model (RLM) in four directions:

Expansion of the number, currently 15, of composite particle mass computations via the RLM by including more complex hadrons (e.g. Kaons) and some simple nuclei (e.g. deuteron) and comparing the RLM computed masses with the measured masses.

Comparison of the RLM predictions for the three neutrino mass eigenstates with more recent experimental results from Superkamiokande, SNOLAB, DUNE, IceCube and KATRIN.

Analysis via the RLM of the published proton-proton (pp) collision data collected at CERN. We are already collaborating with two prominent CERN researchers in this direction. Agreement with the RLM predictions looks quite good.

We also plan to compare the RLM computations with the "World data" of positron-electron annihilation, also obtained at CERN. "

The rotating lepton model

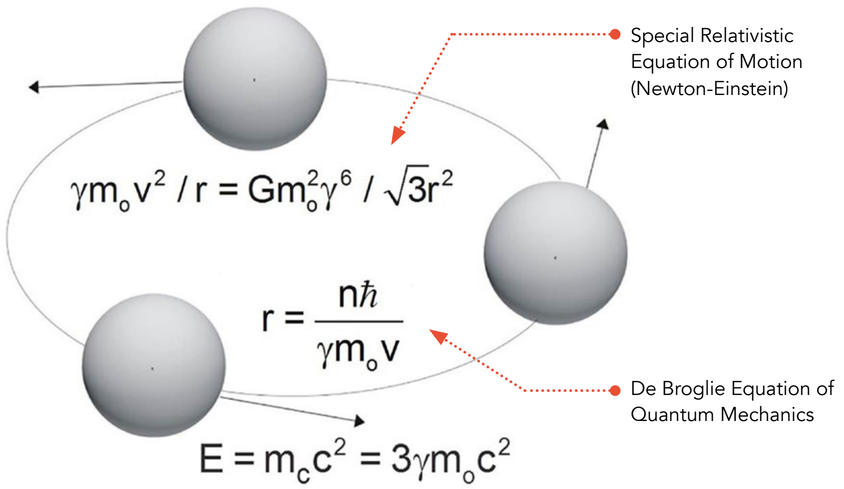
Combining fundamental theories

For decades, physicists have known that their descriptions of the universe's fundamental building blocks have been incomplete. So far, however, no conclusive theories have emerged to propose more suitable alternatives. Now, Professor Costas Vayenas at the University of Patras in Greece believes that the problem could be solved through the 'Rotating Lepton Model' – in which particles named neutrinos rotate at close to the speed of light. By combining the theories of Quantum Mechanics and Special or General Relativity, his theories could prove to transform the way we view the universe on the smallest of scales.

The Standard Model of particle physics has long provided physicists with a basis for understanding the basic structure of all observable matter in the universe. Among the indivisible particles it describes are quarks – which make up 'hadrons' including protons and neutrons; and leptons – which include electrons, and the far more elusive neutrinos.

In addition, the model describes four fundamental forces, which mediate all interactions between observable matter – often via exchanges of particles named 'bosons'. These include: *gravity*, which acts between massive objects; *electromagnetism*, which regulates interactions between charged particles via photons; *the strong nuclear force* – which acts between quarks via 'gluons'; and *the weak nuclear force* – involving exchanges of 'W' and 'Z bosons' characteristic of radioactive decay.

ROTATING LEPTON MODEL (RLM) SYNOPSIS: COMBINING RELATIVITY AND QUANTUM MECHANICS



Energy balance computation of Composite Particle (neutron) mass.
For n=1 $m_c=3^{13/12}(m_{Pl}\, m_o^2)^{1/3}$

e.g. m_o=0.0437 eV/c^2 Neutrino mass
m_n=939.565 MeV/c^2 Neutron mass

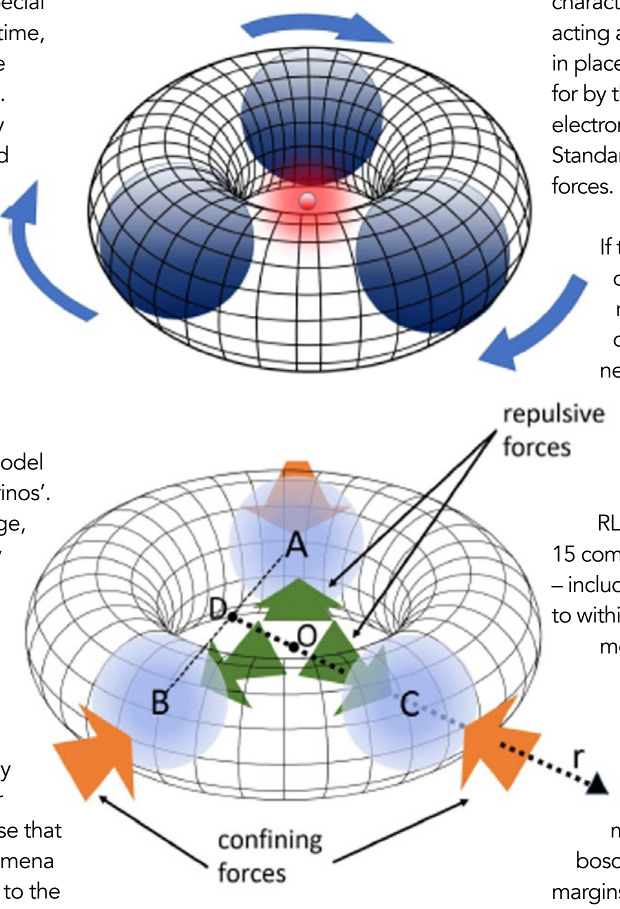
So far, the Standard Model has been an excellent basis for researchers to explain their observations, with experimental results rarely deviating far from theoretical calculations. Yet despite its success, physicists have known for some time that the model in its current form cannot be complete. Among its most glaring discrepancies is the fact that it appears to be incompatible with Einstein's robust theory of General Relativity. To date, researchers have now conceived a diverse variety of ideas about how the Standard Model could be altered to reproduce this important law. So far, however, their ideas have yet to be proven through real experiments.

INTRODUCING THE ROTATING LEPTON MODEL

Einstein first published his groundbreaking Special Relativity and General Relativity theories in 1905 and 1915, respectively. The former provided the means to account for the pronounced increase in inertial and gravitational particle mass with particle speed. The latter provided the first long-awaited description of how Newton's ideas about gravity arose from a more fundamental property: namely, the curvature of spacetime, whose effects can be readily observed on astronomical scales. However, even over a century later, no concrete theories have emerged which unify Relativity with Quantum Mechanics – which describes how the universe behaves on the very smallest of scales, and forms the basis of the Standard Model.

In his research, Professor Vayenas argues that contrary to previous theories, the Standard Model doesn't need to be expanded in order to achieve this unification. Instead, the number of indivisible particles and forces it describes should be cut down significantly. His ideas have culminated in the 'Rotating Lepton Model' (RLM): an elegant theory which Professor Vayenas believes could unite Quantum Mechanics with Special and General Relativity for the first time, through a thorough re-vamp of the Standard Model in its current form. Broadly speaking, the RLM entirely eliminates the need for quarks, and reduces the four fundamental forces down to just two. Such sweeping changes may seem ambitious, but according to Professor Vayenas, they are firmly rooted in existing theories.

ROTATING LEPTON MODEL (RLM) OF THE PROTON



The Rotating Lepton Model (RLM) entirely eliminates the need for quarks, and reduces the four fundamental forces down to just two.

CUTTING DOWN ON FUNDAMENTAL PARTICLES

One key aspect of the Standard Model is a family of leptons named 'neutrinos'. Since these particles have no charge, along with minuscule masses, they only interact with other forms of matter extremely rarely. Yet according to Special Relativity, objects travelling or rotating at extremely high speeds – approaching the speed of light – can appear to become dramatically heavier. In their research, Professor Vayenas and his colleagues propose that when combined, these two phenomena provide an alternative explanation to the presence of quarks.

As stated by the Standard Model, quarks have the mysterious property of only existing in groups. Baryons, for example, are made up of combinations of three quarks, which cannot be individually isolated under any circumstances. When these particles were first proposed in the 1960s, questions arose as to how they could interact with each other. Since quarks have such minuscule masses and charges, researchers believed they could only interact through the newly proposed strong force. However, Professor Vayenas argues that this is not necessarily the case.

Since gravity is by far the weakest of the four currently proposed fundamental forces, it is only thought to be relevant when describing masses far higher than those of quantum particles. Yet according to Special Relativity, these masses could be reached if quarks were, in fact, composed of neutrinos, spinning at close to the speed of light. With masses vastly higher than their stationary counterparts, groups of these particles can be held together by gravitational forces, making them virtually impossible to isolate.

WIDESPREAD IMPLICATIONS FOR PHYSICAL THEORIES

Leading on from this, Professor Vayenas and his colleagues propose that the RLM can also remove the need for both the strong and weak nuclear forces. Instead, hadrons could be held together by relativistic gravity, with their constituent rapidly rotating and spinning neutrinos following the well-established 'Bohr model'. Typically, this model describes the quantum properties of the Hydrogen atom. In this case, neutrinos could adopt characteristic circular orbits, with gravity acting as a centripetal force to keep them in place. The only force not accounted for by this description would be the electromagnetic force – leaving the Standard Model with just two fundamental forces.

If this theory is correct, it would cut down the 16 indivisible particles required by the Standard Model down to just five: including three neutrinos, the electron, and its antimatter counterpart – the positron. In their latest research, Professor Vayenas and his colleagues have now used the RLM to calculate the masses of 15 composite hadrons and bosons – including protons and neutrons: all to within 1% of their experimentally measured values. Their approach has also enabled them to calculate the masses of stationary neutrinos with less than 3% deviations among the values obtained when using the composite masses of different hadrons and bosons – compared with the 20% error margins associated with far more costly experiments.

The Rotating Lepton Model (RLM) is an elegant theory which can unite Quantum Mechanics with Gravity and Relativity for the first time.

Overall, the RLM suggests that many of the fundamental phenomena described by the Standard Model are not so fundamental after all. Instead, they exist as combinations of five truly indivisible particles; or, in the case of gluons, may not need to exist at all. Based on the robust results they have gathered so far, Professor Vayenas' team believes their theories now hold the potential to provide long-awaited solutions to the unification of Quantum Mechanics and General Relativity – with no need for novel, as-yet unproven theories. Ultimately, their discoveries could lead to profound changes in the ways that physicists view the fundamental structure of the universe, and how we explore its many remaining mysteries in the future.

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