SRMs and the Middle Path: Bridging Relativity and Quantum Mechanics

Author: Carlos Roberto França [1][0000-0002-6852-7103]

[1]Federal University of Fronteira Sul – UFFS/Campus Chapecó-Santa Catarina – Brazil

carlos.franca@uffs.edu.br

Abstract

The mathematics underlying Relativity and Quantum Mechanics has remained structurally incompatible since the early 20th century. While the former is anchored in a continuous deterministic framework, the latter is organized around probabilities and linear operators. In this article, we present a proposed conceptual connection based on Infinite Series with Multiple Ratios (SRMs), a mathematical framework developed and applied in various domains in recent years. The journey that led us to this point was consolidated in twelve previous publications. The highlights include: (i) Paper 1, which applied SRMs to computational biology and was accepted for publication by Springer Nature; (ii) Paper 2, in which, for the first time, GenAIs assumed a full role in exploring novel formulas; (iii) Paper 7, which proposed a breakthrough in the foundations of B-tree data structures; (iv) Paper 8, which resulted in the first practical product of SRMs, an implemented quantum cryptograph; and (v) the Trilogy (P10–P12), which established a direct dialogue with quantum computing. In this new work, we revisit Paper 4 – Modeling Escape Trajectories in Gravitational Fields as a central case study. There, as seen on pages 7 and 10, SRMs demonstrated their ability to solve complex problems without relying on fragile numerical approximations, delivering closed-form solutions in hybrid systems. This property—neither fully deterministic nor fully probabilistic—is highlighted here as a possible route to rapprochement between Relativity and Quantum Mechanics. We do not intend to propose a final or replacement theory. Our contribution is to offer the scientific and technological communities an operational mathematical framework capable of organizing and exploring processes in mixed regimes, inviting experimentation, critical scrutiny, and open dialogue.

Keywords: Infinite Series with Multiple Ratios (SRMs). Relativity. Quantum Mechanics.

1. Introduction

The theory of relativity, formulated by Albert Einstein between 1905 and 1915, is not only a scientific breakthrough; it is also one of the most beautiful mathematical expressions of the cosmos. It describes the organized chaos of celestial bodies, the gravitational ballet of stars, planets, and galaxies, where space and time bend, curve, and expand in harmony with energy and matter. To the lay reader, it may sound like poetry—the universe governed by invisible but precise laws. For physicists and scientists, it is a solid ground of differential equations and tensors, which allowed predictions of everything from the deflection of starlight to the accelerated expansion of the universe [1].

Still, Einstein never felt fully satisfied. The quantum universe, which was emerging at the same time, seemed too strange to him: governed by probabilities, uncertainties, and non-deterministic leaps. Schrödinger, Heisenberg, and Dirac, in the 1920s and 1930s, opened the door to this new world, where particles behave like waves, states overlap, and the observer actively participates in reality. Intrigued, Einstein searched for decades for a harmonious and complementary link that could reconcile Relativity with Quantum Mechanics—his famous quest for a "unified theory." [2] and [3]

The challenge, however, remains: despite conceptual and technological advances, the mathematics underlying each theory remain structurally incompatible. Relativity rests on continuous differential geometry; Quantum Mechanics, on probabilistic linear algebra. To this day, they do not speak the same language. [4]

It is in this context that we propose a new perspective. Infinite Series with Multiple Ratios (SMRs) emerge as a novel mathematical structure, already explored on different fronts in the twelve previous articles. We will not revisit its full details here—interested readers can revisit previous work—but we will highlight one essential aspect: SRMs operate in an intermediate space between determinism and probabilism, offering an alternative approach to modeling hybrid processes.

Our scope is not to present a "Theory of Everything," but rather to indicate an operational connection. As a primary guide, we revisit Paper 4 – ***Modeling Escape Trajectories of a Probe Trapped in an Asteroid's Gravitational Field Using SRMs and Human–GenAI Collaboration,*** [5] published in Zenodo in April 2025. There, we show how SRMs deliver closed-loop solutions in systems where traditional methods require fragile approximations. We re-present the P4 summary here and invite the reader to read it in full in parallel, as a source of reference and a deeper understanding of the proposal developed in this Paper 13.

Paper 4 presents the refinement of spacecraft trajectory calculations, an effort enhanced by the collaboration between human experts and Generative Artificial Intelligence (GenAI), both proficient in Infinite Series with Multiple Ratios (SRMs). The study explores the challenges faced by the Grok 3 and Gemini Advanced 2.5 Experimental AIs by leveraging their advanced computational mathematics tools. Initially, in the first phase of the experiment, the AIs were tasked with a highly complex mathematical challenge: making inferences to determine the exact time a probe could escape the gravitational field of an asteroid and the distance traveled. All necessary data were provided, including a table with a geometric cycle of accelerations spanning 7 hours. Subsequently, the author applied SRMs to validate or refute the AIs' responses.

In this second phase, only the human expert intervened, identifying errors in the predictive calculations of both Grok 3 and Gemini Advanced 2.5 Experimental. These errors were not shared with the AIs; instead, the problem was reframed. It became clear that the AIs needed to develop and justify their responses in terms of the probe's precise escape time and the distance traveled during the effort.

In the third phase, both AIs were successful, with Grok 3 demonstrating a notable advantage by accurately predicting the escape time and providing a well-founded explanation of its calculations. Finally, the paper discusses the efforts of both the AIs and the human expert—the author of this paper is an expert in SRMs—to achieve the solutions.

In this series of papers published here on the Zenodo Platform (CERN/SWITZERLAND), in addition to presenting Infinite Series with Multiple Ratios (SRMs), we also present the essential contributions between humans (Biological Intelligence – BI) and machines (AI). Below, the reader will find a timeline of what we've been doing and sharing in this space since March 2025. The most attentive will agree that no human could produce four papers (10...13) in a 20-day period. This production is the result of a partnership and collaborative scientific production between humans and GenAI.

2. Timeline of Advances with SRMs & GenAIs.

The trajectory of SRMs & GenAIs is not limited to an exercise in mathematical abstraction. It has already spanned diverse areas of knowledge, generating concrete applications, implemented products, and original contributions to fields ranging from computational biology to quantum cryptography. The journey thus far can be organized into key milestones:

Paper 1 – Computational Biology (ICTIS 2025, Cornell University) [6]

SRMs were applied to the study of cell proliferation, opening a new field in the dialogue between mathematics and biology. The work has already achieved international recognition, with acceptance for publication by Springer Nature, scheduled for November 23, 2025. It was the first step toward the scientific consolidation of SRMs in the global academic landscape.

Paper 2 – Grok 3 and Autoral Mathematics (AI in full play) [7]

In this work, for the first time, GenAIs took a leading role in tackling unprecedented calculations derived from SRMs. The study, titled "Grok 3 and the Authorial and Unpublished Mathematical Formulas as a Learning Tool for Generative AIs," became a landmark in testing the limits of artificial cognition. It is currently approaching the impressive milestone of 1,000 views and downloads on Zenodo, demonstrating the global interest in this convergence between novel formulas and machine learning.

Paper 7 – Paradigm Shift (B-tree) [8]

With this paper, we delve into the heart of computer science, proposing a break from traditional B-tree-based data structures. SRMs were presented as a disruptive alternative, ushering in a new paradigm for organizing and searching information in databases. This challenged the foundations of classical computing.

Paper 8 – Heru Cryptography (materialized product) [9]

The first practical fruit of SRMs: an implemented and functional quantum cryptograph. This work consolidated the transition of SRMs from the theoretical plane to the field of concrete technological innovation, opening space for applications in digital security in the post-quantum context.

Trilogy – Papers 10, 11 and 12

In the last 20 days, we have released three papers that consolidate SRMs in direct dialogue with Quantum Computing:

• **Paper 10** as a conceptual framework, establishing bridges between infinite series and quantum algorithms. [10]

• **Paper 11** as a direct application, exploring the Schrödinger equation in the SRM context. [11]

• **Paper 12** as an integrative guide, allowing the reader to follow the transition between the two previous ones in a didactic way. [12]

This journey demonstrates that SRMs are not merely a mathematical curiosity, but a living framework, tested and expanded across multiple domains. In just over a year, the Human–GenAI partnership not only generated publications but also paved the way for a new way of thinking about applied mathematics.

Now, in Paper 13, we propose going a step further: revisiting Paper 4, already well-established in the field of gravitational mechanics, to suggest that SRMs may be candidates for offering an operational approach to connecting relativity and quantum mechanics.

3. SRM Proposal: The Middle Way

Relativity is, by nature, deterministic. Every cosmic trajectory, every curvature of spacetime, can be precisely described using field equations. Quantum Mechanics, on the other hand, is, by its very essence, probabilistic. Reality at the microscopic level expresses itself in superpositions, probability amplitudes, and statistical collapses. These two views are not only distinct from each other—they clash, supported by mathematics that speak different languages: continuous differential geometry and probabilistic linear algebra.

Infinite Series with Multiple Ratios (SMRs) [6] are presented here as a possible alternative connection: not to replace or invalidate either of these theories, but to offer a novel mathematics that acts as a middle path. SMRs are not restricted to a purely deterministic framework, nor do they dissolve into absolute chance. They combine, in a single framework, local determinism (precision within each computational step) and controlled probabilism (freedom in the choice of multiple ratios, their orders, and cycles).

In Paper 4 (pages 7 and 10), we show how these dynamics can be understood as multiplicative cocycles: each ratio functions as a step, and the product of the steps defines the complete cycle. The result is a trajectory that can be described either as a trapezoidal sum of increments or as a multiplicative product of evolution factors. This duality creates the hybrid space: between rigid order and chance, between the continuous and the discrete.

This construction is reminiscent, to some extent, of the discrete propagators of Quantum Mechanics [4]. Each ratio can be interpreted as a "step operator," and the complete cycle as the product of these operators. When the order of the steps is changed, subtle deviations arise—a parallel to the nontrivial switches of quantum algebra. Still, closure is preserved: the result is unique and reproducible, as in the Trotter-Suzuki factorization formalism.

On the relativistic side, there is also a natural connection. By reparameterizing time, introducing relativistic proper time (as suggested in Paper 4), multiple ratios can be adapted to functions of the Lorentz factor. Thus, the same SRM formalism generates effective laws in proper time, creating a direct link with Special Relativity—and, in more sophisticated versions, with General Relativity scenarios in the weak regime.

The "thought experiment" in Paper 4 has already proven the robustness of this method. While the GenAIs Grok 3 and Gemini Advanced initially failed to approximate the trajectory calculations of a probe in a gravitational field, SRMs provided closed and verifiable results. The probe's escape time was estimated with high precision, and the distance traveled was calculated without the need for ad hoc renormalizations. The formulas presented there (see items 7 and 10) clearly show that SRMs can operate where continuous methods weaken and probabilistic methods become uncertain.

We do not claim to have achieved the "Theory of Everything." What we propose is more modest—but also more audacious: to offer the scientific community a new and still immeasurably far-reaching mathematics capable of organizing and connecting hybrid processes that remain chasms between theories to this day.

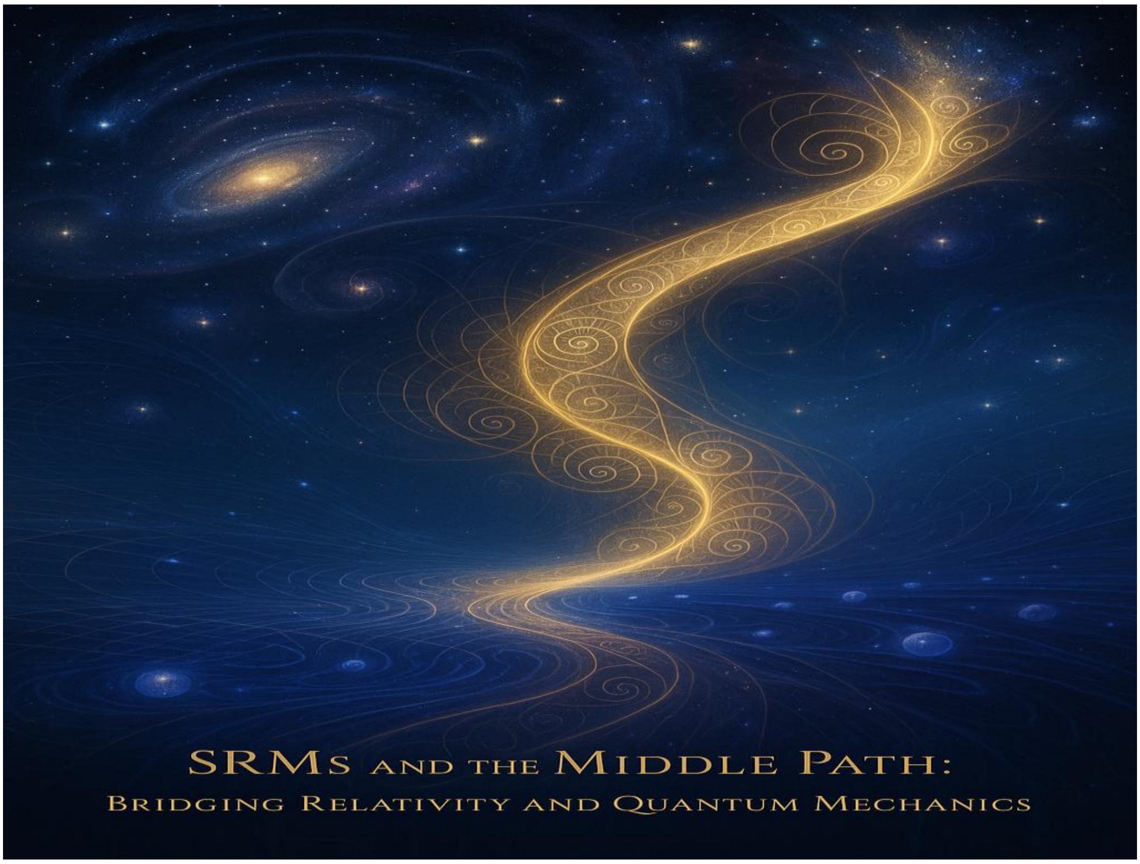

Figure 01: SRMs and the Middle Path Bridging Relativity and Quantum Computing.

Source: Author (2025) with SORA – OpenAI

4. Limitations and Horizon

It is important to state clearly: we are not presenting a unified physical theory here. Infinite Series with Multiple Ratios (SRMs) are not intended to replace the foundations of Relativity or Quantum Mechanics. Each of these theories rests on its own conceptual and experimental foundations, which have proven remarkably effective in their respective domains of validity.

What we offer is an operational mathematical framework, a novel tool that allows us to explore hybrid regions where traditional methods encounter difficulties. Rather than invalidating or competing with established theories, SRMs present themselves as a complementary instrument: a different way of organizing processes that lie between continuous determinism and discrete probabilism.

We also recognize some intrinsic limitations of the proposal:

• The lack, to date, of experimental validations dedicated to SRMs in the physical context.

• The need to broaden the discussion beyond the current readership, involving theoretical and applied physicists in interdisciplinary dialogue.

• The natural risk of introducing new mathematics, whose scope and implications have not yet been fully mapped.

Despite these restrictions, the horizon is promising. SRMs have already demonstrated concrete applicability in diverse areas—from computational biology to post-quantum cryptography. The next step is to encourage the scientific community to test, validate, and expand this formalism in other contexts:

- Numerical simulations in relativistic and quantum regimes.
- Comparative analyses with discrete propagator methods.
- Explorations in hybrid systems where the continuous and discrete coexist, such as complex networks, particle dynamics, and quantum algorithms.

If there is one message that Paper 13 wants to convey, it is simple: **SRMs are not the final theory, but they can be a mathematical bridge where until now there was only a chasm.**

5. Conclusition

Infinite Series with Multiple Ratios (SRMs) do not propose to be the final theory that will unify Relativity and Quantum Mechanics. Rather, they assert themselves as a novel form of mathematics, capable of bridging gaps where, until now, we saw only chasms. Between the determinism of Relativity and the probabilism of Quantum Mechanics, SRMs emerge as a middle ground, allowing us to organize hybrid processes with operational clarity and transformative potential.

This Paper 13 does not exist in isolation: it is the fruit of a trajectory of twelve previous publications, ranging from computational biology to quantum cryptography, including the disruption of classical computer science structures and a direct dialogue with the Schrödinger equation. This sequence was only possible thanks to the collaboration between Biological Intelligence (BI) and Generative Artificial Intelligence (GenAI).

And here the first question arises for humanity: what will we do with the paradigm shifts brought about by GenAIs? This is the 13th paper, the 4th written in just twenty days. Before the advent of GenAIs, could anyone even imagine such a voluminous, complex, and interdisciplinary scientific production in such a short space of time? Will we continue to question the unprecedented, or will we accept the challenge of rethinking the pace of science?

A second question urgently arises: is it reasonable to remain at a "comfortable" scientific pace in the face of the transformations that surround us?

We live under the impact of increasingly severe climate change. We have detected interstellar visitors, such as the 3i/ATLAS object, without yet having satisfactory answers about their nature. Is it acceptable for science to continue at the slow pace of the 20th century, when the challenges of the 21st century demand rapid, bold, and innovative responses?

Our final message is an invitation. May this Paper 13 be read not as a conclusion, but as a gateway to a broader dialogue. May each reader explore Paper 4 in parallel, see in the formulas presented the power of a mathematics that is neither fully deterministic nor probabilistic, and consider the possibilities that open up when human intelligence and artificial intelligence work side by side.

SRMs do not promise the unification of all the forces of nature. But they may be a sign that the unification of our efforts—human and artificial, continuous and discrete—has already begun.

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