Qeios

Peer Review

Review of: "Relativistic Shedding (RS) as Threshold Emission into Hidden Sectors"

Mykola Maksyuta[1]

1. National Taras Shevchenko University of Kiev, Ukraine

I will begin by pointing out the shortcomings of this work, which touches on interesting theoretical as well as experimental aspects.

First, the exposition style is rather disorganized, which hampers the readability of the text. The paper would benefit from an introduction that provides a detailed analysis of the kinematic aspects of the physical processes, for example, by examining the impossibility of implementing the so-called relativistic shedding (RS) in a vacuum and in ordinary dielectric media. This would immediately give the reader a clear understanding of the physical motivation behind RS and the limits of applicability of the proposed models.

Second, the structure of Section 2 (“Notation, conventions, and scope”) is not optimal. The statement that natural units $\hbar = c = 1$ are used could be placed immediately after the first formula $\omega \geq m$, without creating a separate subsection 2.1, which contains elementary observations $\omega = 2\pi f$ and $E = \hbar\omega$. Subsection 2.2 could also be removed, while the important points could be transferred to the conclusion. Thus, Section 2 is largely redundant and only overloads the text.

Third, all appendices in the work are largely superfluous. Appendix A presents a well-known formula $k^2 = \varepsilon_r(\omega)\,\omega^2$, which would be more logically placed in the main text. In addition, the formula $\Pi_T(\omega) \approx \omega^2\big(1 - \varepsilon_r(\omega)\big)$ linking transverse polarization to dielectric permittivity is duplicated both in the main text (Section 1.3) and in Appendix A (formula 24). At the same time, the reader would expect at least a phenomenological explanation of this dependence, which is absent, rendering the appendix useless. The text in Appendix B and formula (25) should be moved to the appropriate place in the main text, making Appendix B unnecessary. Appendix C also does not provide independent value: its content can be included in subsection 7.4 (step 3). Finally, the translation of physical quantities presented in Appendix D is not original and can be found in any physics reference book.

Furthermore, the work contains repeated formulas: formula (3) from Section 1.3 is repeated in Section

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5.2. In such cases, it would be more appropriate to derive the formulas using the provided Lagrangian (14). Similar remarks apply to formulas (17) and (18), which also require additional explanations.

In addition to the above shortcomings, the following should be noted:

1) The absence of visual diagrams and explanatory figures, which could help clarify the architecture of the RS laboratory program (Section 7). For example, diagrams of the slowly propagating wave structure, source, wall, and resonant receiver would make the exposition more illustrative.

2) Some formulas are cumbersome, containing many symbols without explanations of the physical meaning of each parameter. Textual explanations should be added so that the reader understands the significance of each quantity and the range of its realistic values.

3) Some references to earlier RS versions and LDMX motivation (Sections 1.2, 6.1–6.2) are excessive for understanding the current version of the laboratory program. These could be condensed, leaving only the key points for motivation.

4) In Section 7 (“A stand-alone RS laboratory program”), it would be useful to highlight the key experimental steps in a structured table or bulleted list for better readability, and to emphasize the differences between RS modulation and classical LSW.

Overall, the preprint contains interesting ideas regarding RS as an experimentally testable mechanism and demonstrates significant work in calculating thresholds and sensitivity. However, the exposition is overloaded with repetitions and appendices, and the text requires organization, the inclusion of explanations, and illustrative diagrams to make the material accessible to a broader audience.

Declarations

Potential competing interests: No potential competing interests to declare.