

mation acquired in the course of studying the passage of rockets through the atmosphere, including electrodynamical processes and the reconnection of electric field lines. Handel (U.S.A.) studied maser effects that can occur in atmospheric water vapor and analyzed the possibility of analogous effects in ball lightning. Koloc (U.S.) discussed an original magnetohydrodynamic model of luminescent ball formation. Together these studies enable us to cull information useful in ball lightning research from the existing body of scientific concepts and ideas.

A number of attendees presented specific models of ball

lightning. Yamamoto (Japan) presented a plasma model, whereas Dijkhuis and Pijpelink (Netherlands) proposed a mechanism in which plasma electrons are paired as bosons, as in the theory of superconductivity. Neda, Ofuruton, and Ohtsuki (Japan) computed the electric field intensity in ball lightning within the framework of the aerosol model. Zou (China) explained the UFO phenomenon reported in China as a plasma soliton.

In all, this book reflects the current state of ball lightning research and will be of interest to scientists pursuing this problem.

## What we can learn from "The Myths of Relativity Theory"

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**A. A. Denisov.** The Myths of Relativity Theory. Lit. NII NTI, Vil'nyus, 1989 pp. 52.

Are the special theory of relativity (STR), modern relativistic theory of gravitation, or classical electrodynamics of relativistic particles really valid? It would appear that these questions, however reasonable early in this century, have been rendered obsolete by the many decades of experimental and theoretical research that have demonstrated convincingly the validity of the fundamental postulates of modern physics. And yet, although by now these postulates have become well-nigh classical, certain recent developments are compelling us to return to this ostensibly outdated issue.

Although the explosive current growth of social self-awareness in our country has been enormously beneficial, certain excesses were bound to occur. Thus, in recent times, astrologers and extrasensory perception practitioners have commanded more radio and television exposure than real scientists addressing real scientific matters. We have also witnessed ever more frequent attempts by insufficiently literate people to supplant the scientific worldview with crude "common sense", as well as heightened interest towards such "scientific sensations" as "unidentified flying objects" and "otherworldly phenomena". Among such recent developments we must, unfortunately, include the ignorant critique of relativity theory by A. A. Denisov in his booklet entitled "The Myths of Relativity Theory", published in a printing of 50 000 copies by the Lithuanian Scientific-Research Institute of Scientific and Technical Information in 1989.

Every individual has the inalienable right to hold personal opinions on scientific and other matters, even if these opinions contradict established facts. Clearly, scientific matters also require a certain competence in the subject. Unfortunately, the author's argumentation clearly indicates his superficial, to put it kindly, familiarity with the postulates of the theory he chooses to criticize. Not all individual opinions

deserve discussion in a scientific journal, especially opinions that are both incompetent and irresponsible. In this case, however, the author of the piece of sensational "debunking" is a professor at an institution of higher learning<sup>1</sup> whose word could carry weight with students. Furthermore, A. A. Denisov attacks a theory that is of fundamental significance to modern physics and of great practical and philosophical import. The theory of relativity underpins the modern physics of elementary particles, atomic and nuclear spectroscopy, nuclear engineering, and many other fields of physics and technology. The design of all modern particle accelerators is based on the results of STR. Because of the theory's fundamental importance, the basic ideas of STR have been incorporated into the physics programs not only of institutions of higher learning, but even of secondary schools. For all the above reasons, it is worth the effort to determine whether A. A. Denisov's "theory" is a revolutionary physical contribution or a misinterpretation of fundamental physical facts and concepts.

For the benefit of the reader unfamiliar with the booklet by A. A. Denisov, let us cite some of the author's basic precepts, which also provide a fair idea of his expository style and self-confident judgement:

"...The Lorentz-Einstein transformations of Cartesian coordinates underlying the Special Theory of Relativity do not satisfy the relativity principle despite the universal conviction to the contrary" (p. 4).

"...The canonization of the absurd postulate of the constant speed of light...was too hurried and unjustified" (p. 10).

"...In constructing his theory Einstein did everything to make these absurdities (*Reviewers' note*: relativistic mass increase, time dilation, length contraction) cancel each other and become an organic part of the theory. Moreover, if Lorentz still attempted to relate these effects to the influence of ether on moving objects, Einstein made them a consequence

of the subjective choice of the frame of reference, thereby rendering objective reality dependent on the observer's point of view.

In fact, no length contraction or other spatial deformation actually occurs. What we have instead is a particular methodological error in the techniques used to measure lengths and keep local time" (p. 15).

"...As for the universally derided ether, once local time is taken into account its existence not only agrees with the relativity principle and all types of physical experiments, but also is in full accord with the materialist worldview and with the common sense of anyone not deluded by the relativistic insanity" (p. 17).

And finally:

"Because of its evident practical success, the idealism implicit in relativity theory has weakened the stereotypes of vulgar materialism and thus prepared the ground for the dialectical-materialist paradigm in which information as a category is treated as equal and complementary to matter"<sup>2</sup> (p. 48).

The author's starting point is clearly expressed in the introduction: "After failing to master the obscure paradoxes of relativity theory in his youth, the author was compelled to develop his own theory of information..."

Apparently one of the inspirations behind the booklet has been the author's failure (or inability) to comprehend the ideas that form an integral part of a general physics course in an institution of higher learning. The fact that relativity theory is generally quite accessible is confirmed by the experience of first-year university physics students, the majority of whom successfully assimilate the material. Generally speaking, the analysis of the main ideas advanced in A. A. Denisov's booklet cannot be the subject of a scientific discussion because the material presented in the booklet does not satisfy the requirements of a *scientific theory* or even a *scientific hypothesis*. If a conscientious author publishes scientific materials with the aim of disproving the results of some theory, he must first have an elementary grasp of the basics of the criticized theory. It is precisely a complete misunderstanding of the elementary ideas and notions behind the formulae of relativity theory that has led our author into error and confusion. We stress once again, that these errors, absurdities, and "myths" have nothing to do with relativity theory, but everything to do with its misunderstanding by Professor A. A. Denisov. Let us cite a few concrete examples.

On p. 4 the author concludes that the Lorentz transformations violate the relativity principle because the spherical symmetry of a light wave is broken as one changes to a different frame of reference. In fact, nothing of the sort occurs. The confusion arises from the misapplication of the Lorentz transformation (the author ignores the relative nature of simultaneity and simply equates  $t$  and  $t'$  in two frames of reference).

On p. 5 the author "disproves" the postulate of the constant speed of light by calculating the speed using a distance interval from one coordinate system and the time interval from another. He is apparently unaware of the fact that speed is physically defined as the relation between distance and time calculated *in the same coordinate system*.

On p. 10 the author writes: "... Since any coordinate system is an artificial means of determining the position of an event, measurement information in a given coordinate

system can only propagate along the coordinate network, rather than directly towards the observer at the origin." From this he draws the astounding conclusion that in the rectangular coordinate system light traveling from the point  $(x, y, z)$  to the origin will traverse a distance  $x + y + z$ , while in the spherical coordinate system the corresponding distance will be  $\sqrt{x^2 + y^2 + z^2}$ . The absurdity of this argument is obvious, regardless of whether it is viewed as a statement of physics, information theory, or Euclidean geometry.

In any scientific field, and especially in physics which is based on reasonably precise quantitative relations, the validity of a given theory must be tested for at least three necessary conditions:

—the theory must explain the available experimental data;

—the theory (or concept) must predict new effects or phenomena that can be observed or reproduced experimentally;

—a new theory must reliably reproduce the results of preceding theories in applicable limiting cases (the principle of complementarity).

The "theory" of A. A. Denisov satisfies none of these conditions. Furthermore, it appears that the author is unaware of the seminal experiments corroborating the predictions of relativity theory and also unfamiliar with the experimental status of relativity today. Otherwise how can one interpret such statements (p. 14) as "Einstein simply discarded both absolute motion and ether, replacing the latter with the field, even though a field cannot exist without ether" (actually a field is just as much a physical reality and is just as successfully studied by scientists as matter) or "Einstein also deprived the special theory of relativity of its physical meaning", whereas it was precisely Einstein who discovered the physical meaning of the theory (the mathematical formulae of coordinate and time transformations were known already before Einstein). And how is one to understand the author's claim on p. 22 that low experimental precision (less than 8%) "has for decades saved the special theory of relativity from experimental repudiation". In fact<sup>3</sup> the effects of STR have been verified by atomic spectroscopy with relative precision of the order of  $10^{-6}$ , while in the determination of the electron's magnetic moment theory and experiment agree to eight significant figures.

On pp. 27–32 the author criticizes the electrodynamic formulae for the field of a moving point charge and concludes that "relativistic electrodynamics is a complete mystification". In fact the field structure and the magnitude of electromagnetic forces between rapidly moving particles have been verified in measurements of scattering processes, radiation, and creation of electron-positron and muon pairs. Granted, the measurement accuracy in such experiments is generally lower than in atomic spectroscopy, usually in the 10–20% range. Consequently, these experiments demonstrate agreement with the theory with the stated precision. The experimental results convincingly support relativistic electrodynamics, rather than the "theory" of A. A. Denisov according to which the cross-section of these processes for 1 GeV electrons would be smaller than the experimentally observed values by a factor of approximately  $[1 - (v^2/c^2)]^{-1/2} \approx 10^3$ .

A number of such inconsistencies in the booklet is rather large and not all can be addressed in this review. Still, the

above examples should suffice to acquaint the reader with the contents of Professor A. A. Denisov's "scientific treatise" which criticizes relativity theory from the standpoint of 19th century ideas.

We can only guess that A. A. Denisov came by his notions of relativity theory from scientific popularizations. Here it is appropriate to recall the words of the noted physicist L. B. Okun', who pointed out that books and articles intended to popularize science "paint a handwaving, very approximate and simplified picture of scientific theories and experiments (for no other is possible in popular books)... and hence may lead the reader to the false impressions of simplicity and complete understanding. The readers come to believe that scientific theories are random and arbitrary. In this way popular scientific literature is responsible for the flood of letters containing illiterate rebuttals and cardinal improvements on relativity theory, quantum mechanics, and particle physics ...".<sup>4</sup> Apparently Professor A. A. Denisov has fallen victim to the dilletantism described by L. B. Okun'.

Finally, we cannot avoid mentioning the low standard of scientific ethics exhibited by this booklet. Indeed, the publication of his ideas and theories did not require A. A. Denisov to criticize relativity theory, the more so as the author freely admits in the introduction his ignorance of this field. The vulgar expository style is symptomatic of the author's disrespect for his readers and for the scientists who developed the theories he attacks. Moreover, the numerous attempts in several chapters to present certain postulates of relativity theory as inconsistent with the philosophy of dialectical materialism, the groundless accusations of "Machism", "idealism", inability to think, and so forth directed at the founders of relativity theory—these are all reminiscent of the pseudoarguments by some of our "philosophers" of the late 1940's and early 1950's who had mobilized to unmask "reactionary Einsteinism". This impression is not dispelled by A. A. Denisov's afterword, in which he does

acknowledge certain successes by "the great physicist Albert Einstein", albeit with many reservations.

The special theory of relativity does not need our defense, nor does it require further experimental verification. It already permeates all branches of modern physics and has been amply validated experimentally. None of the contemporary physical fields, no matter how diverse their methods and subjects of research, has uncovered any discrepancy between STR predictions and experiment. But we would like to stress another aspect of this issue. The incompetent critique of relativity theory by Professor A. A. Denisov demonstrates that the familiarity of even university-level instructors with the foundations of modern physics is woefully inadequate. Surely this is a consequence of our failure to teach fundamental science in the institutions of higher learning. Yet without instruction in the fundamentals we can produce only unoriginal and poorly educated specialists. Clearly, the resulting toadying, incompetence and irresponsible mismanagement of the environment and modern technology have already cost us in such incompetent and economically harmful projects as Kara-Bogaz-Gol and Aral,<sup>5</sup> as well as the Chernobyl tragedy. Is all of this not an indication of continuing troubles in our institutions of higher learning?

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<sup>2</sup>The author modestly appropriates part of the credit for the creation of the paradigm and refers the reader to his booklet "Introduction to Information Systems Analysis" published by the Leningrad Polytechnical Institute in 1988.

<sup>3</sup>S. Drell, *Physica* **96A**, 3 (1979) [Russ. transl. *Usp. Fiz. Nauk* **130**, 507 (1980)].

<sup>4</sup>L. B. Okun', *Alpha, Beta, Gamma...Zeta: Elementary Introduction to the Physics of Elementary Particles* [in Russian], Nauka, M., 1985.

<sup>5</sup>Kara-Bogaz-Gol and Aral refer to the grandiose water diversion and irrigation schemes that have led to rapidly falling water levels in the Caspian and Aral seas and other ecological disasters [*Transl. note*].

Translated by A. Zaslavsky