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Review of *Spezielle und Allgemeine Relativitätstheorie für Physiker und Philosophen (Special and general theories of relativity for physicists and philosophers)* by J. Brandes und J. Czerniawski, Karlsbad 4th edition 2010

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Written largely by Jürgen Brandes, with a one-chapter contribution from Jan Czerniawski, this book is a profound and a technically in-depth representation of the „Lorentzian Interpretation of the theory of relativity“ (LI), which has thus far been recognised by only a few, and is set against the Einsteinian standard interpretation.

It is the latest stance in a „work in progress“, which since 1994 has now appeared in its 4th extended edition. The book captivates with its mathematically exact, and yet for the most part, generally comprehensible representation. It also impresses the reader with physically as well as philosophically transparent arguments and a wealth of ideas. It includes revisions of earlier approaches, new ideas and critical views also with regard to arguments within the Lorentzian camp (thus, for example, the claim of some Lorentz supporters on the difference between the one-way speed of light and average speed of light on closed paths is rejected on p. 75 and p. 107). Overall, the reader gains insights into a very lively and innovative research area and school of thought, beyond the mainstream. In addition, one also learns something through suitably selected and generally lesser-known quotes from Einstein and other researchers to underpin what has been stated (especially statements relating to LI in chap. 7). In light of these many positive features one can look beyond the fact that perhaps the one or the other formulation appears unclear, and several marginal errors in the text as well as in some formulas are noted. However, in none of these cases does it affect the correctness of the results and conclusions.

The remarkable and special feature of this book in comparison to other textbooks on the theory of relativity is that the topic of „The theory of relativity“ is dealt with more comprehensibly and more refined than usual. In this way, *physical* and *philosophical* aspects are simultaneously illuminated (chap. 11). It clearly differentiates between facts (cf. chap. 5 on experimental proof) and interpretations, and as the readers are introduced step by step into the theory of relativity they also learn about the two most important competing interpretations (LI and EI) of the theory of relativity. Although the authors clearly plead for the LI (cf. in summary chap. 12), they avoid one-sidedness and also present the EI fairly so that readers can form their own judgment. Finally, alongside the *special theory of relativity*, to which the standard representations of the LI are usually limited, the *general theory of relativity* and cosmology are also included (chap. 14 – 22). The extension of the LI to the general theory of relativity and cosmology is partly a new development of the LI, where the authors themselves play a significant role. This extension is based on the idea of Poincaré, that the abstract space-time curvature of the EI can be explained as the effect of a real benchmark distortion.

For the EI, absolute space and time lengths do not exist, and there is neither rest nor movement nor simultaneity in the absolute sense. For the LI however, all of these *do* exist because here the existence of a preferred absolute stationary reference system is postulated (even though this system cannot be detected through measurement). This postulate, a hallmark of the LI, is simply added to Einstein’s postulates, which do not have to be negated (compare chapter 6.6, 13 and 20), whereas the special feature of the EI is that it negates precisely this postulate. Both interpretations are in accordance with observations to date and can thus be counted as experimentally equal as already Sexl and Mansouri had ascertained in their “test theory of special relativity” (chap. 7.4). Experimental decisions for the one or the other theory are therefore not possible, or at least so it seems.

In the peripheral zone of the theory however, especially in its extension to the general theory of relativity and cosmology there are still experimentally testable differences between the predictions of both theories. And so it is shown that in applications of the general theory of relativity and cosmology, there are indeed principal experimental testable differences (chap. 21.2, 21.5, 24.8 and 24.11). Furthermore, in this relation, it is important that according to the LI (but not to the EI) forces arise in the Lorentz contraction, and that in the LI-version of the general theory of relativity (differently to the EI-version thereof) it is easy to explain energy conservation and

the negative Newtonian gravitational potential. Moreover, there are differences in the solution of the paradoxes, which in the LI often appear simple and thus convincing, whereas based on the EI, there are sometimes different (and mutually exclusive) solutions provided.

Generally known and also lesser known paradoxes and their solutions are also illustrated here in detail: the paradoxes of Bell (9.3 and 24.3), Wood (10.3), Ehrenfest (10.5), Sagnac (10.7) and generally the problem of circular accelerating bodies (chap. 9.4 and 24.1.3) as well as the Garage and Lid paradox (10.2 and 10.4). The best known of these is the clock or twin paradox (chap. 10.8) presented with different solutions in particular detail.

Of special interest for the debate between philosophy and the natural sciences are the “philosophical contributions” of EI and LI in chapter 11, where various aspects of the phenomenology of times are discussed and various interpretations are developed with regards to the Minkowski space, the Ether concept and the interpretation of physical quantities in EI and LI. Lastly, philosophical reflections are also relevant here because the two interpretations had been mainly philosophically motivated by Einstein and Lorentz.

Also enlightening is chapter 8, written by Czerniawski, where initially a general kinematic transformation formula is deduced from four plausible assumptions. Remarkably, the linearity of the formula does not belong to the presupposed assumptions, but is the result thereof. Depending on the specification of certain parameters, the general transformation formula goes across into the non-relativistic Galilean transformation or the relativistic Lorentzian transformation. The addition of two further assumptions, namely Einstein’s principle of relativity and the principle of the constancy of the speed of light then ensures the accuracy of the Lorentz transformation. Czerniawski defends the absolute reality of relativist effects and distances himself from more radical critics of Einstein, who, for example, deny Einstein’s postulates. He believes that the actual core of the LI is the postulate of non-invariant, absolute sizes and a thereby related privileged reference system. In favour of this postulate, Czerniawski points to the experience of time flow and the correspondence principle (whereby a newer physical theory is meant to include the old theory as a special or extreme case). Czerniawski believes this principle is violated if one sees the Minkowski timespace as real, as it appears in the EI; because in this timespace there is no element that corresponds with the absolute time of the non-relativist physics.

Czerniawski finally differentiates a material ether (whose existence is hypothetical) from the “protophysicist” geometric ether, required by LI, which is identical with the special frame of reference. Should a material ether exist, one can view it as the special frame of reference in this ether resting frame of reference. Otherwise, with regard to clocks, one can determine absolute simultaneity through suitable adjustments free from the influence of gravity and movement, and define a special reference system through the Weltlinien, which run orthogonally to the hyper levels of absolute simultaneity.”

All in all this book can be recommended to philosophers of science and expert physicists, but also to all those laypersons interested in a modern physical view of the world. Also those who are critical of the stance of the authors will be able to profit from reading it because the facts and arguments laid down here can certainly also provide food for thought in many aspects, and is definitely suitable for broadening the horizons of the reader.