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The Ritz-Einstein Agreement to Disagree

3. THE WAR

During 1908 and 1909 Ritz and Einstein had a war that started over the failure of Maxwell-Lorentz electromagnetic theory to handle blackbody radiation, i.e., the ultraviolet catastrophe.(10),(11) Ritz took to the offensive, arguing from his 1908 theory, which he claimed allowed us to hold on to our hard-won ideas about space and time, while Einstein defended the new ideas that eventually overthrew classical physics and banished physical intuition in the relativistic arena. Ritz claimed in the third paper of the series,(12) that by mathematically reversing the direction of time, i.e., by switching to the advanced potential, you actually invoke a different kind of physical process and do not simply arrive at the equivalent of the retarded potential acting in reverse time sequence. The same argument, in quantum mechanical notation, has been recently revoiced by Leiter.(13)

Ritz and Einstein's final written communication in this battle was a joint paper (14) that has the appearance of having been forced upon them by the editorial staff of *Physikalische Zeitschrift*. The paper is their *agreement to disagree*.

The appendix to the present paper is a translation of the Ritz-Einstein paper so English-speaking readers can study a unique memento from a critical turning point in the world of science. One point of ambiguity in the paper needs comment. It is not clear, based on the terse German text, to which case Einstein is saying one can restrict oneself. It appears to be either: using both retarded and advanced potentials on equal footing or restricting our considerations to electromagnetic processes confined to a finite space. My sketchy peek at the earlier papers (through a translator) favors the first case.

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The series of exchanges, including this paper, has been summarized by Fox (5b) and Lanczos.(15) Table 1 shows, side by side, their thumbnail abstracts of the series. Note that [...] Lanczos curiously misrepresents the import of the joint paper. He has Einstein apparently admitting that he had been wrong to defend the use of advanced potentials. Actually, although neither author admitted any mistake, many present-day authors are expressing the idea that the *viewpoint* that Einstein defended is becoming untenable.(13), (16) - (22)

4. SECOND THOUGHTS?

Einstein, in later years, may have had second thoughts about irreversibility, but because of his revered position with respect to the geometrodynamics paradigm was probably prevented from expressing them publicly. We do have three glimpses into his private leanings on the subject. In 1941 he called Wheeler and Feynman's attention to Ritz's (1908) and Tetrode's (1921) time asymmetric electrodynamic theories. [This was while Wheeler and Feynman were laying the groundwork for their less than successful (1945) time-symmetric *absorber theory*, (23) which was really *emission/absorber theory*, with a lot of help from the future. They could not embrace time asymmetry, but Gill(24) now proposes to revitalize absorber theory by creating a generalized version *without* advanced interactions.] Two pieces of Einstein's private correspondence touch indirectly on the subject of time asymmetry.(25) In these letters Einstein expresses his growing doubts about the validity of the field theory space continuum hypothesis and all that goes with it.

Since time symmetry is intimately tied to the space continuum, if the latter falls, the former may well follow. Lanczos's slip of the pen may be accidental but, nevertheless, could be indicative of Einstein's feelings on this subject in his final years.

5. CONCLUSIONS

Except for the growing consensus about the asymmetry of the arrows of time, we might have concluded that the battle between Ritz and Einstein was a moot point and should be forgotten. The current paradigm says that Einstein prevailed, but many of us never heard of the battle, nor of Ritz's electrodynamics. If an earlier court gave the decision to Einstein, it did so by default. Ritz, at age 31, died 7 July 1909, two months after the joint paper was published.

The world of science of Ritz's day seems to have been so grateful to Maxwell, Lorentz and Hertz for rescuing it from the clutches of instantaneous action-at-a-distance (through empty space) that it couldn't bring itself to entertain any hypothesis that sounded even remotely like the "old" action-at-a-distance. Thus Ritz's electrodynamic theory was bundled up and tucked away after a short but respectful period following his death.

If science cannot prove the existence of a microscopic symmetrical time arrow (Heisenberg's uncertainty principle says we cannot do it), then we may eventually find ourselves using more and more of Ritz's conceptions and giving credit where credit is due. As a minimum, Ritz's (1908) criticism of electromagnetic field theory needs to be subjected to a modern reevaluation.

Acknowledgement

My thanks to [Bryan G. Wallace](#) of St. Petersburg, Florida, for calling my attention to the Einstein letters in Pais's book, *Subtle is the Lord ...* .

APPENDIX: ENGLISH TRANSLATION OF AGREEMENT TO DISAGREE(14)

In order to clarify the difference in opinion that has arisen in our separate publications (1) we present the following.

In the special cases in which an electromagnetic process *stays confined in a finite space*, it is possible to represent the process not only in the form

$$f = f_1 = \frac{1}{4\pi} \int \frac{\varphi(x', y', z', t - r/c)}{r} dx' dy' dz'$$

but likewise in the form

$$f = f_2 = \frac{1}{4\pi} \int \frac{\varphi(x', y', z', t + r/c)}{r} dx' dy' dz'$$

While Einstein believes it to be possible to restrict oneself to this case [both forms] without *essentially* limiting the generality of the consideration, Ritz considers this restriction as *in principle* not allowed. If one takes the position that experience compels the representation with aid of the retarded potential as the only possibility to consider, and supposing one is inclined to the view that the fact of irreversibility of the radiation process is already in the basic laws, its expression has to be found. Ritz considers the restriction to the form of the retarded potential as one of the roots of the second law [of thermodynamics] while Einstein believes that irreversibility depends exclusively upon reasons of probability.

Zurich, April 1909

Received on 10 August 1989.

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Résumé

En 1908 et 1909 Ritz et Einstein se querellaient sur ce que nous appelons maintenant les flèches de temps d'électrodynamique et entropie. Ritz soutenait que l'irréversibilité électrodynamique était à la racine de la deuxième loi de la

thermodynamique tandis qu'Einstein défendait la symétrie de temps de l'électromagnétisme de Maxwell-Lorentz. La microréversibilité demeure un fondement de notre paradigme courant, toutefois nous trouvons de plus en plus des preuves que les flèches de temps mises en évidence expérimentalement sont asymétriques et toujours du passé vers le futur. Cet article fournit quelques commentaires sur les événements qui menèrent à la querelle susdite, quelques développements ultérieurs et une traduction en anglais de leur accord sur le désaccord. Une comparaison directe de deux sommaires récents de leur bulletins de bataille est inclus afin que le lecteur puisse avoir un aperçu de ce qu'ils avaient à dire à ce sujet toujours actuel.

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