Sauer, Tilman
Einstein equations and Hilbert action: what is missing on page 8 of the proofs for Hilbert’s first communication on the foundations of physics? (English) Zbl 1080.01007

Hilbert’s First Communication on the Foundations of Physics was first presented to the Göttingen Academy of Sciences on 20th November 1915, while Einstein’s The Field Equation of Gravitation was presented to the Berlin Academy of Sciences on 25th November 1915. Hilbert and Einstein arrived at the final gravitational field equations by different methods. It was pointed out in 1997 that proofs for the above mentioned paper of Hilbert are to be found in Hilbert archives in Göttingen, as well as that a portion of one sheet of the proofs of Hilbert’s First Communication is missing.

The author briefly discusses events related to these publications and addresses the question as to what could have been on the missing part of the manuscript. His conclusion is that the missing piece contained the explicit form of the Riemann curvature scalar in terms of the Ricci tensor as a specification of the axiomatically undetermined Lagrangian in Hilbert’s action integral. An alternative hypothesis already in circulation is examined: Whether the missing piece could have contained the explicit form of the variational derivative for some gravitational Lagrangian $K$. Specifically under the assumption that $K$ was defined or characterized as the Riemannian curvature scalar, it would then have displayed what is now called the Einstein tensor with its trace term $Kg_{\mu\nu}/2$. The author argues, by analyzing the internal logic and structure of both the proofs and Hilbert’s published paper that this is highly unlikely (in addition to having to physically fit too much material on the small missing piece of the proofs). The author suggests still some other questions.

Reviewer: Radoslav M. Dimitrič (Uniontown)

MSC:
01A60 History of mathematics in the 20th century
01A70 Biographies, obituaries, personalia, bibliographies
01A85 Historiography
83C05 Einstein’s equations (general structure, canonical formalism, Cauchy problems)

Keywords:
Hilbert’s variational principle; Einstein’s equivalence hypothesis; Riemann’s curvature scalar; Ricci tensor; action integral; coordinate restrictions

Full Text: DOI

References:


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