Einstein Unites Gravity and Electricity

Physics

By PAUL R. HEYL

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Since the days of Maxwell, over fifty years ago, we have had a mathematical theory of electricity and magnetism due to Maxwell which gives a fairly satisfactory account of the principal electrical and magnetic phenomena. And since Einstein published his general theory of gravitation, now some twelve years ago, we have had a similar mathematical theory for gravitational phenomena. These two theories bear no apparent resemblance to each other.

Now it is a physical fact that gravitation bears a close resemblance to electric and magnetic attraction in that all these forces act according to the inverse square of the distance, and there has been for many years a branch of mathematical physics (Theory of Potential) which handles the elementary phenomena of gravitation, electricity and magnetism by the same identical mathematical treatment. This theory, however, cannot go far, as there is one important feature in which gravitation differs from electricity and magnetism. There is no screen or insulator for gravitation.

Einstein seems to have developed a general mathematical theory for all three of these physical manifestations which includes as special cases Maxwell equations and his own gravitational theory, and automatically provides for the important difference above mentioned—the absence of a screen for gravitation.

The idea is this: Maxwell's equations describe the electromagnetic phenomena, insulation and all; Einstein's relativity theory describes gravitation equally well, including the lack of insulation. In his present paper he has established a common ancestor for these two theories. Like many cases of two sons of the same father, these two theories differ in important traits.

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Two Earlier Papers

The mathematical paper just published by Prof. Albert Einstein by the Prussian Academy of Sciences in Berlin, and heralded throughout the world, is actually the third of a series of short theoretical communications by the great physicist.

As important as the last are two earlier ones. They both appeared in the June 14, 1928, issue of the "Sitzungberichte der Preussichen Akademie der Wissenschaften" ("Proceedings of the Prussian Academy of Sciences"). This is the same journal that has published the new paper.

The first one is entitled "Riemann-Geometrie mit Aufrechterhaltung des Begriffes des Fernparallelismus" ("Riemann Geometrie with the Introduction of the Concept of Distant Parallelism"). It contains sections on "n-Leg Field and Mensuration", "Distant Parallelism and Rotational Invariants" and "Invariants and Covariants." Though only consisting of five pages, it is highly mathematical and gives ten equations.

The second paper, in the same issue, is called "Neue Möglichkeit für eine einheitliche Feldtheorie von Gravitation und Elektrizität" ("New Possibility for a single Comprehensive Field Theory of Gravitation and Electricity"). This occupies only three and a half pages, but is also highly mathematical and includes a sub-section on "The Field Law and Its First Approximation." Nine equations are developed.

Even those working along parallel lines with Einstein will require days of careful and detailed analysis of his formulae and equations in order to obtain the full import and meaning of his new papers.

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