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Minkowski's Road to Space-Time, and its Consequences and an Alternative FELIX T. SMITH, retired — The road from Maxwell's equations to early relativity and then to Minkowski's space-time is traced through his Göttingen lecture in 1907 and his paper in 1908 that introduced the 4-dimensional tensor form of electrodynamics. This led to a puzzle: What is the reason for the time dependence in its position space geometry shown in the metric sum $ds^2 = dx_1^2 + dx_2^2 + dx_3^2 - c^2 dt^2$? Having no physical explanation for this, Minkowski made the drastic move of enlarging 3-space into 4-dimensional space-time, advocating it powerfully in his paper "Space and Time" (1909). I will discuss the circumstances that led to its rapid acceptance (but not by Poincaré), and its consequences that emerged much later in the partial disconnect between relativity and the other domains of modern physics. Much later still, the Hubble expansion of our cosmos can now be shown to imply that the term $-c^2 dt^2$ is a direct concomitant of an expanding, negatively curved 3-space and does not require either a 4-dimensional space-time or multiple time dimensions for multiple particles.

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