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Emergence and Interpretation of Lorentz Invariance

MICHEL JANSSEN, University of Minnesota

In the course of his work on optics and electrodynamics in systems moving through the ether, the 19th-century medium for light waves and electric and magnetic fields, Lorentz discovered and exploited the invariance of the free-field Maxwell equations under what Poincaré later proposed to call Lorentz transformations. To account for the negative results of optical experiments aimed at detecting the earth's motion through the ether, Lorentz, in effect, assumed that the laws governing matter interacting with light waves are Lorentz invariant too. Like Lorentz, Einstein first encountered the Lorentz transformations in electrodynamics. Unlike Lorentz, however, for whom the transformation merely provided convenient mathematical substitutions, but like Poincaré, Einstein recognized that the Lorentz- transformed quantities are the measured quantities for the moving observer. More importantly, Einstein recognized that the Lorentz invariance of all physical laws had nothing to do with electrodynamics per se, but reflected the kinematics in a new relativistic space-time, to be named after Minkowski who worked out its geometry a few years later.