

the relativity of hyperbolic space

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Abstract

Paths of shortest length, or geodesics, may not appear as straight lines because acceleration creates distortion. For spaces of constant curvature there are only two possibilities: Either rulers get longer as they move away from the origin or they shrink. Because the longitudinal Doppler shift corresponds to the measure of distance, in velocity space, this space is hyperbolic, corresponding to the second of the two possibilities. Transformations from one inertial frame to another are related to geometrical rigid motions. The square root of the Doppler shift is related to transformations of uniformly accelerated frames. Applications to general relativity and cosmology are given including the time-velocity metric of the Friedmann universe of dust at zero pressure, Hubble's law and the exponential red-shift.

Keywords: hyperbolic geometry, Doppler shift and cross ratio, uniformly accelerated systems

Subjects: [Specific Sciences: Physics: Relativity Theory](#)

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