

Uniqueness of Simultaneity

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Abstract

I investigate the question of existence and uniqueness of simultaneity structures in spacetimes whose automorphism group, Aut , is either the inhomogeneous proper orthochronous Galilei or Lorentz group. An absolute simultaneity structure is defined as Aut -invariant equivalence relation whose equivalence classes are acausal sets. It is unique for Galilean and non-existent for Lorentzian spacetimes. Simultaneity relative to some additional structure X on spacetime is defined analogously, where Aut is now replaced with the stabilizer subgroup of X in Aut . It turns out that Einsteinian simultaneity is unique if X is an inertial frame (foliation by timelike straight lines). Finally I discuss the relation to work of others.

Keywords: relativity, simultaneity, conventionalism

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

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