

Symmetries and Orbit Theory in 4-dimensional Lorentz Manifolds

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In a 4-dimensional Lorentz Manifold (M, g) , symmetries are often described by a finite dimensional Lie algebra A of vector fields. The associated distribution $\Delta : m \rightarrow \Delta(m) = \{X(m) : X \in A\}$ is integrable with a natural orbit structure generated by the local flows of members of A . Usually the symmetries involved are the symmetries or conformal symmetries of the Lorentz metric g or the affine or projective symmetries of its associated Levi-Civita connection. (Other symmetries may also be considered but then A may not be finite-dimensional). In studying the orbits of A , concepts of stability and dimensional stability will be introduced. A general review of the theory will be given and, in particular, the application to the study of symmetry in general relativity theory.