Abstract

We propose an action for a free particle in Horava-Lifshitz gravity based on Foliation Preserving Diffeomorphisms. The action reduces to the usual relativistic action in the low energy limit and allows for subluminal and superluminal motions with upper and lower bounds on velocity respectively. We find that deviation from general relativity is governed by a position dependent coupling constant which also depends on the mass of the particle. As a result, light-like geodesics are not affected whereas massive particles follow geodesics that become mass dependent and hence the equivalence principle is violated. We make an exact study for geodesics in flat space and a qualitative analysis for those in a spherically symmetric curved background.