Plan

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My research thema is Ricci solitons and Algebraic solitons. My plan is as follows

(1) **Lorentzian algebraic soliton (nil-soliton) on (2-step) Nilpotent Lie group**

I will consider Lorentzian nil-soliton on (2-step) Nilpotent Lie group, and metric solvable extension.

The study of Riemannian nil-solitons on (2-step) Nilpotent Lie groups is investigated. I will study in pseudo-Riemannian settings. The point at issue is that Lorentzian Lie groups have many left-invariant metric. For example, the 3-dimensional Heisenberg group admits only one left-invariant Riemannian metric up to isometry and scaling. However it admits only three left-invariant Lorentzian metrics up to isometry and scaling.

Next, I will consider a metric solvable extension of a Lorentzian nil-soliton. In the Riemannian case, it is known that a metric solvable extension of Riemannian nil-soliton has an Einstein metric. I will study in pseudo-Riemannian settings. In [3], I consider a sol-soliton on Oscillator group, and the metric solvable extension. I proved that the metric solvable extension of a sol-soliton on Oscillator group is not Einstein.

(2) **Ricci solitons on 4-dimensional Walker manifolds**

W. Batat et. al studied Lorentzian rigid Ricci soliton. They proved that there exist homogeneous non-rigid Lorentzian Ricci solitons on a Walker manifold. This leads to new examples of Lorentzian locally conformally flat Ricci solitons without Riemannian analog.

I will study Ricci solitons on 4-dimensional Walker manifolds with Professor Batat. Some researcher study 4-dimensional Walker metrics. We will use their results.