Contribution ID: **447** Type: **Invited talk in the parallel session**

Finite Action Principle and the beginning of the universe in Horava-Lifshitz gravity

Wednesday, 7 July 2021 12:10 (20 minutes)

The path integral approach yields a powerful framework in the quantum theory. It emphasizes Lorentz covariance and allows for the description of non-perturbative phenomena. In the path integral, one sums over all possible configurations of a field(s) Φ weighted by $e^{iS[]}$, where S[Φ] is the classical action of the theory. In the Minkowski path integral, the classical action approaching infinity causes fast oscillations in the exponential weight and hence the destructive interference of the neighboring field configurations. Such configurations do not contribute to the physical quantities. Furthermore, in Wick rotated path integral is weighted by $e^{S[]}$, and the field(s) configurations on which the action is infinite do not contribute at all. This provides theoretical motivation for the Finite Action Principle, saying that an action of the universe should be finite. This principle has a significant impact on the nature of quantum gravity and the cosmological evolution, once the higher-curvature terms are included. In the framework of Horava-Lifshitz gravity, field configurations with finite classical action describe a flat universe with a homogeneous and isotropic beginning without the ghost particles.

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Session Classification: Hořava–Lifshitz Gravity

Track Classification: Alternative Theories: Horava-Lifshitz Gravity