Geodesic completeness, cosmological bounces and inflation

Yunke Zhao

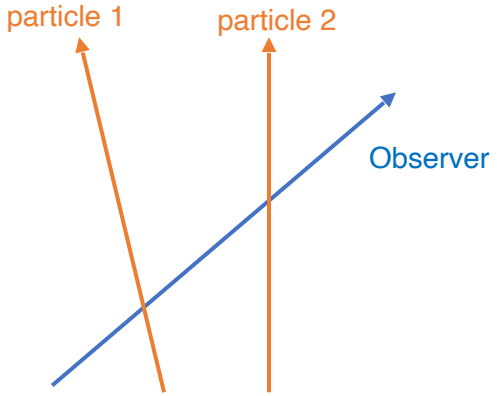
Department of Physics, Southern University of Science and Technology, Shenzhen 518055, China

03/12/2025 @ Inflation 2025

Based on **2405.04062**, in collaboration with Sebastian Garcia-Saenz and Junjie Hua.

Generalized Hubble Parameter

$$H(\lambda) \equiv \frac{v_\mu v^\nu \nabla_\nu u^\mu}{v^2 + \gamma^2}$$



Borde-Guth-Vilenkin (BGV) Theorem

$H_{av} > 0 \longrightarrow$ Past-incomplete

Complete FLRW Spacetime

Bouncing Universe

Borde, Guth, and Vilenkin (2004)

BGV Theorem contains a subtle loophole!

Easson and Lesnefsky (2023)

$H_{av} > 0$ ⟶ Past-incomplete

Garcia-Saenz, Hua, and **Zhao** (2024)

$$\dot{a}(t) = \sum_{n=1}^{\infty} e^{-n^4(t+n^2)^2}$$

Past-complete but has no bounce

Past-complete FLRW spacetime
$H(t_0)>0$ ⟶ exhibit a phase of accelerated expansion

Thank you!