Revisiting Cluster Decomposition in de Sitter

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Motivation

The aim of our research is to investigate
cluster decomposition in de Sitter space with respect to
unitary irreducible representation categories of de Sitter group.

Cluster Decomposition

Cluster Decomposition Principle

Experiments done in distant laboratories should be uncorrelated.

- In Minkowski space, cluster decomposition is manifested as analytical conditions on the S-matrix. [Weinberg '95]
- In curved spaces, its imprint is the power law decay of the two point function at large distances in the late time limit. [Benincasa '22]

UIRs of $SO(4,1)$

- Principal Series
- Complementary Series
- Discrete Series
- Exceptional Series

$$\Delta_{\pm} = \frac{d}{2} \pm \nu$$

What we have done so far

$$\langle \Phi(x)\Phi(y)\rangle_{discrete} \supset log|x-y| \qquad (s=0, m=0)$$

$$\langle \Phi(x)\Phi(y)\rangle_{principal} \supset \frac{1}{|x-y|^{2\Delta_+}}, \frac{1}{|x-y|^{2\Delta_-}} \qquad (s=0, m^2 > d^2H^2/4)$$

Work to be done

- Distance distribution in state space of a massless scalar field exhibits an ultrametric structure. [Anninos, Denef '12].
- Their analysis is extended to massive fields in [Roberts, Stanford '13] and we want to understand better its implications for the principal series.