



Contribution ID: 8

Type: **not specified**

Quantum Gravity from Timelike Liouville

Wednesday, 23 January 2019 11:45 (30 minutes)

The Euclidean path integral of quantum gravity has long resisted a proper definition because the kinetic term for the conformal factor of the metric comes with an additional minus sign. We propose a definition of two-dimensional quantum gravity with a cosmological constant based on the conformal bootstrap results of timelike Liouville theory coupled to matter. For the spectrum, we prove a no-ghost theorem for the states in the BRST cohomology. We then show that the crossing symmetric four-point function constructed by gluing the timelike DOZZ three-point function with the Ribault-Santachiara contour for internal momenta, is well-defined when the external momenta are continued to correspond to the physical states in the BRST cohomology.

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