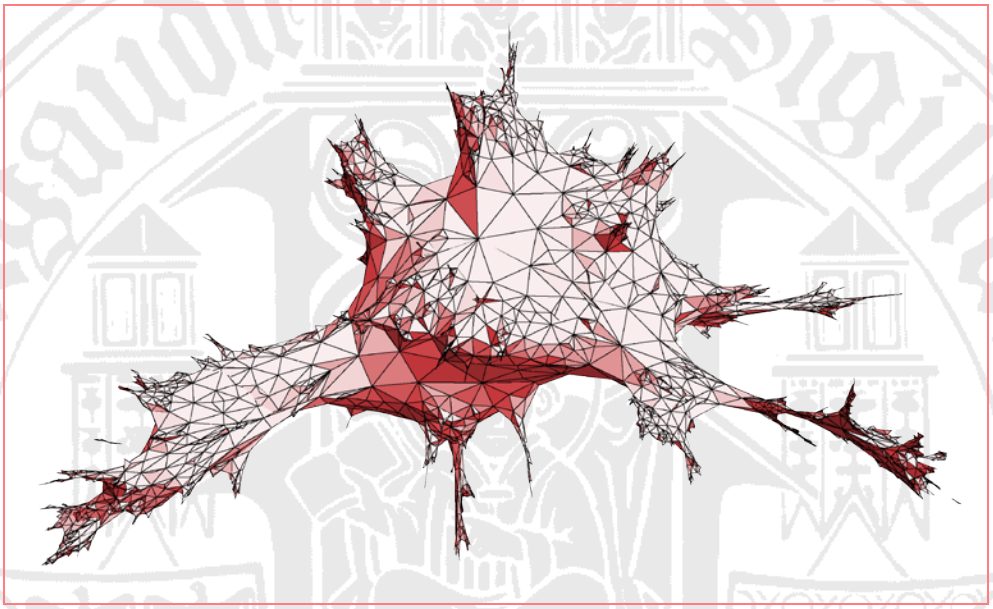
UNI FREIBURG
Physikalisches Institut
Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg

# PHYSIKALISCHES KOLLOQUIUM

AM 13. JUNI 2016 UM 17 UHR C.T.

IM GROßEN HÖRSAAL



## QUANTUM GRAVITY FROM CAUSAL DYNAMICAL TRIANGULATIONS (FOR THE UNINITIATED)

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A holy grail of high-energy physics is the search for quantum gravity, the fundamental quantum theory underlying Einstein's classical theory of general relativity, including a description of gravitational interactions and the structure of spacetime at the ultra-short Planck scale. After briefly reviewing the motivation and state-of-the-art of the subject, I will introduce Causal Dynamical Triangulations (CDT), a nonperturbative path integral method for constructing a fundamental theory of quantum gravity. It is based entirely on the use of good old quantum field theory, applied to the situation where spacetime geometry is dynamical, and not part of a fixed background.

I will describe the ingredients and computational implementation of CDT quantum gravity and highlight some of the remarkable results obtained in this approach. These include the statistical model's phase structure, the emergence of semiclassical geometry from nonperturbative quantum configurations, the counterintuitive phenomenon of dimensional reduction near the Planck scale and the applicability of standard renormalisation group methods. I will attempt to assess what these findings tell us about the nature of quantum spacetime and nonperturbative formulations of quantum gravity in general.