Abstract Submitted
for the APR18 Meeting of
The American Physical Society

Gravitational thermodynamics of causal diamonds[1] TED JACOBSON, Univ of Maryland-College Park, MANUS VISSER, University of Amsterdam
— A maximally symmetric causal diamond is a solution to Einstein's equation with a cosmological constant. We establish a "first law", analogous to the first law of black hole mechanics, for variations to nearby solutions. It relates the variations of the bounding area, spatial volume of the maximal slice, matter Hamiltonian, and cosmological constant. The Hamiltonian is the generator of evolution along the conformal Killing flow that preserves the diamond. It is the same as the generator of York time (mean curvature) flow orthogonal to the maximal foliation, and its gravitational part is the spatial volume of the maximal slice. To interpret this first law as a Clausius relation, $\delta S = \delta Q/T$, it appears necessary to assign a negative temperature to the diamond, as has been suggested previously for the special case of the static patch of de Sitter spacetime. We discuss arguments pro and con for this negative temperature.

[1]Partially supported by the National Science Foundation under grants No. PHY-1407744 and PHY-1708139

Theodore Jacobson
Univ of Maryland-College Park

Date submitted: 12 Jan 2018 Electronic form version 1.4