Contribution ID: **9**   Type: **not specified**

Forgotten modular bootstrap equations and 3d quantum gravity

Friday, 13 December 2019 09:30 (15 minutes)

The modular bootstrap program for two-dimensional conformal field theories could be seen as a systematic exploration of the physical consequences of consistency conditions at the elliptic points and at the cusp of their torus partition function. The study at $\tau = i$, the elliptic point stabilized by the modular inversion S, was initiated in 2009 by Hellerman, who found a general upper bound for the most relevant scaling dimension Δ_0. Likewise, analyticity at $\tau = i\infty$, the cusp stabilized by the modular translation T, yields an upper bound on the twist gap, whereas to date
the study at $\tau = \exp[2i\pi/3]$, the elliptic point stabilized by ST has been neglected.
Here I found a far stronger upper bound in the large-c limit which is remarkably close to
the minimal mass threshold of the BTZ black holes in the holographic dual $3d$ gravity. Even a modest improvement could push Δ_0 down this threshold, implying that
pure Einstein gravity do not exist as a quantum theory.

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Session Classification: Session 9