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Geometric microstates for the three dimensional black hole?

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We study microstates of the three dimensional black hole obtained by quantizing topologically non-trivial geometries behind the event horizon. In chiral gravity these states are found by quantizing the moduli space of bordered Riemann surfaces. In the semiclassical limit these microstates can be counted using intersection theory on the moduli space of punctured Riemann surfaces. We make a conjecture (supported by numerics) for the asymptotic behaviour of the relevant intersection numbers. The result is that the geometric microstates with fixed topology have an entropy which grows too slowly to account for the semiclassical Bekenstein-Hawking entropy. The sum over topologies, however, leads to a divergence. We speculate about how this might be resolved to give an entropy proportional to horizon area. We conclude by generalizing these results to wormhole geometries used to describe multipartite entanglement.

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