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Einstein Gravity as a Disorder Averaged CFT

A CFT is defined by a spectrum of operators and a set of coupling constants, the operator product expansion coefficients. These data are subject to consistency conditions – the conformal bootstrap constraints – which, if solved, would provide a complete classification of all CFTs. But solving the conformal bootstrap problem is hard. So, I will explore an easier problem, where these data are viewed as random variables in a two-dimensional CFT with quenched disorder. We can then find an “averaged” solution to the bootstrap problem, which obeys the consistency conditions up to exponentially small corrections. This ensemble of two dimensional CFTs has a remarkable interpretation in the limit of large central charge: it is general relativity in three dimensional Anti-de Sitter space. This sheds light on recently discussed connections between black holes, wormholes, chaos, and the dynamics of disordered systems.