Scale vs Conformal Invariance from Entanglement Entropy

Abstract: For a generic conformal field theory (CFT) in four dimensions, the scale anomaly dictates that the universal part of entanglement entropy across a sphere (Cuniv ($S2$)) is positive. Based on this fact, we explore the consequences of assuming positive sign for Cuniv ($S2$) in a four dimensional scale invariant theory (SFT). In absence of a dimension two scalar operator O2 in the spectrum of a SFT, we show that this assumption suggests that SFT is a CFT. In presence of O2, we show that this assumption can fix the coefficient of the nonlinear coupling term $\int d4xg\sqrt{R}$O2 to a conformal value.