Report

This is an interesting paper that discusses entanglement entropy computations in BCFTs in states corresponding to a local quench, i.e. states where a boundary local quasi-primary operator is located at $t = 0$. The main object of consideration is the entanglement entropy of a semi-infinite interval and its time dependence. This is computed thanks to a three-point function in a BCFT, which is a function of a single cross-ratio and the authors first study the convergence of the OPE. They then study various OPE limits, including early and late times where the OPE is dominated by the lightest operator in the theory. Using the positivity of relative entropy, they prove a bound on the entanglement entropy and study various particular cases, going from the Ising model to holographic CFTs. Finally the authors provide holographic computations in gravity coupled to end-of-the-world branes and compare to the CFT calculations finding agreement when needed. The paper is well-written, clear and easy to follow, in particular thanks to the multiple figures the authors have included. I would be happy to recommend this paper be published in Scipost. There are however a few minor issues that the authors should address first:

- Using the positivity of relative entropy, the authors find a universal bound for the behaviour of the entanglement entropy, equation (4.12). At early and late times, the entanglement entropy is dominated by light operators, and the bound constrains the contribution of the lightest operator. Can the authors comment on the gravitational interpretation of (4.12)?

- There are various aspects of section 5 that are confusing. First, the operators declare that the operator O has a dimension that scales with c. Above (5.7), then the authors claim that the operator O is single-trace and corresponds to a particle in the bulk. The two statements are not compatible. Either O is light and creates a particle, or O is heavy and there is no notion of single-trace vs multi-trace.

- Another confusing aspect of section 5 is that the authors are working out the geometry dual to the particular state at hand. It is far from clear that geometry alone is sufficient information to really describe the state, because the state is more like a black hole microstate rather than a coherent state which would truly be described by a semi-classical geometry. I believe the authors are building a geometry solely from the expectation value of the stress-tensor in the state they consider. To be clear, I think the results of the authors are correct, but they should add clarifying statements stating that the geometry they are writing down is sufficient to capture the relevant properties of the states at hand only for simple enough probes, and to leading order in c. In particular, I imagine what they have in mind is that the CFT calculation including only the identity block is equivalent to computing the entanglement entropy with the RT formula on the background that they work out.

- The inequality above (5.49) is confusing. Do the authors mean $\Delta \sim c$?, i.e. $\Delta/c \sim \mathcal{O}(1)$?

- Finally, the authors could have done a better job with referencing earlier literature. A lot of the technology they use to compute the entanglement entropy, including the uniformization map that maps to a $2n$-point function, was done for ordinary CFTs in 1101.2881. In some sense, the authors provide a BCFT generalization of these results. In the context of holography, the papers 1603.03057 in 2d and 1611.02959 in higher dimensions also seem particularly relevant for the computation of relative entropy and the use of the same conformal mappings the authors use, as well as the relevant OPE expansions (for example, (3.39 is derived there). Again, the authors provide a BCFT generalization. Finally, the authors refer to [5] for the case where the scalar is light. While [5] did consider the case of a local quench, the holographic dictionary for the light scalar was setup in 1805.08782 and more recently in 2107.07516. I believe all these papers are worth mentioning.