Quantum Gravity and Black Holes: Questions on Lectures 20-21-22

April 5, 2016

1 Lec.20

1. Why does the RG flow end on CFTs?

2. Can we clarify again the distinction between a 'scale-invariant' theory and a 'conformal' theory?

3. So RG flow has to do with T=0 QFTs. What happens if we consider finite temperature theories?Do they flow as well and what is different there?

4. Is it possible to have 2 (or more) QFTs in d=2 with the same dofs as one QFT in e.g. d=4? Example?

5. Why are we associating r (interval length) with the RG scale? Is this somehow related with the coordinate z in the dual AdS picture or is it irrelevant?

6. (x2) I don't understand why 20.16 is true / Figure out which interval is what length.

7. I tried to obtain 20.17 but I couldn't so can we do it?

8. He says that *"In the vacuum state the EE can depend only on the proper length of the region..bla bla"*. What happens in excited states? Do we need to consider excited states and if yes, does the Casini-Huerta argument still hold?

9. How should I view Figure (20.27)?

2 Lec.21

1. I just notice that now, but the vacuum is dual to only a part of AdS (Poincare patch) so what is dual to the entire spacetime?

2. (x2) When going from 21.12 to 21.14 he seems to take the factor of L_A into the central charge but in c isn't it the AdS length and not the length of the interval? / It looks like the result (21.14) takes $L_A = \ell_{AdS}$. Why so?

3. How should I view (21.20)?

3 Lec.22

1. Is it obvious that 22.5 describes the geodesic for big R? Because it is not the same geodesic, i think, than the one it is originally related to.

2. (x3) Figure out again which geodesic is what. / I am confused about which geodesic is what. He seems to say that the disjoint geodesic is the union of a wrapped and the horizon but then this is not what the blue line is right? Also I'm not clear on how the blue geodesic is homologous to the region A. / In what sense is the union (22.6) homologous to A ?

3. Shouldn't the second type of interval be R close to 2π? Because bigger than 2π goes around the circle no?

4. Can we think that there is a critical temperature (instead of a critical R) that the exchange of dominance between S_{red} and S_{blue} happens?

5. Is there something special physically happening at R_*?

6. What would happen if we had a star in the center of AdS? Will an analogous transition happen? The R_* will be smaller or bigger? What about the Araki-Lieb inequality?(I guess we won't expect saturation, right?)