Questions – Week 6: AdS from Near Horizon Limits, Absorption Cross Sections of the D1-D5-P, Absorption Cross Section from the Dual CFT, and The Near-Horizon Region (from Kiritsis)

February 19, 2016

1. (Guilherme) If the solution (11.1) is valid only for $M > Q$, why do we study it in the extremal limit?
2. (Guilherme) Why does it make sense to consider $Q > 0$ only?
3. (Guilherme) What does it mean having Hawking temperature equal to zero? The black hole stops to radiate? Wouldn't the decay rate of such condition be amazingly small (e.g. it just eats another electron)?
4. (Evan) In (11.3), and similarly in (11.12), why do we take $t \sim 1/\lambda$?
5. (Yan) If we take different scalings for coordinates to go to near horizon is it possible to get another interesting thing?
6. (Leila) How were Eqs. (11.5) and (11.6) obtained?
7. (Leila) Page 108 - what does it mean that the solution carries two charges related to r_1 and r_5?
8. (Evan) On the uniqueness of the near horizon limit: is it possible to take a different near horizon limit of the D1-D5 system that would give $\mathrm{AdS}_3 \times S_3$ with unequal radii?
9. (Kale) Why can we interpret the Wronskian as the conserved flux?
10. (Yan) If the flux is conserved then why do we have different values at infinity and at the horizon?
11. (Evan) On equations (12.17) to (12.21): how to see the definition in (12.17) is the correct one? Why are (12.19) and (12.20) negative? What are the qualitative features of (12.21)?
12. (Yan) The boundary condition at the horizon is that there is only ingoing waves so how can there be outgoing ones at infinity?

13. (Yan) Just to be sure when he says free scalar he means conformal scalar right? So it doesn't transform under all conformal transfo.

14. (Evan) On two-pt functions in CFT: how to see that the two-pt fcn of operators vanishes if the operators have unequal conformal weights?

15. (Yan) Is (13.16) working for descendants? From what I know it's only primaries but he seems to talk about descendants too.

16. (Jerome) What would the topology of the 2-pt function look like for Eq. (13.19). I don't have an intuition for $|0\rangle_{\text{line}}$ being "the vacuum state of the theory on an infinite line (which you can think of as the Im $z = 0$ axis)."

17. (Yan) We discussed that last year but I am still confused. For me it seems that conformal transfo are a special set of coordinates transfo but when we map to cylinder we go from a space to another one.

18. (Evan) Can we discuss a bit the claim below equation 13.25?

19. (Yan) He says that the CFT lives in the matching region, which is in between two finite values of r, but then he says that we evaluate the field at $r = 0$.

20. (Evan) Equations 13.32 to 13.33: why assume ω_L and ω_R are independent and then set them equal? Regarding the two different $i\epsilon$ prescriptions: can we draw these two different contours?

21. (Yan) The obvious question I guess is why absorption and emission cross sections are given by different $i\epsilon$ prescription?

22. (Yan) Is there a reason why what he does to compute things in AdS from CFT is the one that works or could we do something else but it just turns out to not work?

23. (Jerome) I realize at the end that I'm confused between near-extremal and exactly extremal. With the $6d$ black string, exactly extremal was $\text{AdS}_3 \times S_3$ and near-extremal was $\text{BTZ}_3 \times S_3$ embedded in $\text{AdS}_3 \times S_3$, is this correct? How is the difference between these two really obtained? Then, he says in Sec. (13.4) that we worked with gravity in $\text{AdS}_3 \times S_3$, not in $\text{BTZ}_3 \times S_3$, and that this was near-extremal. So, I'm confused... Can I see it as $T_H \ll 1$ being near-extremal and $T_H = 0$ being exactly extremal?

24. (Evan) On the last page of lecture 13: "we retained some coupling between the near horizon DOF and the fields in the asymptotically flat region". We did? Where?