Holographic study of deformed Wilson loop

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In the AdS/CFT correspondence, it is conjectured that a string world sheet whose boundary is attached to the loop C on the conformal boundary of AdS_5 corresponds to the Wilson loop operator which is defined on the same loop C. The concrete correspondence is that the expectation value of a Wilson loop operator is given by exponential of the minus area of such string world sheet. In this talk, we consider the Wilson loop operator with large R-charge operator insertions. Such local operator insertions can be interpreted as the deformations of a Wilson loop operator, and thus they correspond to the deformations of the string world sheet in the context of the AdS/CFT correspondence. In particular insertions of large R-charge operators mean that corresponding string world sheet have large angular momentum along S^5 direction. However, the counterparts of such large R-charge local operators , i.e., the string modes with large angular momentum along S^5-direction, are known to propagate along the trajectory near the center of AdS_5 in Minkowski signature. Thus, it is not clear where is the corresponding object to such Wilson loop operator with large R-charge operator insertions located. Similar question is already well discussed previously for the case of correlation functions of local R-charge operators in [1]. The authors of this paper considered that the reason why the large angular momentum modes can not reach the boundary is that there exists a potential barrier which arises because of the angular momentum along S^5 direction. They proposed that if we consider the tunneling solution against this barrier by performing the Wick rotation and turn to the Euclidean AdS_5, then we can introduce the counterpart of large R-charge operator near the boundary. By considering the propagations of large angular momentum modes along the so-called tunneling geodesic, we can actually calculate the correlation functions of local operators. In this talk, however, we are interested in the expectation values of the Wilson loop operators with local operator insertions. So we have to consider the string world sheet who is extended around the tunneling geodesic mentioned above. In actually, it is not difficult to find such string world sheet solutions and to evaluate their "area". We have compared such "area" of the string world sheet with the expectation values of the Wilson loop operator in gauge theory side. We found that our result from string theory side consistently reproduces the ladder graph approximation of the expectation values of Wilson loop operators in gauge theory.

References

[1] S. Dobashi, H. Shimada and T. Yoneya, Nucl. Phys. B **665** (2003) 94 [arXiv:hep-th/0209251].

[2] A. Miwa and T. Yoneya, arXiv:hep-th/0609007.