

**PHY680-02 (Advanced Nonperturbative QFT):  
Introduction to the AdS/CFT correspondence**

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YITP seminar room (Math 6-125), Tu-Th 110am–12:20pm, Fall '24

This course is an introduction to the AdS/CFT correspondence, aimed at a broad audience. The AdS/CFT correspondence (or more broadly the gauge/gravity duality and various related incarnations of holography) is an essential pillar of modern theoretical physics. While it originated in string theory, it has come to play an important role in many other fields. It has interesting applications in nuclear and condensed matter theory and deep conceptual links with quantum information theory.

We will follow (roughly in this order) three main conceptual threads:

1. A bottom-up approach, motivating the correspondence from general features of quantum gravity in asymptotically Anti de Sitter space. We will establish a universal dictionary between AdS quantum gravity and conformal field theory (CFT). As we are it, we will review the necessary background about CFT.
2. A more historic route that follows the discovery of AdS/CFT in string theory, motivating and then studying in some detail the paradigmatic example of the duality between  $\mathcal{N} = 4$  super Yang-Mills and Type IIB string theory in  $AdS_5 \times S^5$ .
3. The conceptual connection with quantum information theory: how spacetime “emerges” from quantum entanglement.

**Prerequisites.** There are no hard technical prerequisites and everyone is welcome, but some familiarity with quantum field theory, as well as with the basics of general relativity and group theory, will be assumed.