Strings, Gauge Theories and Anti-de Sitter Space[*]

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Abstract

In 1997, Maldacena forwarded the remarkable conjecture that string theory / M-theory taken on various compactifications of anti-de Sitter space are dual to certain large-N SU(N) gauge theories living on their asymptotic boundaries. In particular, it was conjectured that weakly-coupled Type IIB string theory compactified on $AdS_5 \otimes S^5$ is dual to strongly-coupled $\mathcal{N} = 4$ d=4 SU(N) Super Yang Mills in the 't Hooft large-N limit. Although there has been a wealth of interesting results, it has in practice been difficult to verify this conjecture beyond the supergravity approximation. This year, however, it was shown that the IIB string theory is *exactly*-quantizable in the pp-wave limit of AdS space, and subsequent work has shown that there is a new perturbative coupling duality between states in the interacting IIB string field theory and certain operators with large R-charge in $\mathcal{N} = 4$ d=4 SYM theory. In this talk, I will review the essential stringy elements leading to these duality conjectures, present some detailed examples, and discuss some open questions in a manner which will hopefully be of interest to both researchers and students alike.