Daniel Heineman Prize: QCD, strings and black holes: A duality between gravity and field theory

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We discuss Yang Mills theory with a large number of colors. In this limit it becomes a theory of strings. We describe the string theory associated to the most supersymmetric version of Yang Mills theory. These strings live in a ten dimensional curved space. Thus supersymmetric Yang Mills theory is related to the ordinary ten dimensional superstring theory which describes quantum gravity. We will review some results in this area and discuss some recent developments. We will also discuss the implications for black hole entropy and the black hole information puzzle.