Project Title

A model for the quantum structure of space-time in the Ads_5xS^5 or the plane-wave backgrounds

Second Winner

Basic Research

Initiator: Theoretical Physics and Mathematics Research Centre

Researcher :

M. M. Sheikh Jabbari (PhD)

Abstract

One of the most important open problems of the theoretical physics today is to reconcile the gravity theory (the general relativity) with the quantum theory and the most promising model to perform this task, which is free of major theoretical difficulties, is the quantum superstring theory.

Our understanding of the superstring theory deepened considerably after 1998 when the AdS/CFT duality according which the quantum gravity -at least in some specific backgrounds- is equivalent to a quantum gauge field theory, usually a (Supersymmetric) Yang - Mills theory. Despite of the progress achieved in light of the AdS/CFT duality, we have not learned much about the quantum structure of space-time from this duality. My research in the recent years, which has been submitted to the 19th Khwarizmi International Award, has been focused around the study of quantum structure of space-time in the AdS/CFT setup. These studies have led to proposing a matrix model formulation for superstring theory on the ten dimensional AdS background which I have called the "Tiny Graviton Matrix Theory". According to this model the quantum structure of space-time is described by some matrices and in general is of the form of Noncommutative Geometry. The continuum (classical) space-time is then recovered in a specific infinite size matrices limit. Our next projects in the analysis of the tiny graviton matrix theory involves extensions of this model to most general backgrounds and also studying quantum structure of black-holes.