

# Research Plans

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I plan to study the following several topics in order to understand fundamental black hole physics and physical phenomena related to dynamics of test bodies in gravitational fields.

## **A. Stationary rotating closed strings in five-dimensional black hole spacetimes**

Stationary closed Nambu-Goto strings are specific objects in higher dimensions, which do not exist in four dimensions. I plan to construct stationary closed strings in five-dimensional black hole spacetimes by solving equations of motion for cohomogeneity-one strings. The method of cohomogeneity-one strings used in [2] is applicable to strings in such black hole spacetimes. The studies show the effect of gravitational field of black holes to stationary string configurations and also reveal hidden symmetries of black holes associated with string motion. I also plan to investigate gravitational radiation from stationary closed strings to extract specific properties of higher-dimensional spacetime. It is expected that the results provide suggestion for observations of spacetime dimensions by signals of gravitational waves from cosmic strings.

## **B. Massless particles and massless scalar fields in black ring spacetimes**

The existence of stable bound orbits of massless particles in singly rotating black ring spacetimes are shown by our paper [1]. One of the next interesting question is whether null geodesics behave chaotic or not as discussed in massive particle case [4]. The previous works of Hoskisson(2007) and Durkee(2008) show that there exist at least an additional constant of motion associated with a conformal Killing tensor for massless particles with zero-energy, which guarantees the separability of null geodesic equations. I plan to reveal the appearance of chaotic motion of massless particles and the existence of hidden symmetries associated with conformal Killing tensors for more general massless particle motion. Further, I also plan to construct an approximate constant of motion of particles moving in black ring spacetimes by using the geometrical analogy between black rings and black strings. It is expected that the results provide some suggestions for stability analysis of scalar fields and the separability of null geodesic equations.