Jan. 31, 2012

Results of research

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I study black holes predicted by general relativity, which is the geometrical theory of gravity. In particular, motivated by unified theories of interactions, I focus on higher-dimensional black hole. By using geometrical symmetries of black holes, we reveal dynamical properties of test bodies (particles and strings). Furthermore, I try to understand the gravitational field of black holes from motion of test bodies. The results of my research is following :

Generalization of the Killing equation by the gauge symmetry in the theory of particle motion (Ref. [1])

We generalized the Killing equation by using reparameterization invariance of the theory of particle motion. These results provide us new insight into the relation between spacetime symmetries and constants of motion. In addition, we applied our formalism to charged particle system, and we revealed that there was nontrivial constants of motion of a charged particle associated with conformal Killing tensors.

Chaotic behavior of geodesics in the black ring geometry (Refs. [2], [3])

Black ring solutions that have the ring shape horizon were discovered in five-dimensions. I studied geodesics in the black ring spacetime and showed that there were nontrivial stable bound orbits unlike the case of the five-dimensional black holes. Furthermore, we showed that chaotic behavior appears in geodesics of the black ring geometry. the geodesics behaved chaotic in some cases.

Dynamics of cohomogeneity-one strings in higher-dimensions (Refs. [4], [5])

We considered a cohomogeneity-one string that is closed around higher-dimensional black hole. We discussed the separability of the equation of motion and the dynamics of the strings around a higher-dimensional black holes.