Research results

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My research interests are in gravitation related to string theory and supergravity. Much of my research has focused on higher-dimensional black holes, because the theories such as string theory and supergravity imply the existence of extra dimensions and motivate us studying gravity in a wider higher-dimesional framework. Another motivation is the gravity/gauge correspondence. This correspondence is one of the most exciting ideas in string theory and relates d+1-dimensional gravitaional theories to d-dimensional gauge theories. Black hole solutions provide important and useful gravitational backgrounds for thses purposes.

We constructed Kerr-AdS black hole metrics with NUT parameters in all dimensions which describe rotating black holes in a vacuum. Although the metrics had already been suggested in arbitrary dimensions and been confirmed that they are the solutions to Einstein equation up to fifteen dimension, we proved it by calculating the cuvature in all dimensions.

Although it was known that a geodesic motion on the higher-dimensional Kerr-NUT-AdS backgrounds is completely integrable in the sense that there exist enough mutually commuting conserved quantities which are constructed through Killing vectors and Killing tensors of rank-2, we demonstrated that from a single non-degenerate closed conformal Killing-Yano 2-form the dimension number of mutually commuting conserved quantities are constructed.

We showed that Kerr-NUT-AdS metric is the only metric admitting a non-degenerate closed conformal Killing-Yano 2-form.

We constructed new solution, which is generalization of Kerr-NUT-AdS metric admitting a closed conformal Killing-Yano 2-form. Their geometries are locally given by a Kaluza-Klein metrics on the bundle over Kähler-Einstein maifolds whose fibers are Kerr-NUT-AdS spacetimes. We classified them by the eigenvalues of the closed conformal Killing-Yano 2-form.