

Research Plan

Objectives

Analysis of higher dimensional black holes in the Large D limit

The Einstein equation is the non-linear partial differential equation, which is quite difficult to solve in general. In the large D limit, however, the Einstein equation reduces its inhomogeneity by one and becomes much more tractable. My research objective is to study the property and dynamics of higher dimensional black holes in more general shapes and with various matter fields and modified gravity theory by the large D expansion method.

Research Plan

Toward the objectives and considering the above result, I am planning the following researches.

Exploring the stationary black holes in the large D limit

The large D limit greatly simplifies the Einstein equation, in which the analysis of non-uniform solutions becomes easier to solve. I and collaborators have shown several non-uniform solutions in the vacuum spacetime. I will study the higher dimensional solutions in more general cases, such with the charges and other matter sources and even with the modified gravity.

General effective theory of Black hole Dynamics in the large D limit

I and collaborator showed that the large D expansion also work with the time dependence as well and further extended in the case with the Maxwell field. Other than this, the large D effective theories are studied in various setup. However, the analyses are done separately and do not have a unified description. We will pursue the covariant description of the effective theory which is independent on the specific symmetry of background spacetime and horizon, studying the general spacetime setup. We will also study the spacetime with charges and other matter fields.

Study for another large D limit

Conventional formulation developed so far do not correctly capture the phenomenon including the the large variation and far region dynamics. Especially, several studies on the gravitational collapse and black hole collision imply that these have a certain large D limit. Studying the large D limit of these phenomenon will open the new applicability of the large D limit.