Current Progress

In recent years, the study of higher dimensions predicted by String Theory have been attracted much attention. The understanding of the higher dimensional gravity is required for the dynamics of the large extra dimension admitted by the braneworld model. Understanding the phase of higher dimensional black holes is important for the various aspects in String theory as AdS/CFT correspon- dence and the compactification of the spacetime. The observation of the black hole nucleatioins in the LHC is also implied if the extra dimensions are large enough. Moreover, higher dimensional black holes itselves are the attractive subjects in the mathmathecal aspects.

In D = 5, there found various explicit solutions as Myers-Perry black holes, black rings, black saturns, etc. for now. The discovery of these solutions greatly owes to the solution generating techniques which were only found for D = 5 stationary spacetime. On the other hand, in D > 5, the only known explicit soluitons are Myers-Perry solutions. Since it is difficult to directly solve the Einstein equation and obtain an explicit solution with less symmetries, some approximation techniques should help us.

The matched asymptotic expansion (MAE) is a useful approximation method for black objects with largely separated multiple scales. Using this method, caged black holes in the Kaluza-Klein spacetime, ultra-spinning (thin) black rings etc. have been constructed up to the linear order. The similar approach is the blackfold approximation, an effetive field thoery for the bent thin black brane. Recently, the blackfold balance equations are shown to be equivalent to the regularity condition for the dipole perturbation on the horizon in the vacuum spacetime.

However, a few applications and extensions have been done. One natural extension is the inclusion of p-form charges and dilaton field, for which only the blackfold approximations have done. By now, I have studied the MAE in the charged caged black holes in the Kaluza-Klein spacetime to understand the extension for the Einstein-Maxwell theory.