Research results

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① **2008-2012: Researcher, Osaka City University Advanced Mathematical Institute**

Introducing a twisted extra dimension, we constructed the five-dimensional exact static Kaluza-Klein black hole solution with squashed S^3 horizons [2]. This black hole spacetime behaves as a fully five-dimensional black hole in the vicinity of the horizon, and asymptotes to a four-dimensional spacetime with a twisted S^1 as a compactified extra dimension. Then we can regard squashed Kaluza-Klein black hole solutions as realistic higher-dimensional spacetime models. We applied this squashing method to some known asymptotically flat black hole solutions, and constructed exact solutions which represent charged rotating Kaluza-Klein black holes, multi-black holes, and dilaton black holes [3,4,7,10,12,14]. We considered the parallel transportation of a spin vector along a circular geodesic in a squashed Kaluza-Klein black hole spacetime, and derived the geodetic precession angle with the higher-dimensional correction [11]. We also discussed Hawking radiation from a five-dimensional squashed Kaluza-Klein black hole on the basis of the tunneling mechanism [13].

Next, to discuss the relations between the variety of the horizon topologies and the asymptotic structures of the spacetimes, we constructed rotating multi-black hole solutions with asymptotically lens space structures [1,6,8]. We also obtained five-dimensional rotating Kaluza-Klein multi-black holes with the Gödel parameter [9]. Further we constructed exact supersymmetric black ring solutions in five-dimensional Einstein-Maxwell-Chern-Simons theory [5].

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We constructed five-dimensional exact solutions which represent regular charged rotating multi-black holes in asymptotically Kaluza-Klein spacetimes [15,16]. We showed that the regularity condition requires the quantization of black hole mass by the size of the extra dimension.

③ **2014-present: Researcher, Osaka City University Advanced Mathematical Institute**

We constructed asymptotically Kaluza-Klein solutions in five-dimensional Einstein-Maxwell theory which represent a pair of extremal, charged, static black holes on Kerr-Taub-bolt space [20]. We showed that for a given topology at spatial infinity, there are an infinite number of different horizon topologies for the black hole pair. We also constructed charged black hole and black string solutions in five-dimensional Kaluza-Klein universes [17,22]. We discussed the smoothness of black hole horizons in higher-dimensional Kaluza-Klein black hole spacetimes [18]. Further we constructed charged rotating dilaton black holes coupled to the exponential form of nonlinear electrodynamics and the Born-Infeld field perturbatively [19,21].