Research Results

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[2]"*Off-shell d=5 Supergravity coupled to Matter-Yang-Mills System*"
With the interesting idea, so called 'brane world scenario' where our four-dimensional world may be '3-brane' embedded in a higher-dimensional spacetime, various problems in particle physics and cosmology have been investigated. It is suggested that models coupled to gravity in this scenario might solve the hierarchy problem in particle physics, and we need such models extended to be coupled to supergravity as like supersymmetric standard models. Here we are interested in the simplest case with a single extra dimension. To give a framework for systematic investigation in this case, we constructed *supergravity tensor calculus in five dimensions* where the supersymmetry algebra closes off-shell. In this paper, by using this result, we present an off-shell formulation of a matter-Yang-Mills system coupled to supergravity in five-dimensional space-time.

[26]"*Supersymmetric Completion of an R^2 Term in Five-Dimensional Supergravity* "
Supergravity tensor calculus in five dimensions we constructed is also useful in different fields of study. In microscopic description of black-hole entropy in the superstring theory, we need to add higher-derivative corrections containing an R^2 term into an action of five-dimensional supergravity, to calculate desired corrections to Bekenstein-Hawking entropy. By using the supergravity tensor calculus we determined all the purely bosonic terms in the supersymmetric invariant action containing R^2. We also checked that this result gives a desired correction in a context of the AdS/CFT correspondence.

[9]"*Construction of Non-Abelian Walls and Their Complete Moduli Space*"
Solitons appeared in supersymmetric Yang-Mills-Higgs systems can be of BPS(Bogomol'nyi-Prasad-Sommerfield) states satisfying BPS equations. Each soliton in a BPS state have no interaction with each other and thus solutions of BPS equations contains moduli parameters of which set forms a moduli space. It is famous that solutions and their moduli spaces for instantons and monopoles are constructed by ADHM construction and Nahm construction respectively. But solutions and their moduli spaces for vortices and domain walls had not been investigated very well, since BPS equations of their systems turn out to be not integrable. In this paper, by taking strong-coupling limit, we solve BPS equations for domain walls and obtain their complete moduli space by using *'the moduli-matrix method'* we called. In ensuing our papers we also apply the moduli-matrix method to determine a moduli space for BPS $U(N)$ vortices.