Research Interest

I have pursued the dynamical origin of our universe. I have strong interest in short distance behaviours of matters in nature, too. These two subjects are closely related to each other. At extremely short distance, dynamics of elementary objects should be reformulated by new physics rather than field theory. String theories seem the best candidate. I study topological features of physics, also.

Matrix description of string in Orientifold background

We computed partition functions of reduced matrix models. However the physical interpretation has not been done enough and there is a lack of proof. I shall prove it and make sense of the calculation as string or brane dynamics. The factors which we obtained resemble to some kind of expansion coefficients of spherical harmonics. I will calculate partition functions and free energies of USp and SO matrix models as realizations of open superstring theories in orientifold background. I attempt to progress our method for the computation of the partition functions to Type I configuration.

The calculation is similar to counting instantons, so I would like to evaluate instanton corrections to prepotentials of four-dimensional extended supersymmetric gauge theories with gauge groups SO and USp.

Higher dimensional soliton

I have interest in solitons in gauge theories with higher derivative couplings in higher dimensional space-time. A kind of these solitons has a charge that takes value in the homotopy group of the spacial infinity. These solitons have been considered by Tchrakian. Recently Yang monopole which is six-dimensional soliton is considered by some people in the context of higher dimensional black-holes. The Yang monopole is described by a chirally projected spin connection of round metric of S^4. I would like to identify the monopole in our matrix models with the Yang monopole or the Tchrakian's solitons. The differential equation as the Bogomolny equation is autonomous and an Abel's differential equation of second kind. I'd like to find the integral factor.

AdS/CFT correspondence

Einstein-Sasaki manifolds are closely related to some kinds of conformal field theories which are described by quiver diagrams. We have studied Einstein-Sasaki manifolds $Y^{p,q}$ and $L^{a,b,c}$. The eigenvalue equations for these spaces are fortunately reduced to Fuchsian equations. These equations have solutions corresponding with BPS geodesics. They also have non-trivial solutions and we don't have the answer to the question; what are their counterpart? I hope that I find the answer.