Hironobu Kihara

Research Plan

Superstring theory is a candidate of the unification of interactions in the realm of nature. This theory is consistent in ten-dimensional space-time. String theory must explain the reason why the extra six dimensions have never observed. One idea is the compactification of those extra dimensions. Especially I have strong interest in the dynamical compactification, in which the size of compact space is a function of time. I will study the dynamical compactification, especially in the ten-dimensional Einstein-Yang=Mills theory. I will study related topics, too.

I will consider the physics behind the solution of dynamical compactifications. My interest is in the length of the span of the inflation, the explanation of the grand unified theory or more, and the search of the scenario of the unification without proton decay. In addition, any kinds of compactification include the problem of the violation of the cosmological principle, especially the isotropy. I will study this problem.

I have interests in the evaluation of the mass spectrum of the fluctuation modes against the classical solution which was obtained in our previous works. Extension of the scenario with infinitely many interaction terms is also interesting problem. I would like to clarify mass spectra in such a extension, focused on the existence of tachyonic modes.

In the case of SO(16) gauge theory, the gauge group breaks down to SO(10) by the Higgs-Kibble mechanism and we obtain several scalar fields, for instance six scalar fields belonging to the vector representation of SO(10), in the effective theory. I would like to explain the difference of generations of quark and lepton by using these fields.

I will consider the generalized self-duality equations by means of Tchrakian. Recently I studied the generalized self-duality equation of polynomial type. I will enlarge my knowledge on the class of equations. Brihaye, Devchand and Nuyts analyzed the generic solutions of self-duality equation in eight-dimensional Yang-Mills by using the decomposition of representation under the Corrigan-Fairlie-Wilzcek ansatz. I will apply this method in general dimension. On homogeneous spaces, especially on symmetric spaces, I would like to consider general theory about solutions of those equations explained in terms of spin connections as shown in Bais and Batenburg.

I will consider the scale parameter, which is introduced artificially in the frame work of the renormalization scheme, and the rigorous explanation of fermion in field theories. If possible, I will study the stochastic quantization.