

**Stony Brook University
The Graduate School**

Doctoral Defense Announcement

Abstract

Some Application of Superspace

By

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Supersymmetry is a very popular topic in recent high energy physics theories. Especially, in order to make sense of string theory, we have to impose supersymmetry. Superspace method is proven to be a very useful approach to supersymmetric theories by treating supersymmetry as part of the geometry. In this dissertation, we use superspace method to investigate superconformal field theory and string/brane theory.

The first part of the dissertation, we rewrite semi-shortening conditions using superspace approach. The rewritten expression is covariant under superconformal transformation. We found that all the known semi-shortening conditions are part of the covariantized ones and can be generalized to weaker shortening conditions. We also give an example how one can find other constraints from the known ones, particularly in $N = 4$ SYM in projective superspace.

The second part is focused on "F-theory", a theory that has manifestly U-duality. It can be reduced to M-theory, manifestly T-dual version string theory, and ordinary string theory. The theory is formulated on coset space G/H where G is the U-duality group and H is the unbroken symmetry group. We modified coset space formalism to find a general algebra for the symmetry currents. And we give an explicit example on 10 dimensional F-theory which can reduce to 3D string theory.

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