

**Stony Brook University
The Graduate School**

Doctoral Defense Announcement

Abstract

Gauge covariant actions from strings

By

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We derive Yang-Mills vertex operators for (super)string theory whose BRST invariance requires only the free gauge-covariant field equation and no gauge condition. Standard conformal field theory methods yield the three-point vertices directly in gauge-invariant form and S-matrices in terms of free field strengths for vector states, which allows arbitrary gauge choices. As examples we give four-vector (super)string tree amplitudes in this form, and find the field theory actions that give the first three orders in the slope. Also, on the String Field Theory side, we construct the Zinn-Justin-Batalin-Vilkovisky action for tachyons and gauge bosons from Witten's 3-string vertex of the bosonic open string without gauge fixing. Through canonical transformations, we find the off-shell, local, gauge-covariant action up to 3-point terms, satisfying the usual field theory gauge transformations. Perturbatively, it can be extended to higher-point terms. It gives a new gauge condition in field theory which corresponds to the Feynman-Siegel gauge on the world-sheet. Finally, we combine two partons as a vector state on a random lattice, which is another approach for strings quantization. In the ladder approximation, we find propagators of such states (after tuning the mass to vanish). We also construct some diagrams which are very similar to 3-string vertices in string field theory for the first oscillator mode. Attaching 3 such lattice states to these vertices, we get Yang-Mills and cubic interactions up to 3-point as from bosonic string (field) theory. This gives another view of a gauge field as a bound state in a theory whose only fundamental fields are scalars.

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