

Homework 7

Due on: Monday, October 21

Problem 1

Prove the following two claims for the spinning string:

- I. Given a field configuration that satisfies the field equations (fields X^μ and $\psi^{+\mu}$ and $\psi^{-\mu}$) and the on-shell boundary conditions that follow from the Euler-Lagrange field equations, and the off-shell boundary conditions that follow from requiring invariance of the action under superconformal symmetry transformations, one can always reach the light-cone gauge ψ^{A+} ($A = +, -$).
- II. This gauge fixes the superconformal symmetry completely (there is no residual symmetry left).

Problem 2

We are going to complete the discussion of the spectra of the closed string in the NS–NS, NS–R, R–NS and R–R sectors.

- (a) We took $a(\text{closed}, NS-NS) = 1$, namely equal to $a(\text{open}, NS) + \tilde{a}(\text{open}, NS) = 1/2 + 1/2$. Why is this choice necessary?
- (b) Consider next the NS–R sector. Write down all states at the first and second mass level that are allowed before the GSO projection, and draw a cross through those states that are projected out by the projection operators Π_{NS}^- and $\tilde{\Pi}_R^-$.
- (c) Finally consider the R–R sector, and answer the same questions as in b) if the GSO projection operators are Π_R^+ and $\tilde{\Pi}_R^-$.