Problem Set 2

Physics 483

Due February 19

Some abbreviations: Pol - Polchinski

1. Pol 2.3

2. Pol 2.8-2.10

3. Pol 3.2

4. The linear dilaton background is an example that we have not considered in detail but is very nice.

(i) Using the energy-momentum tensor defined on p. 49, explicitly compute the $T(z)T(0)$ OPE, and determine the central charge.

(ii) Compute the OPE of $J^\mu(z) = \frac{i}{\alpha'}\partial_z X^\mu$ with $T(z)$. What does the result teach you about the charge

$$\oint \frac{dz}{2\pi i} J^\mu(z)$$

on a genus g Riemann surface.

(iii) Check that this background satisfies the β-function equations of motion (p. 111) with a varying dilaton, and a non-critical D. What can you conclude about string perturbation theory in such a background?