



Texifier (Texpad) 1.9.27 macOS

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1 Moduli Stabilization
2   ① Moduli in String Theory
3   ② Flux Compactifications...
4   ③ Other approaches
5 Conformal Field Theory
6   ① Conformal symmetry in...
7   ② Specializing to 6d-38 ...
8   ③ The Superconformal Al...
9   ④ Rational and Noncompact...
10  ⑤ Minimal Models
11  ⑥ Noncompact Theories
12  ⑦ General Models and Ex...
13  ⑧ Boundary Conformal Field...
14  ⑨ Effective Spacetime Physics...
15  ⑩ Effective Spacetime Phys...
16  ⑪ The Sie > 65 Models
17  ⑫ The Sie < 65 Models
18 Stability Conditions
19 A Note on Similar Approaches
20 The Noncompact Conformal...
21 The Linear Dilaton CFT
22  ① The Basic Data
23  ② The Mass Formula
24  ③ The Boundary Theory...
25 Liouville Theory
26  ① The Bosonic Case
27  ② The Siegel/B Liouville...
28  ③ The Sauerhoff Liouville...
29  ④ The Boundary Theory...
30 Timeline Liouville Theory
31  ① Timeline Liouville...
32  ② Extension to Timeline...
33 Moduli-free String Backgrounds
34 Closed String Spectrum
35 General Remarks on Se...
36 Examples
37
38 used in these compactifications
39 do not necessarily have a geometrical limit.
40 %tempdoc{Summary in the charge deficit approach}
41
42 As stated in section 10 (String-theory-basics), the critical string theory
43 requires the central charge of 15 for the
44 full superstring background. The usual flat compactification comprises
45 of a split of 30+9 for
46 central charges of CFTs corresponding to external and internal sectors
47 respectively.
48 The central charge of six for the external theory corresponds to four
49 bosons and four fermions.
50 These numbers consider here indeed provide critical string theory
51 backgrounds -- the overall charge
52 is always 15. The central idea for us will be to introduce a 'len
53 ght' central charge deficit.
54 This will allow us to parameterize the central charges of both the internal and external
55 CFTs and play with the 30+9 split.
56 The various ways of constructing models will be the central theme of
57 this work.
58
59 ====== Section
60 ======
61 Section[The Charge Deficit,{\sec}]{charge-deficit-aec}
62
63 ======
64
65 %tempdoc{The effective Theory}
66 Consider the sigma-model action of the string moving in a background with massless
67 fields, the graviton  $g_{\mu\nu}$ , the Kalb-Ramond field  $\beta_{\mu\nu}$  and the dilaton  $\phi$ .
68
69 \begin{aligned}
70 S = & n \int d^D x \sqrt{-g} \left\{ \frac{1}{2} g_{\mu\nu} \partial_\mu X^\alpha \partial_\nu X^\alpha + \mathcal{L}_D(X^\alpha, \partial_\mu X^\alpha) \right. \\
71 & \left. + \epsilon^{abc} \beta_{\mu\nu}(X^\alpha, X^\beta, \partial_\mu X^\alpha + \epsilon^{abc} \mathcal{R}(X)) \right\}.
72 \end{aligned} \quad (4.1)
```

where the $n, \beta = 0, 1, \dots, D-1$ are the worldsheet and spacetime indices respectively. R is the Ricci scalar of the worldsheet metric $g_{\mu\nu}$. The string perturbation theory is valid wherever the string coupling constant $\beta_s = e^{\phi}$ is small. Although this action is classically conformally invariant, coupling to a generic non-constant dilaton as seen in 2.1.3, breaks the invariance in the quantum theory. To one-loop order one finds the condition for conformal invariance are $\beta_{\mu\nu}^D = \beta_{\mu\nu}^B = 0$ where

$$\beta_{\mu\nu}^D = n \left\{ \beta_{\mu\nu} - \frac{1}{2} (\partial_\mu H_{\nu\rho} \epsilon^{\rho\sigma} + 2D \partial_\nu \delta_{\mu\nu}) \right\} + \mathcal{O}(n^2) \quad (4.2a)$$

$$\beta_{\mu\nu}^B = n (D^2 H_{\mu\nu} - 2D (\partial_\mu \delta_{\mu\nu}) + \mathcal{O}(n^2)). \quad (4.2b)$$

If these equations are satisfied one finds that the central charge c of the worldsheet conformal field theory is indeed a constant and is given by

$$c = \frac{3}{2} D^2 \quad (4.3)$$

where

$$\beta^2 = D + n \left\{ 8(D\partial\phi)^2 - 4D^2 \partial^2 \phi - R + \frac{1}{2\beta_s^2} H^2 \right\} + \mathcal{O}(n^2). \quad (4.4)$$

To construct string backgrounds, one needs a worldsheet CFT with $c = 15$. In the usual uncompactified superstring theory seen above, this is achieved by taking $D = 10$ and solving



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