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Erratum: revisiting coupling selection rules in heterotic orbifold models

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The derivation of Rule 5 for higher order couplings in section 3.4 has an error in it. On considering the general expression of the correlation function eq. (3.17), we stated on page 14 that the OPE eq. (3.20) implies that all terms in the sum over t vanish apart from $t = 0$. However, this missed finite terms in the OPE $\partial X \bar{\partial} \bar{X}$, which can be seen for example in ref. [12]. The correct condition for non-vanishing correlation functions is $r = s + t$. This does follow from the OPE eq. (3.20), simply by changing to holomorphic spacetime coordinates.

Consequently, the condition that Rule 5 imposes on the oscillator numbers for non-vanishing couplings is weaker than originally stated. The correct conditions read:

$$\begin{aligned}
&\text{holomorphic instantons forbidden: } \mathcal{N}_L^i \leq \bar{\mathcal{N}}_L^i + \bar{\mathcal{N}}_R^i \\
&\text{anti-holomorphic instantons forbidden: } \mathcal{N}_L^i \geq \bar{\mathcal{N}}_L^i \\
&\text{no instantons allowed: } \mathcal{N}_L^i = \bar{\mathcal{N}}_L^i + \bar{\mathcal{N}}_R^i \,.
\end{aligned}$$

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The implication stated in eq. (3.30) that $\mathrm{L} - 3 = 0$ still holds for untwisted charged matter. Indeed, the masslessness condition implies that untwisted charged matter carry no oscillators, so $0 = \sum_i \mathcal{N}_L^i - \bar{\mathcal{N}}_L^i = \sum_i \mathcal{N}_R^i = \mathrm{L} - 3$.

Twist invariance and Rule 4 can subsequently be derived in the same way as in section 3.4. Applying the correct Rule 5 to explicit models yields similar results to those described in section 4. The numbers in table 1 are modified as follows. Instead of the original 10%, only about 7% of the couplings vanish when the new selection rules are correctly applied. We still find that a great number of dangerous baryon decay operators disappear in the effective field theory emerging from promising orbifold compactifications.

The main conclusions of the paper remain unchanged.

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