

Towards a String theory for 2D YM theory

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2312.12266

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Review: 2D Yang-Mills & large N

- 2D Yang-Mills is exactly solvable. (Migdal '75, Kazakov-Kostov '80, Rusakov '90, Fine '90, Witten '92, Blau '91 ...)
- Large N expansion of Partition function \mathcal{Z} , and $\langle WL \rangle$ organizes into sum over world sheet maps. (Gross-Taylor '93)
- No known world sheet action.
- Only particular kind of maps contribute.

Previous Attempts:

Topological String theory at $g_{YM} = 0$

Cordes, Moore, Ramgoolam '94

- Localization to 'holomorphic maps'.
- Contributes to only 'chiral' part (chiral YM).

Horava '96

- Localization to 'Extremal area maps'.
- Solution to Nambu-Goto equation of motion.
- Includes 'non-chiral' maps.

Both gives vague proposal for finite 't Hooft coupling λ ($= g_{YM}^2 N$).

Our work:

Topological String theory at $g_{YM} = 0$

Horava '96

- A term in Horava action vanishes identically.
- Moduli space integral is ill-defined.

We found a non-vanishing replacement: gives correct measure on the moduli space for $\lambda = 0$ (topological YM theory).

- We reformulated this action as a Polyakov-type path integral,

$$S = -i \frac{t}{2} \int d^2\sigma d^2\theta \sqrt{H} H^{ab} \partial_a X \cdot \partial_b X + \frac{1}{2} \int d^2\sigma d^2\theta \partial_\theta X^\mu K_{\mu\nu}[X] \partial_{\bar{\theta}} X^\nu$$

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- This regulates some of the ill-behaved non-chiral maps.

Future Directions:

- $\langle WL \rangle$: Adding boundaries to these string world-sheet maps we can match the Wilson loop expectation values.
- Finite λ : Add corrections ($\propto \lambda$) to the action to match the finite coupling contributions. Note, the theory is no longer topological.
- 't Hooft meson spectrum;
- Adjoint particles: as an extra bid on the strings.
- Higher D .

Thank you!