O(D,D) COVARIANT NOETHER CURRENT AND GLOBAL CHARGES IN DFT

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INTRODUCTION

- Double Field Theory
  - A reformulation of SUGRA with manifest T-duality covariance.
- Under T-duality, $P_\mu \leftrightarrow W^\mu$.
- In Einstein Gravity, we have ADM momenta
- ADM momenta in DFT will give (P, W).

O(D,D)-COVARIANT REFORMULATION

SUGRA(NSNS) on T^D

- Field Content: $G_{\mu\nu}, B_{\mu\nu}, e^{-2\phi}$
- Gauge Symmetries
  - Diffeomorphism
  - Local $B_2 \to B_2 + d\Lambda_1$
- Global Symmetries
  - GL(D)
  - Global $B_2 \to B_2 + \Lambda_2$
  - T-duality

Double Field Theory

- $\mathcal{H}_{MN} = \begin{bmatrix} G^{-1} & -G^{-1}B \\ BG^{-1} & G - BG^{-1}B \end{bmatrix}$
- $e^{-2d} = e^{-2\phi}\sqrt{-G}$
- Generalised Diffeomorphism
- O(D,D) Rotations

DOUBLE FIELD THEORY [HULL, ZWIEBACH '09]

- Background fields depend on $(x^m, \tilde{x}_m)$.

  Level matching condition ; $\tilde{\partial}^m \partial_m = 0$ ⟹ $\tilde{\partial}^m = 0$ (canonical section).

- Generalised Lie derivative

$$\mathcal{L}_X T^{M\cdots} = X^N \partial_N T^{M\cdots} + \omega \partial_N X^N T^{M\cdots} + (\partial^M X_N - \partial_N X^M) T^{N\cdots} + \cdots$$

- DFT action = O(D,D) inv. curvature $\mathcal{S}(\mathcal{H}_{MN}, d)$ [Jeon, Lee, Park '11]

$$I = \int e^{-2d} \mathcal{S} = \int e^{-2\phi} \sqrt{-g} \left(R + 4(\partial\phi)^2 - \frac{1}{12} H^2 \right) + (boundary) + (section)$$

- Necessary to describe
  - Non-geometric backgrounds (T-folds)
  - Non-Riemannian backgrounds.

CONSERVED CHARGES IN DFT

- Action with Boundary term

$$I = \int e^{-2d}(\mathcal{S} - \nabla_A B^A)$$

  - Dirichlet boundary problem well-defined with

$$B^A = 4\mathcal{H}^{AB}\partial_B d - \partial_B \mathcal{H}^{AB}$$

- We considered asymp. flat backgrounds in DFT.
  Noether charge associated with an asymp. Killing vector, X^M,

$$Q[X] = \int_{\partial\mathcal{M}} dx_{AB}\, e^{-2d}\left(K^{[AB]} + 2X^{[A}B^{B]}\right)$$

$$K^{AB} = 4\left[(\bar{P}\nabla)^{[A}(PX)^{B]} - (P\nabla)^{[A}(\bar{P}X)^{B]}\right]$$

  - Same form with Iyer-Wald's conserved charge.

APPLICATIONS

- In pure gravity, they give ADM momenta.
- Null waves $P_A = (M, -M; 0,0)$

$\Updownarrow$

- F1 String $P_A = (M, 0; 0, -M)$

- Non-Riemannian Background [K Lee, JH Park '13]

$$\mathcal{H}_{MN} = \begin{bmatrix} 0 & * \\ * & * \end{bmatrix} \nrightarrow \begin{bmatrix} G^{-1} & -G^{-1}B \\ BG^{-1} & G - BG^{-1}B \end{bmatrix}$$

Still, O(D,D) current formula can be evaluated.

THANK YOU FOR LISTENING