High Energy Theory and Gender, CERN, Switzerland

D-branes in λ-deformations

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Research Foundation Flanders
Opening new horizons

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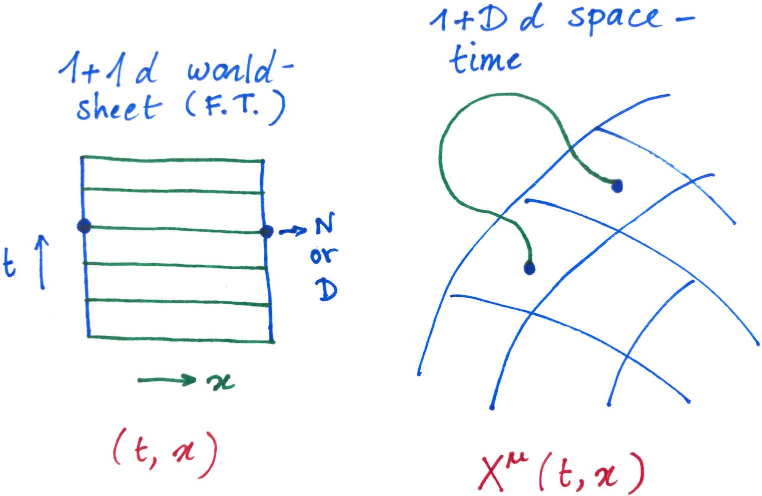
Open strings in spacetime



Setting and motivation

$$\begin{array}{ccc} \text{WZW} & \xrightarrow{\text{deform}} & \lambda\text{-deformation} \\ (\textit{conformal FT}) & & (\textit{integrable FT}) \end{array}$$

[Sfetsos '14]

- Tools for (open) strings in curved spacetimes: 1+1 d. **CFT** or **IFT**
- Adding **fermions**: expected to satisfy string theory requirements (one-loop β functions vanish, SUGRA embeddings, ...)
  [Appadu, Borsato, Demulder, Hollowood, Miramontes, Schmidtt, Sfetsos, Thompson, Tseytlin, Wulff ... '14-'16]

λ as a potential string model $\rightarrow$ **D-branes** that preserve integrability?

λ-deformations on group manifolds G

[Sfetsos '14]

$$S = S_{\mathrm{WZW},k} + \frac{k}{\pi}\int_\Sigma \mathrm{d}^2x\, \partial_+ X\, M(\lambda, X)\, \partial_- X, \quad \lambda \in [0,1], \quad X : \Sigma \to G$$

Effectively **deforms the spacetime data**, i.e.

- the spacetime metric G
- H-flux, $\mathcal{F}$-flux, dilaton profile $\Phi(X)$

Integrable: EOMs encoded in a flat Lax connection $\mathcal{L}(\mu, \lambda, X)$, $\mu \in \mathbb{C}$

$$\mathrm{d}\mathcal{L} + \mathcal{L} \wedge \mathcal{L} = 0,$$

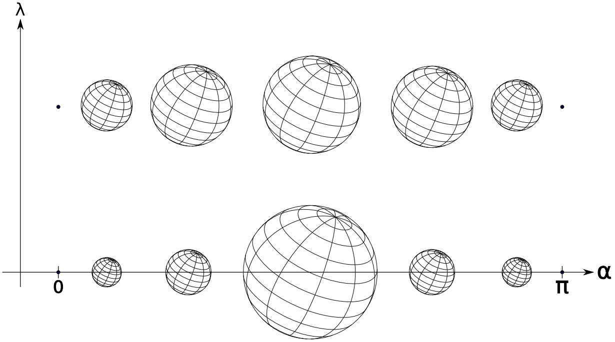
- tower of conserved charges iff. certain boundary conditions (P, D, N)
- corresponding D-branes wrap (twisted) conjugacy classes of G

  independent of λ

[SD, Sevrin, Thompson '18]

$SU(2) \simeq S^3$ illustration

- Conjugacy classes are $S^2 \subset S^3$ spheres: 2 D0-branes and $(k-1)$ D2-branes [Alekseev, Schomerus '98]
- Effect of λ: alters size of the branes by $G|_{\text{brane}}$



Before: WZW exact CFT formulation for D-branes

Take-home

- λ-deformation: **no CFT formulation** BUT **integrability** naturally generalises WZW boundary conditions
- Geometrically D-branes wrap twisted conjugacy classes

Other interesting directions

- Incl. black hole spacetimes (coset manifolds)
- Adding fermions (super-coset manifolds)