$$S_{10} = \int e^{+\phi} H_{RR}^2 + e^{-\phi} H_{NS}^2$$

$$Q_1 = \int e^{\phi} H_{RR} \,, \quad d * e^{\phi} H_{RR} = 0$$

$$ds^2 = \left(1 + \frac{g Q_5}{r^2} \right)^{\#} \left(1 + \frac{g Q_1}{r^2} \right)^{\#'} d\tau^2 + \cdots$$

$r \Rightarrow 0$

$$ds^2 = \underset{K^3 \text{ or } T^4}{ds_4^2} + \underset{S^3}{d\Omega_3^2} + ds_{AdS_3}^2$$

$$ds_{AdS_3}^2 = l^2 \left(\frac{dr^2}{r^2} + r^2 \left(-dt^2 + dx_5^2 \right) \right)$$

$$l^2 = g \sqrt{Q_1 Q_5}$$

Important digression

Properties of AdS_3

$$r = \frac{1}{y} \qquad w_\pm = x_5 \pm t$$

$$ds^2_{AdS_3} = R^2 \left(\frac{dy^2 + dw_+ dw_-}{y^2} \right)$$

$SO(2,2)$

$SL(2,R)_L \times SL(2,R)_R$ Isometry

$$w_+' = \frac{a w_+ + b}{c w_+ + d} \qquad (ad - cb = 1)$$

$$w_-' = w_- + \frac{c y^2}{c w_+ + d}$$

$+ \leftrightarrow -$

$$y' = \frac{y}{c w_+ + d}$$

Killing vectors

$$H_{-1} = i\partial_+$$

$$H_0 = i\left(w^+\partial_+ + \frac{1}{2}y\,\partial_y\right)$$

$$H_{+1} = i\left(w^{+2}\partial_+ + w^+ y\,\partial_y - y^2\partial_-\right)$$

$$\vdots$$

$$H_n = i(w^+)^{n+1}\partial_n + \cdots$$

$$[H_m, H_n]_{L.B.} = i(m-n)H_{m+n}$$

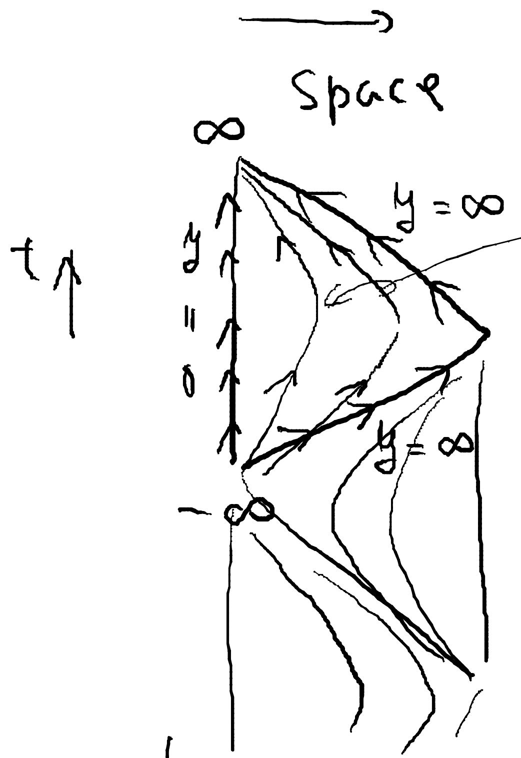
$$ds^2 = -(dx^0)^2 - (dx^1)^2 + (dx_2)^2 + (dx_3)^2$$

$SO(2,2)$

$$-(X^0)^2 - (X^1)^2 + (X_2)^2 + (X_3)^2 = -\ell^2$$

$$\frac{\partial}{\partial t} = \partial_+ - \partial_- = -i H_{-1} + i \tilde{H}_{-1}$$

$$\| \partial_t \|^2 \sim \frac{1}{y^2} \xrightarrow{y \to \infty} 0$$

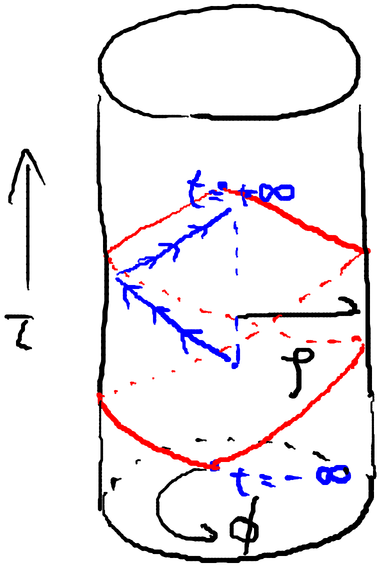


Poincare patch : $y, w^{\pm}$

$$\frac{1}{y} = \cosh\rho \cos\tau + \sinh\rho \cos\phi$$

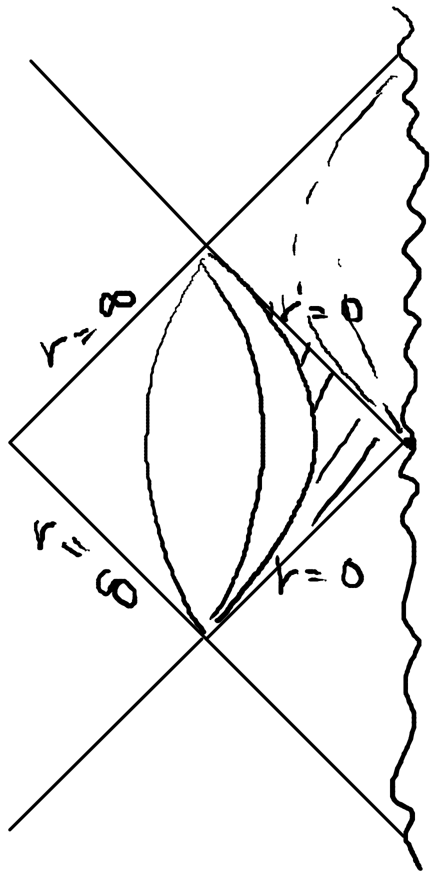
$$w^{\pm} = y(\sinh\rho \sin\phi \mp \cosh\rho \sin\tau)$$

$$ds_3^2 = \ell^2 \left(-\cosh^2\rho \, d\tau^2 + d\rho^2 + \sinh^2\rho \, d\phi^2\right)$$



← covered by Poincare coord.

$$ds_3^2 = \ell^2 \left(\frac{-dt^2 + dx_5^2 + dy^2}{y^2} \right)$$



$$L_0 = i(\partial\tau + \partial\phi)$$

$$\bar{L}_0 = i(\partial\tau - \partial\phi)$$

$$\partial\tau = \frac{1}{2} L_0 + \bar{L}_0$$

$$H_{+1} = \omega^{+2}\partial_{+} \quad \cdots$$

$$H_0 = \omega^{+}\partial_{+} \quad \cdots$$

$$H_{-1} = \partial_{+}$$

$$\Rightarrow \left\{ L_0 = \frac{1}{2}\left(H_1 + H_{-1}\right) \right.$$

$$\left\{ \bar{L}_0 = \frac{1}{2}\left(\widehat{\bar{H}}_1 + \widehat{\bar{H}}_{-1}\right) \right.$$