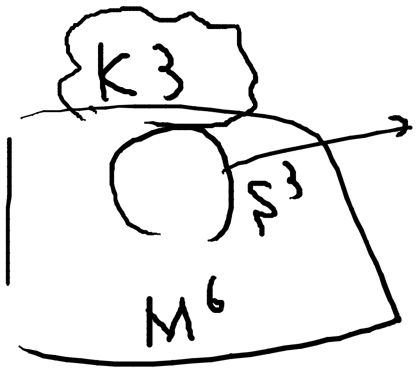

$$Q_5 = \frac{1}{4\pi^2 g} \int_{S^3} H_{RR}$$

$$Q_1 = \frac{1}{4\pi^2 g} \int_{S^3 \times K^3} {*e^{\phi} H_{RR}}$$

$$ds^2 = \left(1 + g\frac{Q_5}{r^2}\right)^{-\frac{1}{4}} \left(1 + g\frac{Q_1}{r^2}\right)^{-\frac{3}{4}}$$

$$\times \left(-dt^2 + dx_5^2 + \left(1 + g\frac{Q_1}{r^2}\right) g_{ij}\, dx^i dx^j \right)$$

$$x_5 \sim x_5 + 2\pi R \qquad + 4\,\text{dim} + \underbrace{\frac{n}{R^2}\frac{g^2}{r^2}\left(dx_5 + dt\right)^2}_{\text{add}}$$

$$e^{-2\phi} = \frac{1 + g\frac{Q_5}{r^2}}{1 + g\frac{Q_1}{r^2}} \Rightarrow \frac{Q_5}{Q_1}$$

5D S_{eff}

$$F_{\mu\nu}^{(1)} \simeq H_{\mu\nu 5}$$

$$F_{\mu\nu}^{(2)} \simeq \varepsilon_{\mu\nu}{}^{\alpha\beta\gamma} H_{\alpha\beta\gamma}$$

$$F_{\mu\nu}^{(3)} \simeq \partial_\mu g_{\nu 5} - \partial_\nu g_{\mu 5}$$

$$S_5 = \frac{1}{16\pi G_5} \int d^5x \sqrt{-g} \left(R + (F^{(1)})^2 F + \cdots \right)$$

$$\frac{1}{G_5} = \frac{V^{(5)}}{G_{(10)}} = \frac{2\pi R (2\pi)^4}{G_{(10)}} \qquad S_{(10)} = \frac{1}{16\pi G_{(10)}} \int d^{10}x \sqrt{-g} (R + \cdots)$$

$$ds_{10}^2 = e^{2D} dx^i dx^i + e^{2N} \left(dx_5 + A_\mu dx^\mu \right)^2$$

$$+ e^{-2(2D+N)/3} ds_5^2$$

$$ds_5^2 = -f^{-\frac{2}{3}} d\tau^2 + f^{\frac{1}{3}} \left(dr^2 + r^2 d\Omega_3^2 \right)$$

$$f \equiv \left(1 + \frac{g Q_5}{r^2}\right)\left(1 + \frac{g Q_5}{r^2}\right)\left(1 + \frac{g^2 n}{R^2 r^2}\right)$$

$$E \sim \left(\frac{g^2 n}{R^2} + g Q_1 + g Q_5 \right) \frac{R}{g^2}$$

$$\sim \frac{n}{R} + \frac{Q_1 R}{g} + \frac{Q_5 R}{g}$$

Entropy

$$\text{Area} = 2\pi^2 r_{(3)}^3$$

$$r_{(3)}^2 = \left(g Q_5 \, g Q_1 \frac{g^2 n}{R^2} \right)^{\frac{1}{3}}$$

$$\text{Area} = \frac{2\pi^2 g^2}{R^2} \sqrt{Q_1 Q_5 n}$$

$$\frac{1}{G_5} = \frac{2\pi R (2\pi)^4}{G_{(10)}} = \frac{4R}{\pi g^2}$$

$$g^2 \to g^2 \hbar$$

$$\frac{\text{Area}}{4 G_5} = \frac{4\cancel{R}}{\pi \cancel{g^2} \cdot 4} \frac{2\pi^2 \cancel{g^2}}{\cancel{R}} \sqrt{Q_1 Q_5 n}$$

cancelling $\hbar$

$$= 2\pi \sqrt{Q_1 Q_5 n}$$

$$g Q_1, \quad g Q_5, \quad g^2 n$$

$$Q_5 = 1$$

$$S_{eff} \sim \sum_{n=1}^{4Q_1} \int dx_5 \, dt \left(\partial_\alpha X^n \partial^\alpha X^n \right)$$

$$X^i (t \pm x_5) = \sum e^{\frac{in}{R}(t \pm x_5)} a_n^\dagger + \cdots$$

$$c = 4Q_1 + 2Q_1 = 6Q_1$$

$$S_{Cardy} = 2\pi \sqrt{\frac{c}{6} n}$$

$$= 2\pi \sqrt{Q_1 n}$$