Gravity waves from Kerr/CFT

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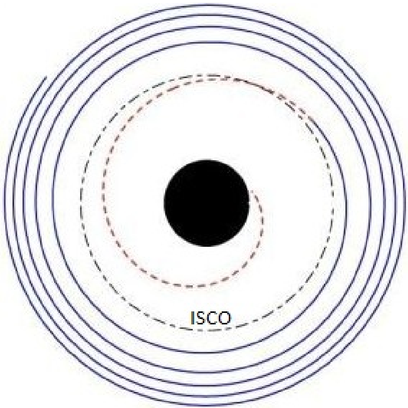
1401.3746 with A. Strominger
1403.2798 with S.Hadar, A. Strominger

The Kerr/CFT correspondence

- The Kerr/CFT conjecture: Quantum gravity in the near horizon region of a (near-)extreme Kerr is dual to a 2D CFT
- Kerr/CFT is bottom-up: Some dictionary entries have been written but we don't know the dual field theory precisely
- For some questions we don't need to though: Can study phenomenological consequences of conformal symmetry

Extreme-Mass-Ratio-Inspirals (EMRIs)



- A primary gravity waves source for LISA mission
- So far people do PN approximation or numerics
- Due to Kerr/CFT analytical treatment is possible

The main result

- Gravity analysis: compute particle number flux at the horizon

$$\mathcal{F}^{gravity} = \frac{dN}{dt}$$

- CFT analysis: compute the transition rate out of the vacuum state

$$\mathcal{R}^{CFT} = \frac{dP}{dt}$$

- Observe that:

$$\mathcal{F}^{gravity} = \mathcal{R}^{CFT}$$

The near horizon metrics and equatorial geodesics

- NHEK & circle:

$$ds^2 = 2M^2\Gamma(\theta)\left[-R^2dT^2 + \frac{dR^2}{R^2} + d\theta^2 + \Lambda(\theta)^2(d\Phi + RdT)^2\right]$$

$$\begin{aligned} R(T) &= R_0 \\ \Phi(T) &= -\frac{3}{4}R_0\,T + \Phi_0 \end{aligned}$$

- near-NHEK & plunge:

$$ds^2 = 2M^2\Gamma(\theta)\left[-r(r+2\kappa)dt^2 + \frac{dr^2}{r(r+2\kappa)} + d\theta^2 + \Lambda(\theta)^2(d\phi + (r+\kappa)dt)^2\right]$$

$$\begin{aligned} t(r) &= \frac{1}{2\kappa}\ln\frac{1}{r(r+2\kappa)} + t_0 \\ \phi(r) &= \frac{3r}{4\kappa} + \frac{1}{2}\ln\frac{r}{r+2\kappa} + \phi_0 \end{aligned}$$

Transformation

- Bulk diffeomorphism:

$$
\begin{aligned}
T &= -e^{-\kappa t}\frac{r+\kappa}{\sqrt{r(r+2\kappa)}} \\
R &= \frac{1}{\kappa}e^{\kappa t}\sqrt{r(r+2\kappa)} \\
\Phi &= \phi - \frac{1}{2}\ln\frac{r}{r+2\kappa}
\end{aligned}
$$

- Boundary conformal transformation:

$$
\begin{aligned}
T &= -e^{-\kappa t} \\
\Phi &= \phi
\end{aligned}
$$

Penrose diagram