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

Achilleas Porfyriadis (Harvard) Gravity waves from Kerr/CFT
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
  \[ \mathcal{F}_{\text{gravity}} = \frac{dN}{dt} \]

- CFT analysis: compute the transition rate out of the vacuum state
  \[ \mathcal{R}^{\text{CFT}} = \frac{dP}{dt} \]

- Observe that:
  \[ \mathcal{F}_{\text{gravity}} = \mathcal{R}^{\text{CFT}} \]
The near horizon metrics and equatorial geodesics

- **NHEK & circle:**

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

\[
R(T) = R_0 \\
\Phi(T) = -\frac{3}{4} R_0 T + \Phi_0
\]

- **near-NHEK & plunge:**

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

\[
t(r) = \frac{1}{2\kappa} \ln \frac{1}{r(r + 2\kappa)} + t_0 \\
\phi(r) = \frac{3r}{4\kappa} + \frac{1}{2} \ln \frac{r}{r + 2\kappa} + \phi_0
\]
Bulk diffeomorphism:

\[
T = -e^{-\kappa t} \frac{r + \kappa}{\sqrt{r(r + 2\kappa)}}
\]

\[
R = \frac{1}{\kappa} e^{\kappa t} \sqrt{r(r + 2\kappa)}
\]

\[
\Phi = \phi - \frac{1}{2} \ln \frac{r}{r + 2\kappa}
\]

Boundary conformal transformation:

\[
T = -e^{-\kappa t}
\]

\[
\Phi = \phi
\]