Null Radial Geodesics & Penrose-Carter Diagrams, The Catalogue

by M.B.Kocic – Version 1.01 (2017-02-16)

Metric in (v,r): $g_{\mu\nu} = -2\ell_{(\mu}n_{\nu)} = \begin{pmatrix} -F & 1 \\ 1 & 0 \end{pmatrix}$

Ingoing vielbein in (v,r): $\ell^\mu = (0,-1), \quad n^\mu = (1, F/2)$

Metric in (u,r): $g_{\mu\nu} = -2\ell_{(\mu}n_{\nu)} = \begin{pmatrix} -F & -1 \\ -1 & 0 \end{pmatrix}$

Outgoing vielbein in (u,r): $\ell^\mu = (1, -F/2), \quad n^\mu = (0,1)$

$v := t + r^*, \quad \mathrm{d}v = \mathrm{d}t + F^{-1}\mathrm{d}r,$
$u := t - r^*, \quad \mathrm{d}u = \mathrm{d}t - F^{-1}\mathrm{d}r,$
$\mathrm{d}r^*/\mathrm{d}r := F^{-1}, \quad t' := t \pm (r^* - r)$

Legend:
blue : ingoing (advanced)
red : outgoing (retarted)
green : Killing vector $K = \partial/\partial t$

Minkowski
$F = 1$

Anti de Sitter
$F = 1 - \frac{\Lambda}{3}r^2, \quad \Lambda < 0$

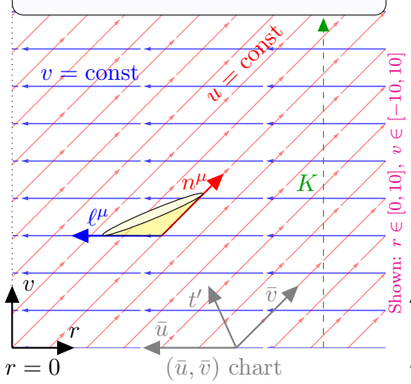
de Sitter
$F = 1 - \frac{\Lambda}{3}r^2, \quad \Lambda > 0$

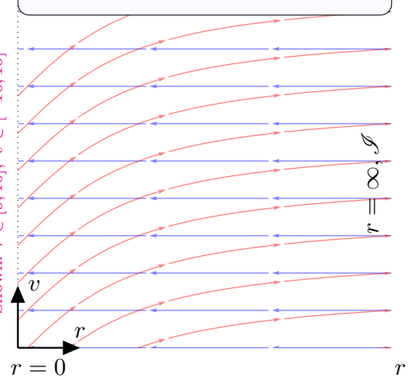
Schwarzschild
$F = 1 - \frac{r_\mathrm{H}}{r}, \quad r_\mathrm{H} > 0$

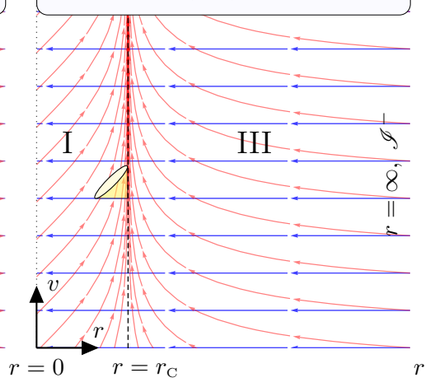
Schwarzschild - Anti de Sitter
$F = 1 - \frac{r_\mathrm{S}}{r} - \frac{\Lambda}{3}r^2, \quad \Lambda < 0$

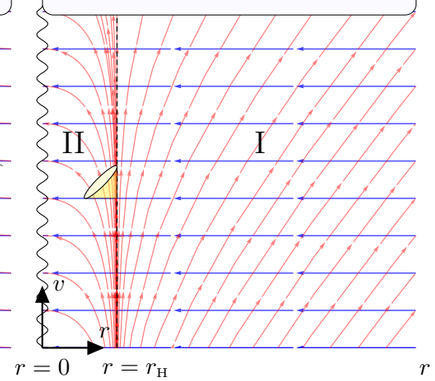
Schwarzschild - de Sitter
$F = 1 - \frac{r_\mathrm{S}}{r} - \frac{\Lambda}{3}r^2, \quad \Lambda > 0$

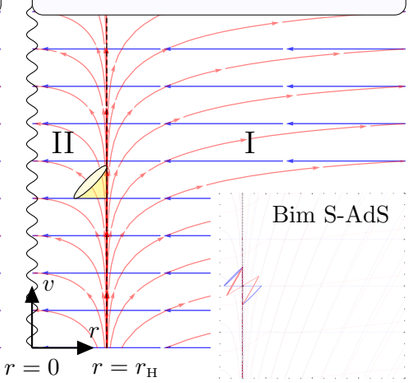
Ingoing chart (v,r)

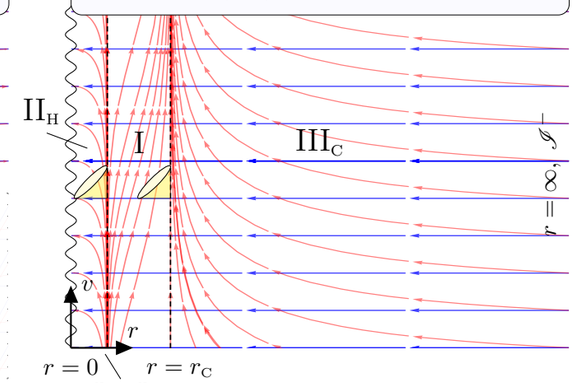




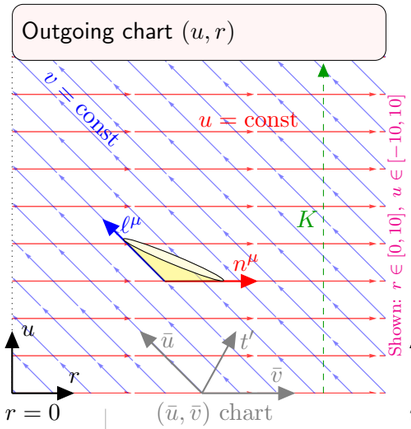


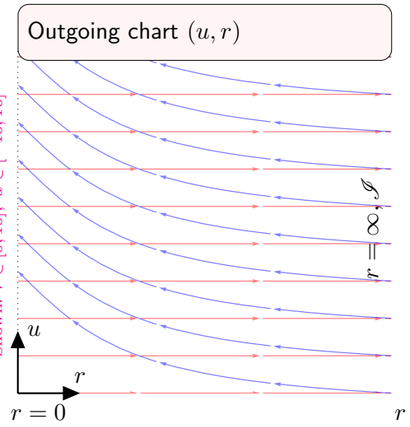


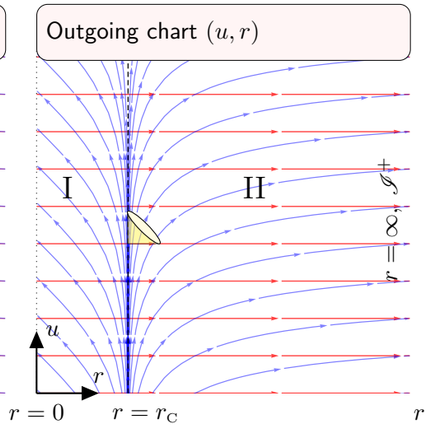


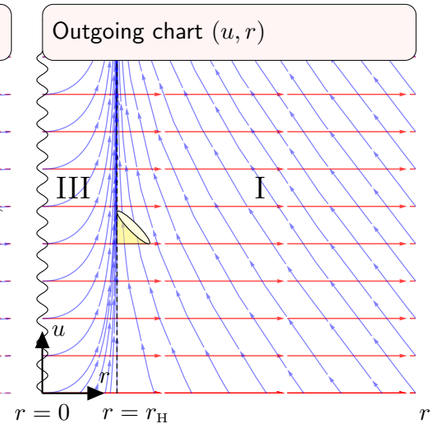


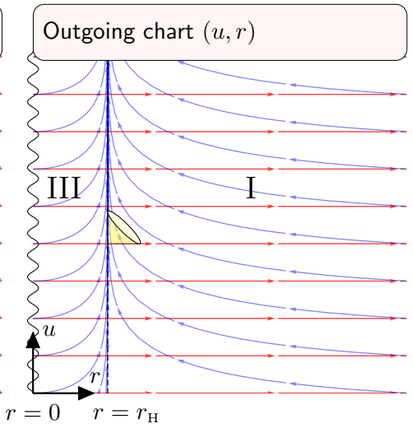
Outgoing chart (u,r)

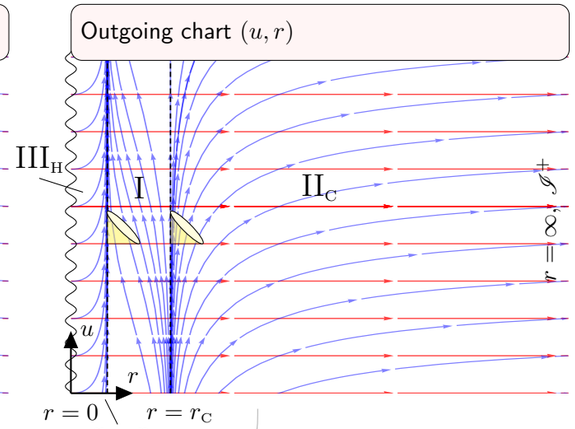




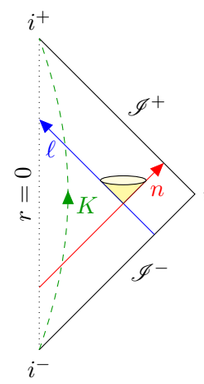




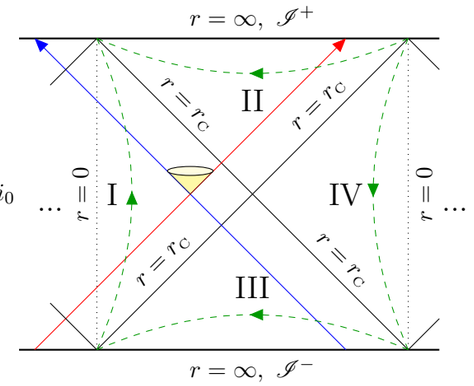




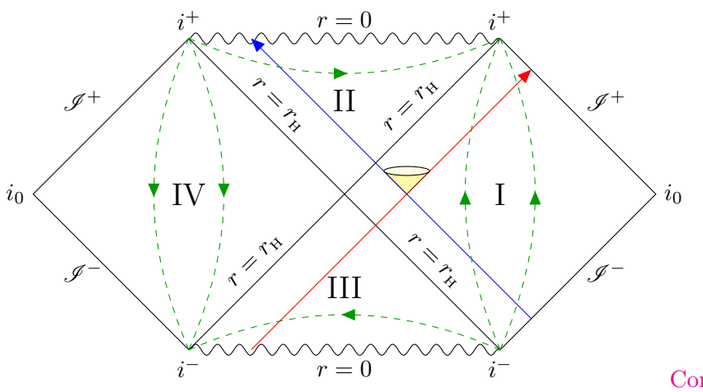
Minkowski



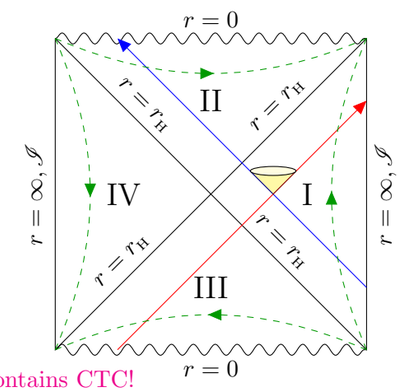
de Sitter



Schwarzschild



Schwarzschild - Anti de Sitter



Contains CTC!

Schwarzschild - de Sitter