

# Build your own embedded spacetime (a theoretical outreach talk)

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make a physical model from any  
static & spherically symmetrical metric:

$$ds^2 = g_{tt}dt^2 + g_{rr}dr^2 + r^2 (d\theta^2 + \sin\theta d\phi^2)$$

choose time slice of the spacetime  
(here:  $t=\text{const}$ )  
(ignore  $g_{tt}$  for now)

look at equatorial plane ( $\theta = \pi$ )

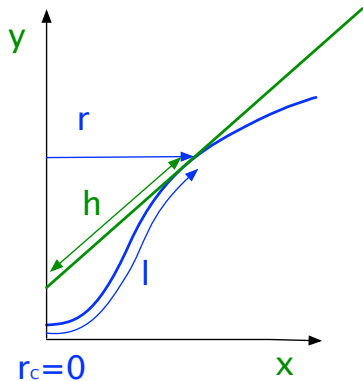
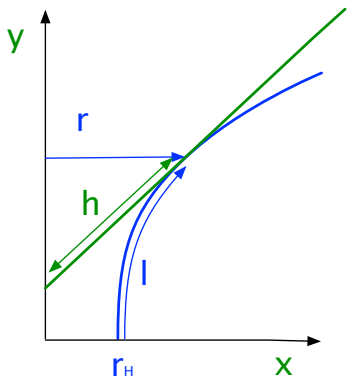
Geometry in the metric:  
it relates proper distance in radial direction

$$l(r) = \int_{r_*}^r \sqrt{g_{r'r'}} dr'$$

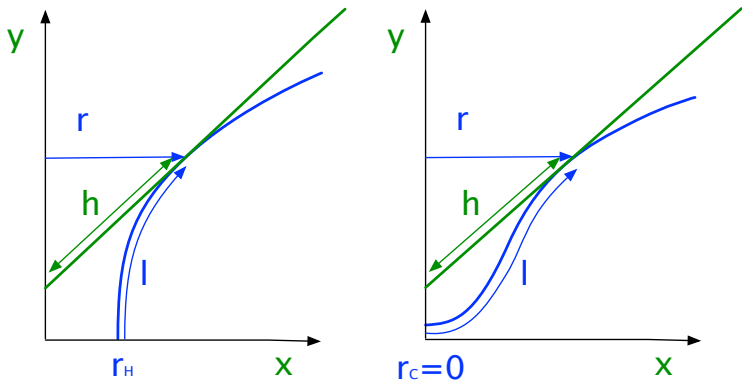
to circumferential distance (in  $\phi$  direction)

$$c(r) = 2\pi r$$

Look at **tangent cones** to embedded **spacetime slice**



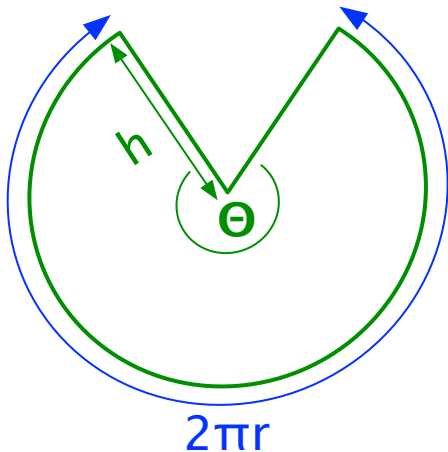
Look at **tangent cones** to embedded **spacetime slice**



distance to centre of cone **in embedding space**:

$$h = r\sqrt{g_{rr}}$$

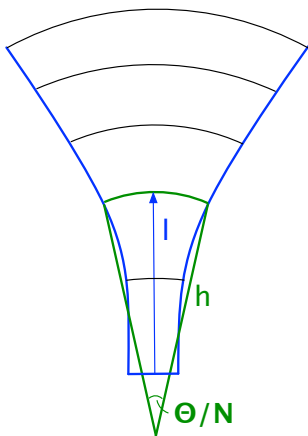
edge of cone with proper circumference



$$h = r\sqrt{g_{rr}}$$

$$\Theta = \frac{2\pi}{\sqrt{g_{rr}}}$$

build spacetime by spacing cone edges by proper length  
divide into N segments to construct from paper

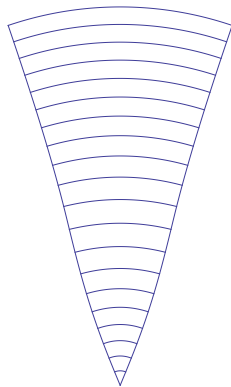


$$h = r\sqrt{g_{rr}}$$

$$\Theta = \frac{2\pi}{\sqrt{g_{rr}}}$$

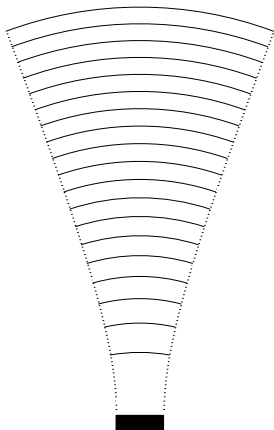
$$l(r) = \int_{r_*}^r \sqrt{g_{r'r'}} dr'$$

for 8 segments



← NS

BH →



Processing code for BHs available!

