



## Kruskal-Szekeres coordinates for Schwarzschild spacetime

$$\left\{ \begin{array}{l} U = \sqrt{\frac{r}{2GM} - 1} e^{\frac{r}{4GM}} \cosh\left(\frac{t}{4GM}\right) \\ V = \sqrt{\frac{r}{2GM} - 1} e^{\frac{r}{4GM}} \sinh\left(\frac{t}{4GM}\right) \end{array} \right\} \quad \text{for } r > 2GM$$
$$\left\{ \begin{array}{l} U = \sqrt{1 - \frac{r}{2GM}} e^{\frac{r}{4GM}} \sinh\left(\frac{t}{4GM}\right) \\ V = \sqrt{1 - \frac{r}{2GM}} e^{\frac{r}{4GM}} \cosh\left(\frac{t}{4GM}\right) \end{array} \right\} \quad \text{for } r < 2GM$$

**Penrose coordinates:**

$$\begin{cases} U + V = \tan(u + v) \\ U - V = \tan(u - v) \end{cases}$$

**Simple coordinate arrows show local  $(x, t)$  directions**