

# ★重力場内の光線軌道の一考察★

Minkowski 時空  $c=1$

$$ds^2 = dt^2 - dr^2 - r^2(d\theta^2 + \sin^2\theta d\varphi^2)$$

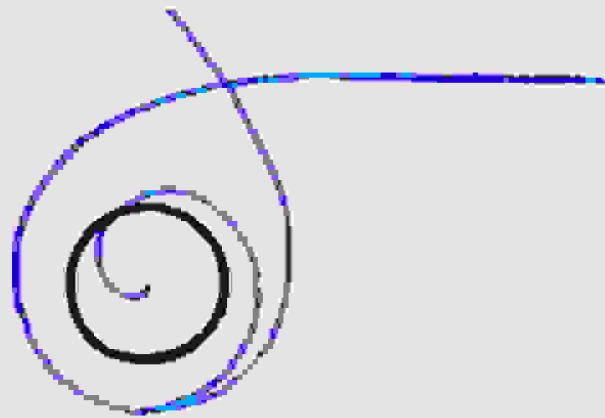
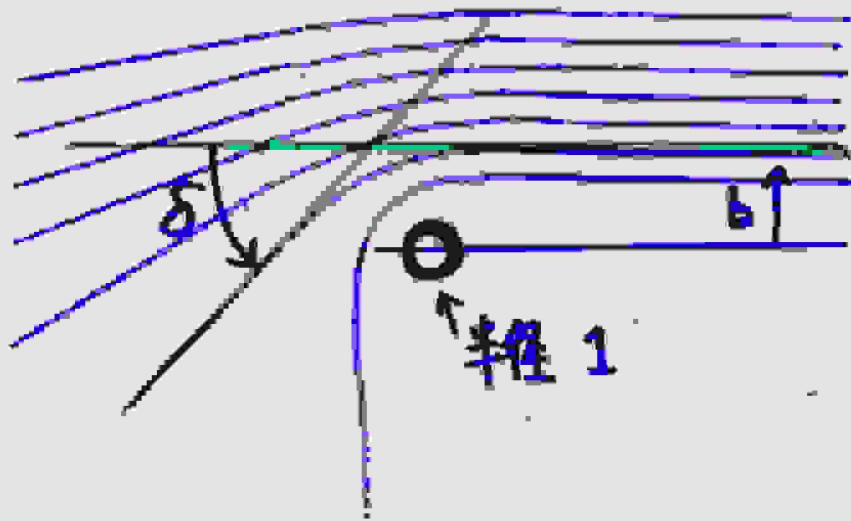
Schwarzschild 時空  $c=1$   $2GM=1$

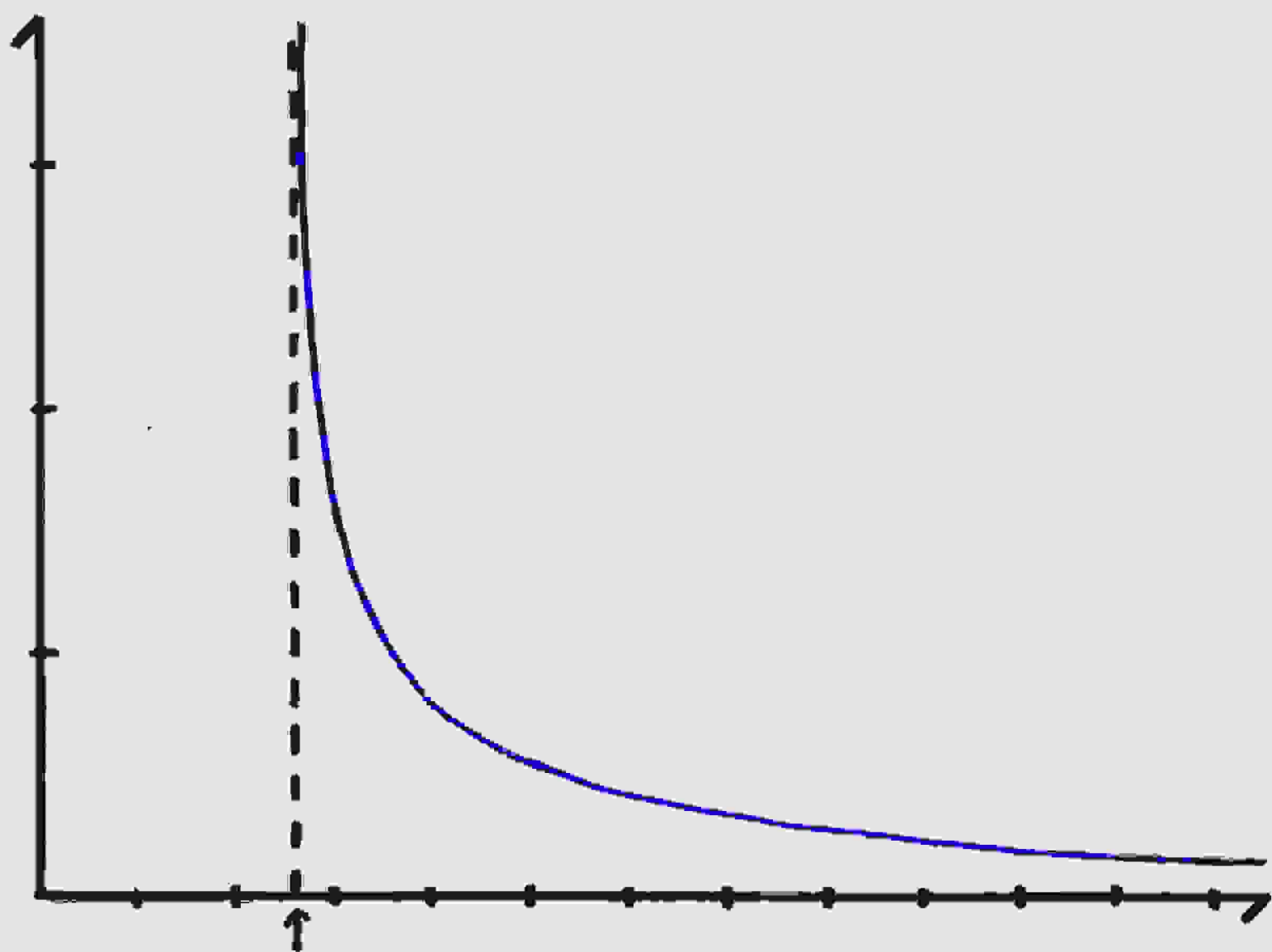
$$ds^2 = \left(1 - \frac{1}{r}\right) dt^2 - \left(1 - \frac{1}{r}\right)^{-1} dr^2 - r^2(d\theta^2 + \sin^2\theta d\varphi^2)$$

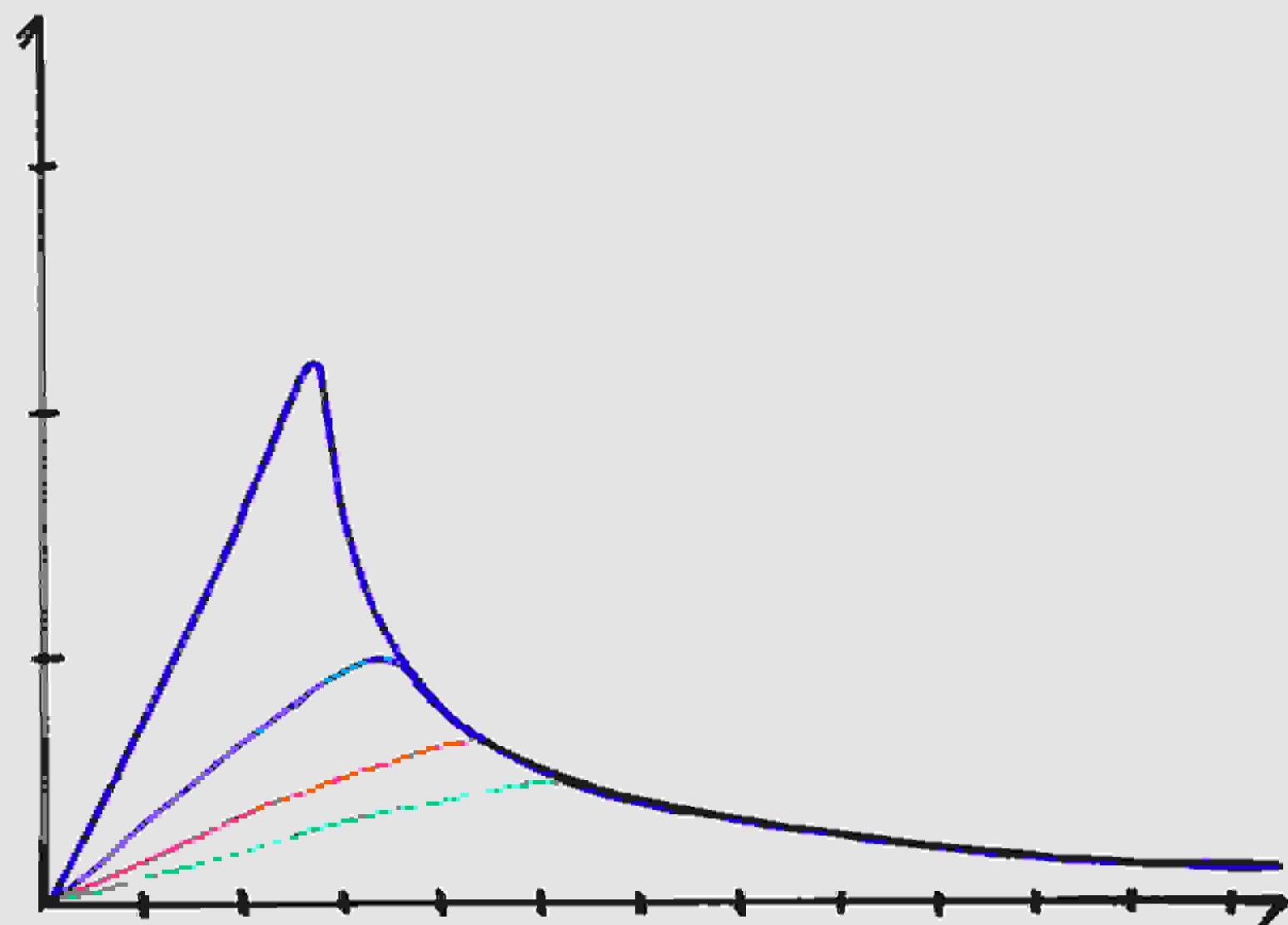
Kerr 時空  $c=1$   $2GM=1$

$$ds^2 = \frac{\Delta}{\rho^2} (dt - a \sin^2\theta d\varphi)^2 - \frac{\sin^2\theta}{\rho^2} [(r^2 + a^2)d\varphi - a dt]^2 - \frac{\rho^2}{\Delta} dr^2 - \rho^2 d\theta^2$$

$$\text{in } \mathbb{R}^4 \quad \Delta = r^2 - r + a^2, \quad \rho^2 = r^2 + a^2 \cos^2\theta$$



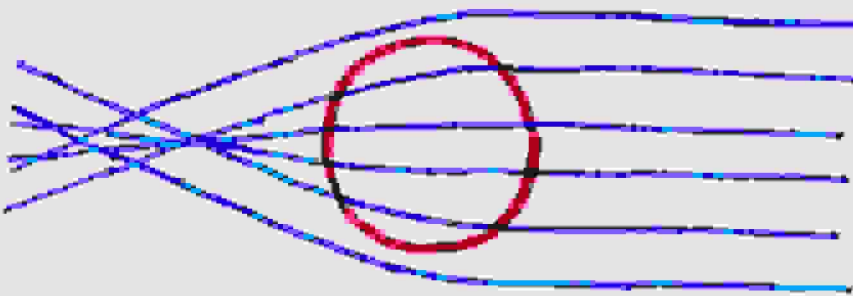
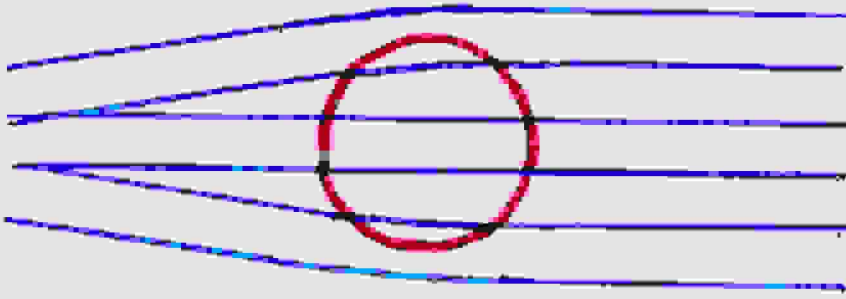


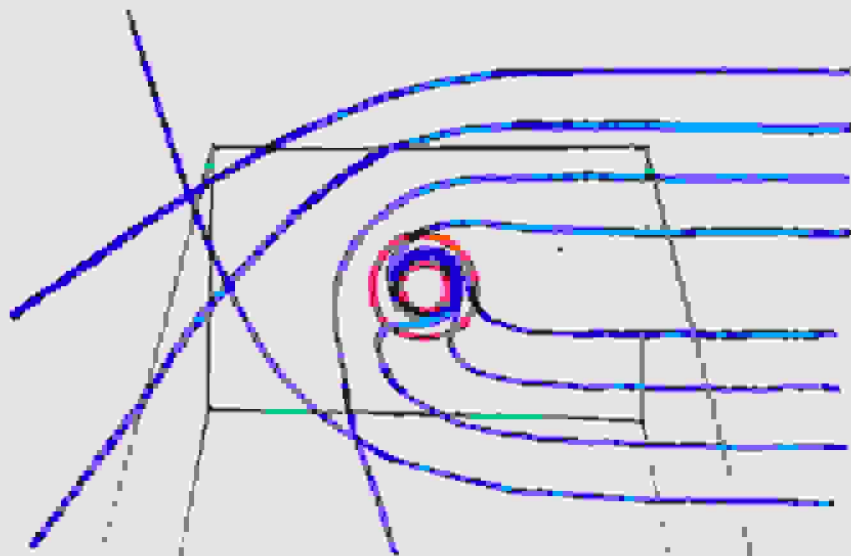


内部  $c=1$   $2GM=1$

$$ds^2 = \left( \frac{3}{2} \sqrt{1 - \frac{1}{R}} - \frac{1}{2} \sqrt{1 - \frac{r^2}{R^3}} \right)^2 dt^2$$

$$- \left( 1 - \frac{r^2}{R^3} \right)^{-1} dr^2 - r^2 (d\theta^2 + \sin^2 \theta d\varphi^2)$$

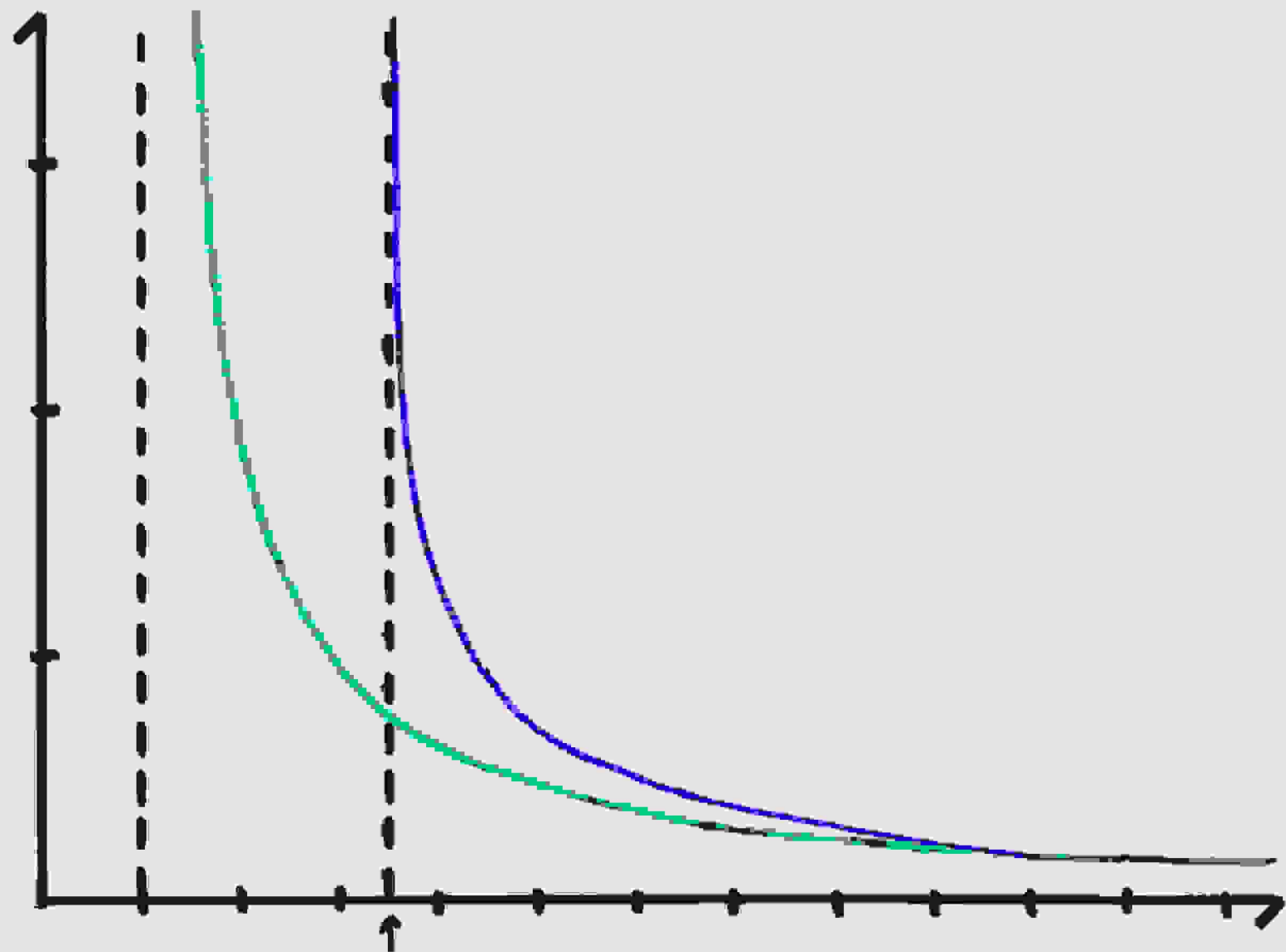


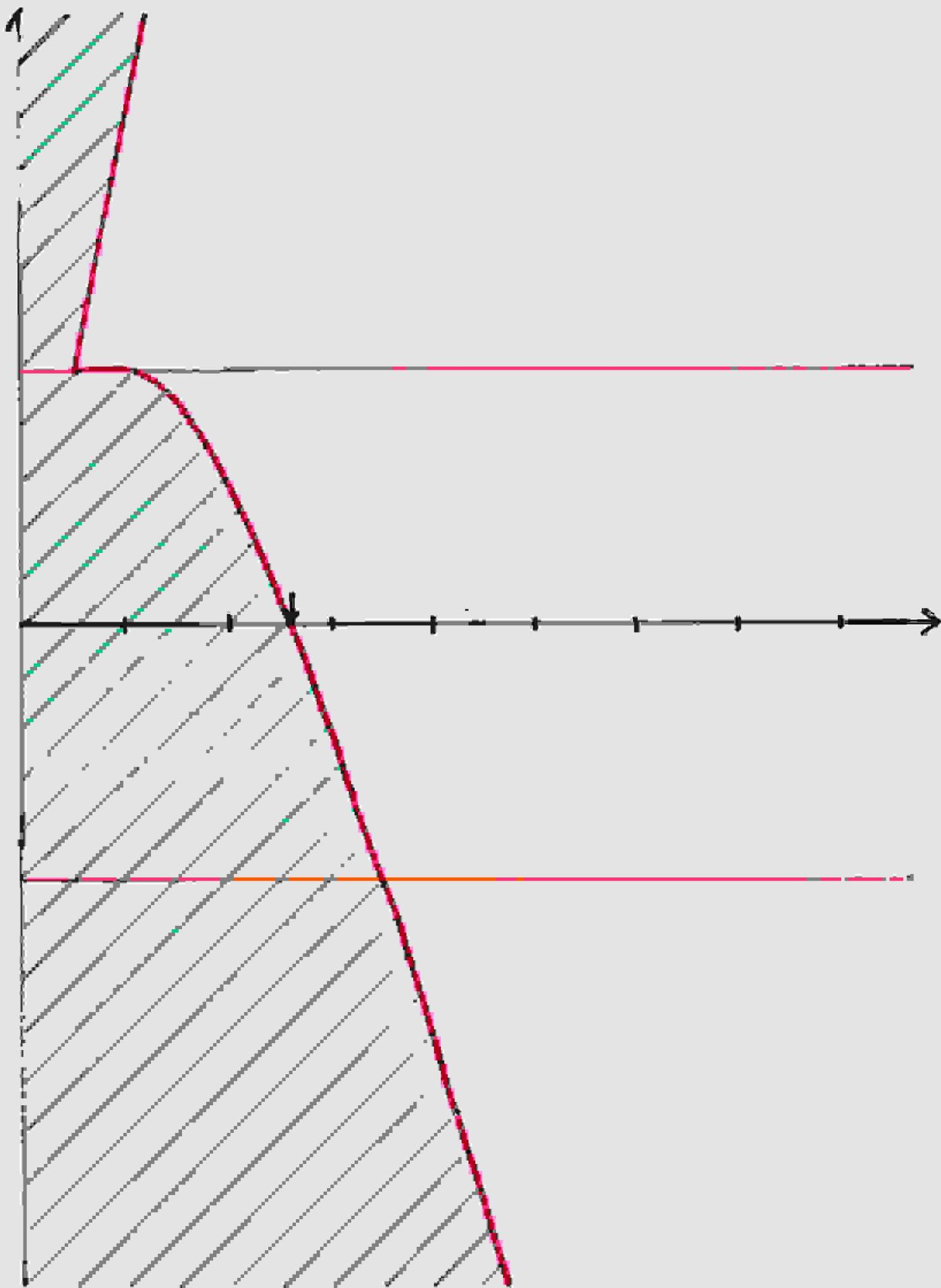


$b = 4$   
 3  
 2  
 1  
 -1  
 -2  
 -3  
 -4

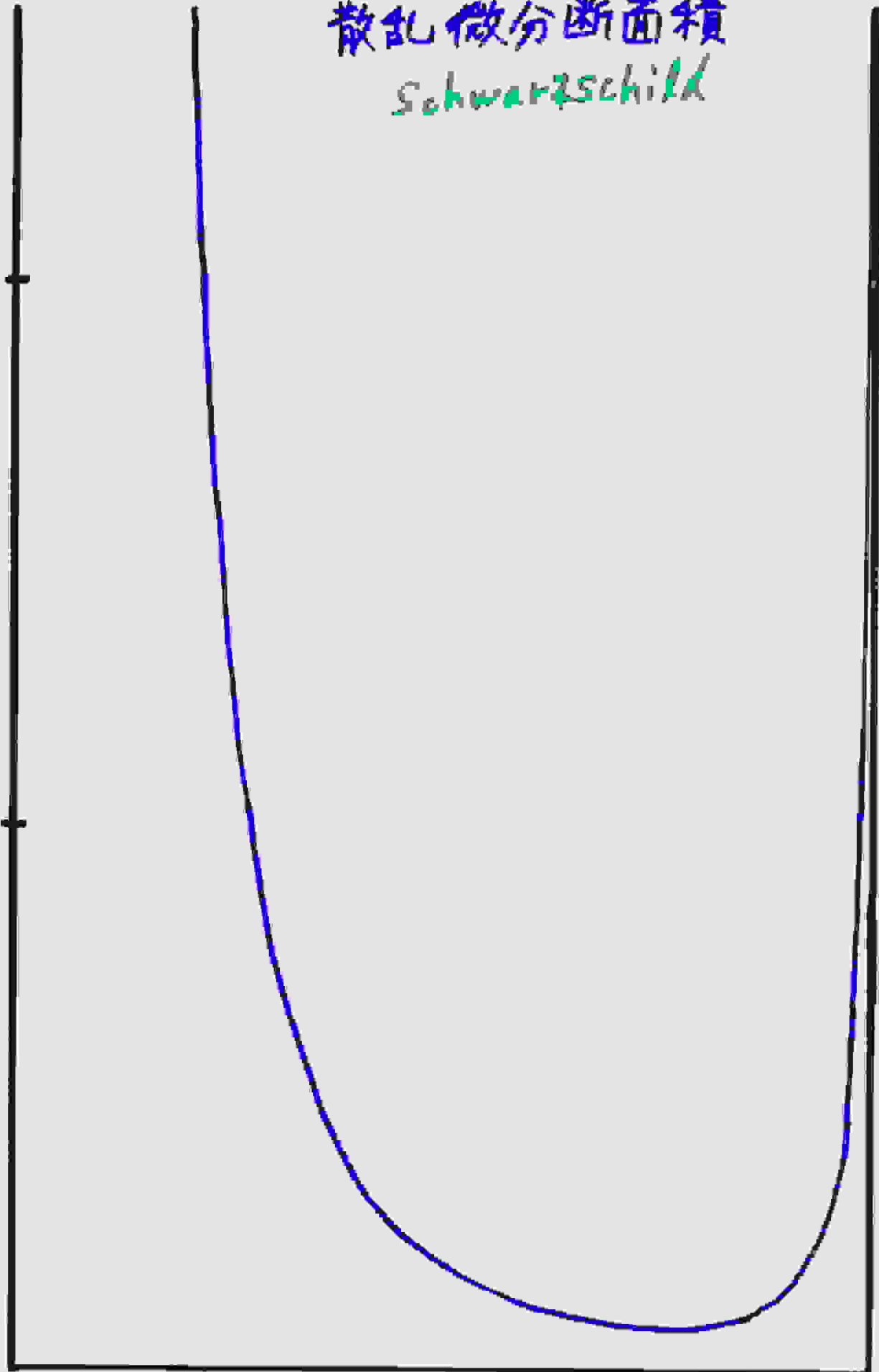


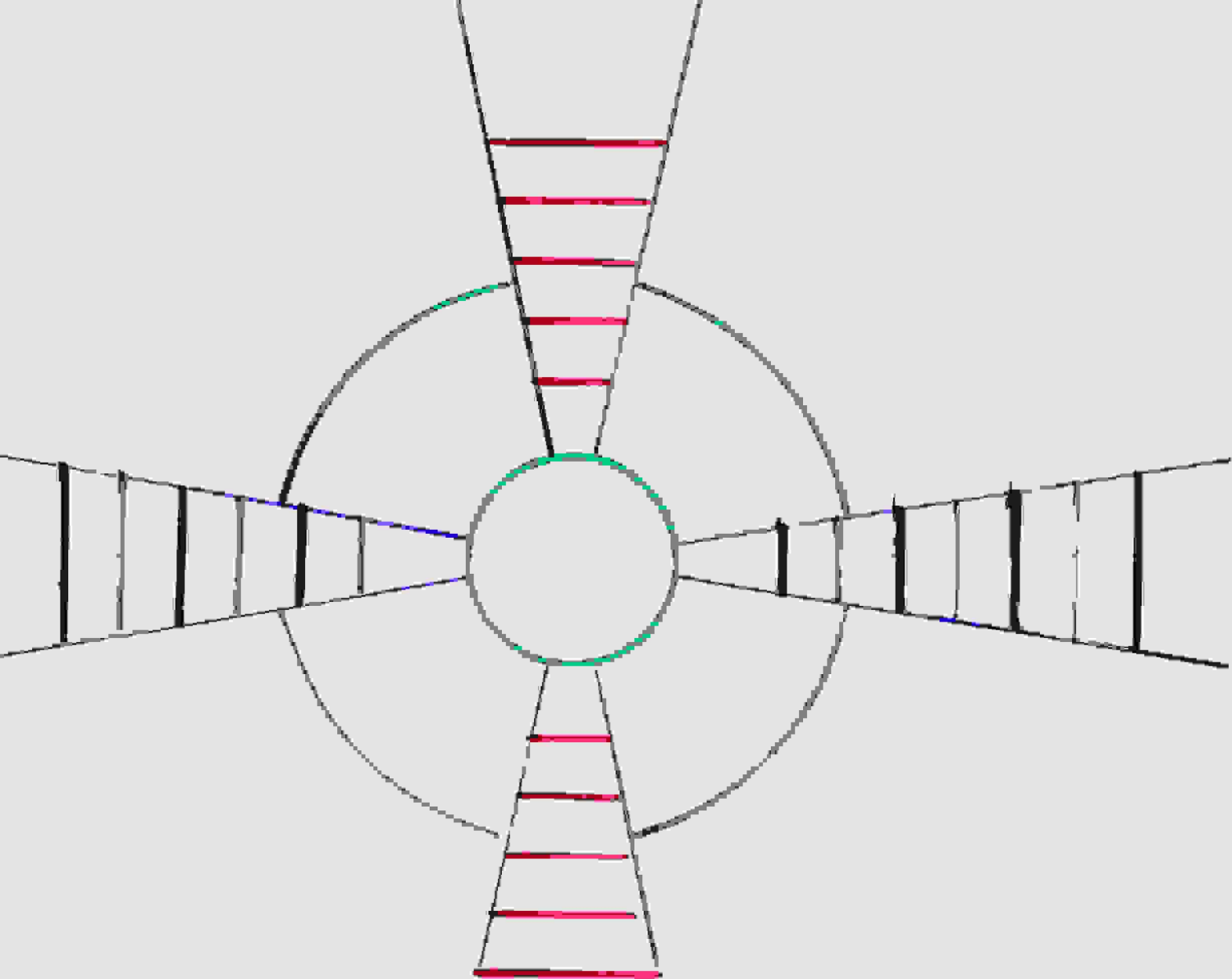
$b = 2$   
 1  
 -1  
 -2





散亂微分斷面積  
Schwarzschild





しばらく

おまちください

