(Bull) 02/06/03

Sourceless Einstein 2+1 D gravity: $R_{ij} = 0 \rightarrow R_{ijkl} = 0$

Spacetime is flat $\xrightarrow{?}$ Minkowsky space

$$ds^2 = -dt^2 + e^{2\varphi}(dr^2 + r^2 d\varphi^2) \quad \text{(a ansatz)}$$

therefore: $\boxed{G_0{}^0 = -\nabla^2 \varphi = 8\pi T_0{}^0}$

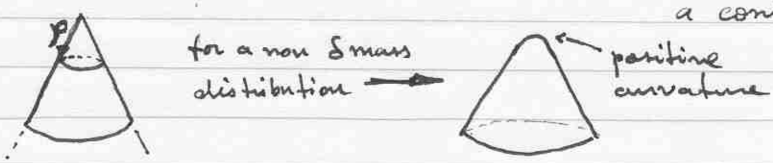
if $T_0{}^0 = 0$ (vacuum) then φ = const. and we have Minkowsky space. ($r \rightarrow e^{\varphi} r$)

point particle: $\boxed{T_0{}^0 = 8\pi \gamma m \,\delta^2(r)} \longrightarrow \boxed{\varphi = 4\gamma m \ln r}$

and then: $\boxed{ds^2 = -dt^2 + r^{-8\gamma m}(dr^2 + r^2 d\varphi^2)}$ is this flat space?

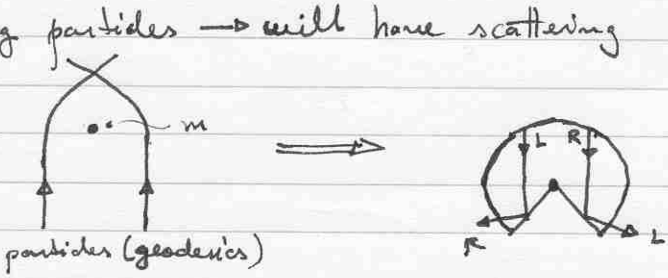
Make a coordinate change: $\rho = \dfrac{r^{1-4\gamma m}}{1-4\gamma m}$, $\theta = (1-4\gamma m)\varphi$

therefore: $ds^2 = -dt^2 + d\rho^2 + \rho^2 d\theta^2 \longleftarrow$ the flat metric. but because $0 \leqslant \varphi \leqslant 2\pi$, $0 \leqslant \theta \leqslant 2\pi(1-4\gamma m)$ we have a conical singularity.

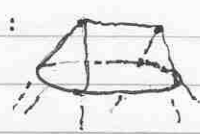


conical singularity: there's no attraction force for statical particles. (it's just flat space)

For moving particles $\rightarrow$ will have scattering



If have two massive particles, would have something like:



But $\rightarrow$ No Black Holes.