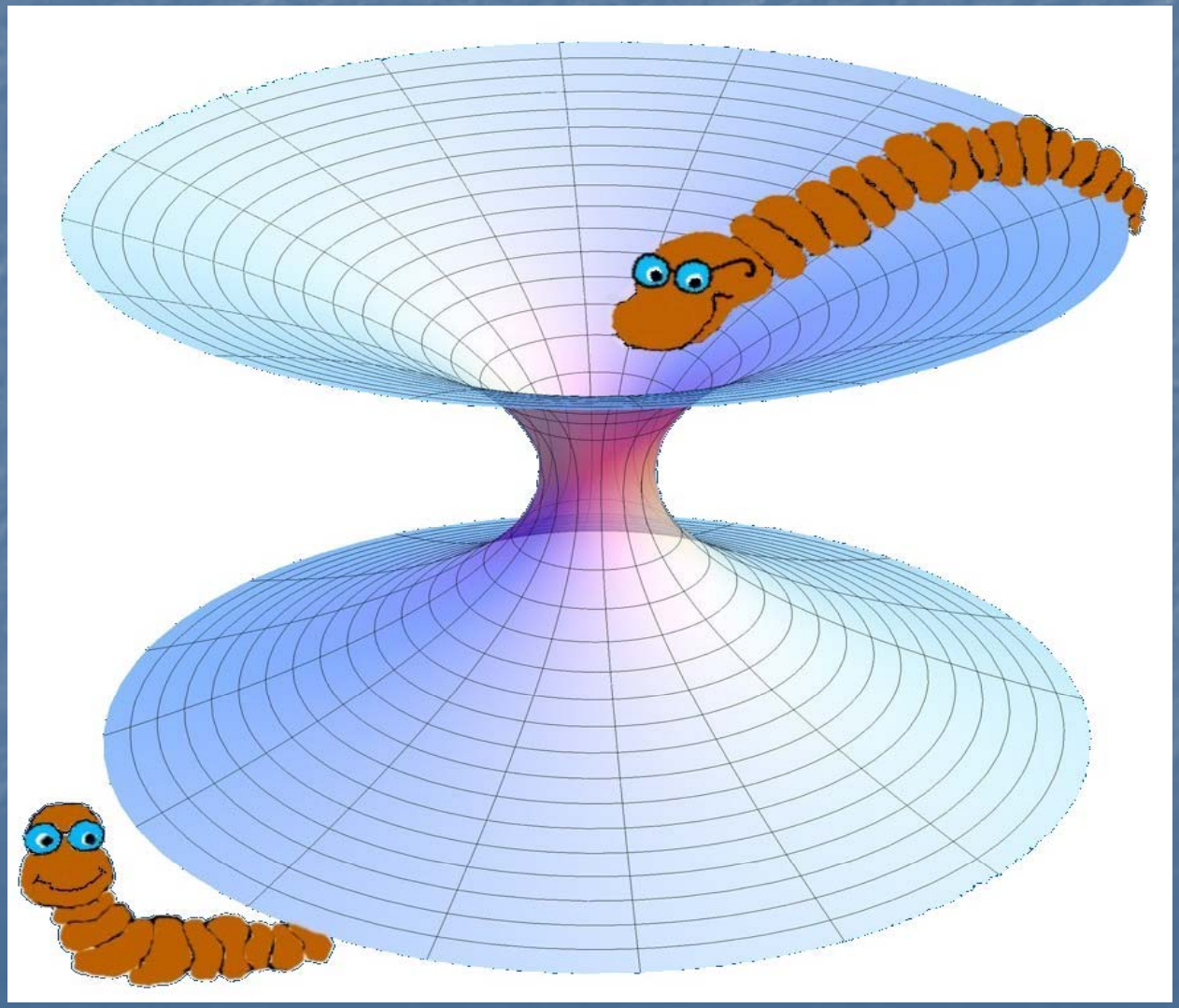
Traversable and semi-traversable wormholes



Andrey Doroshkevich,

Jakob Hansen,

Nikolay Kardashev,

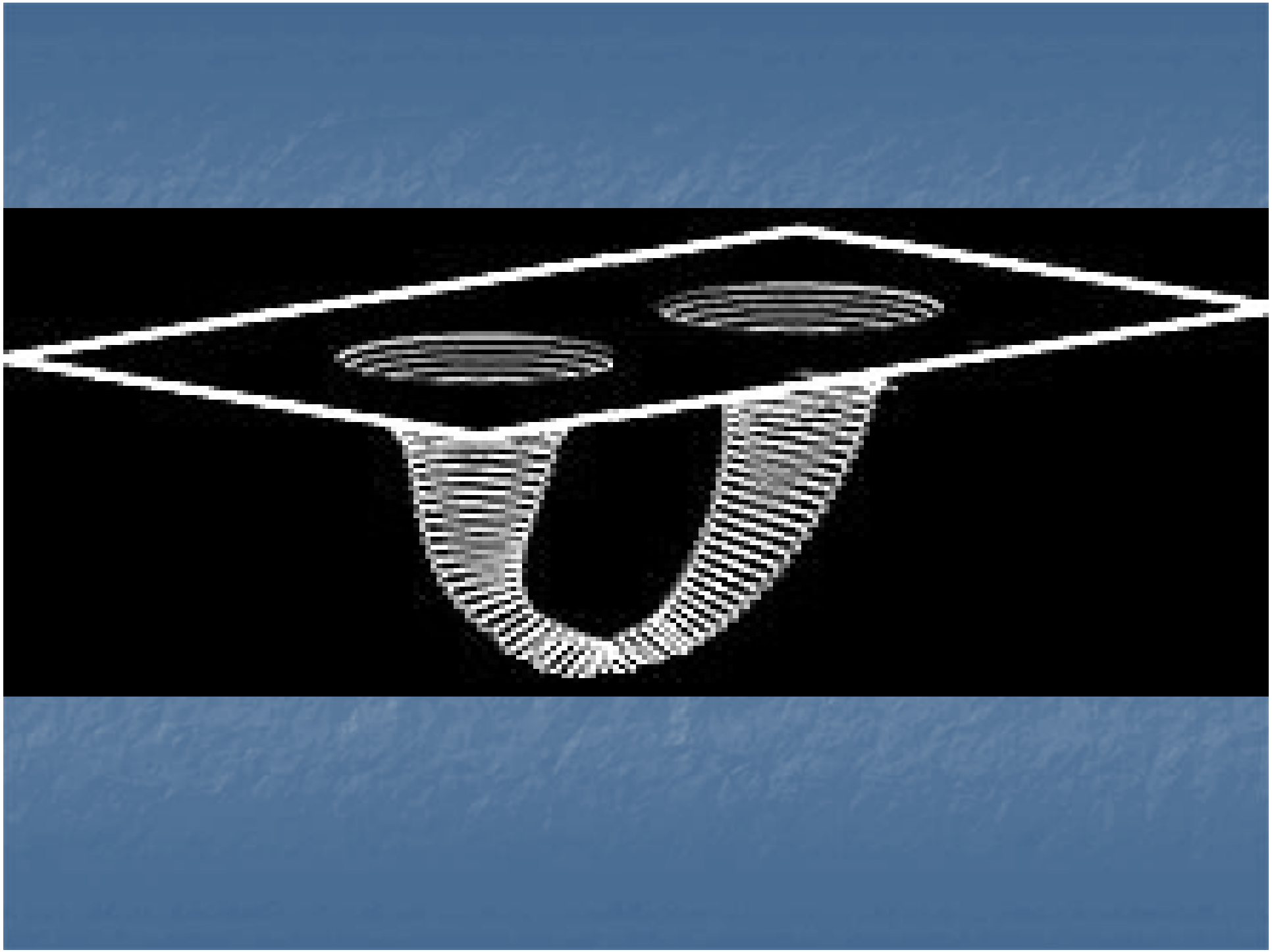
Dmitriy Novikov,

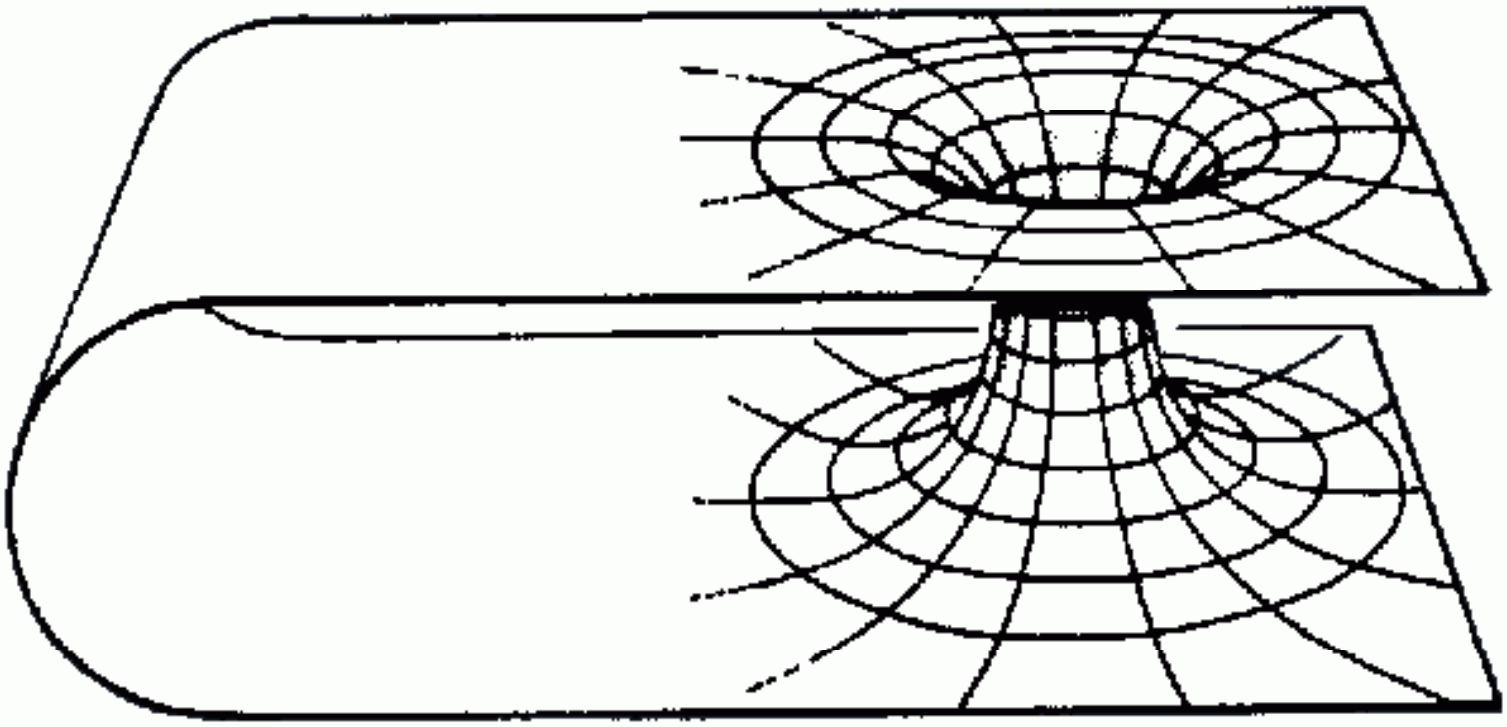
Igor Novikov,

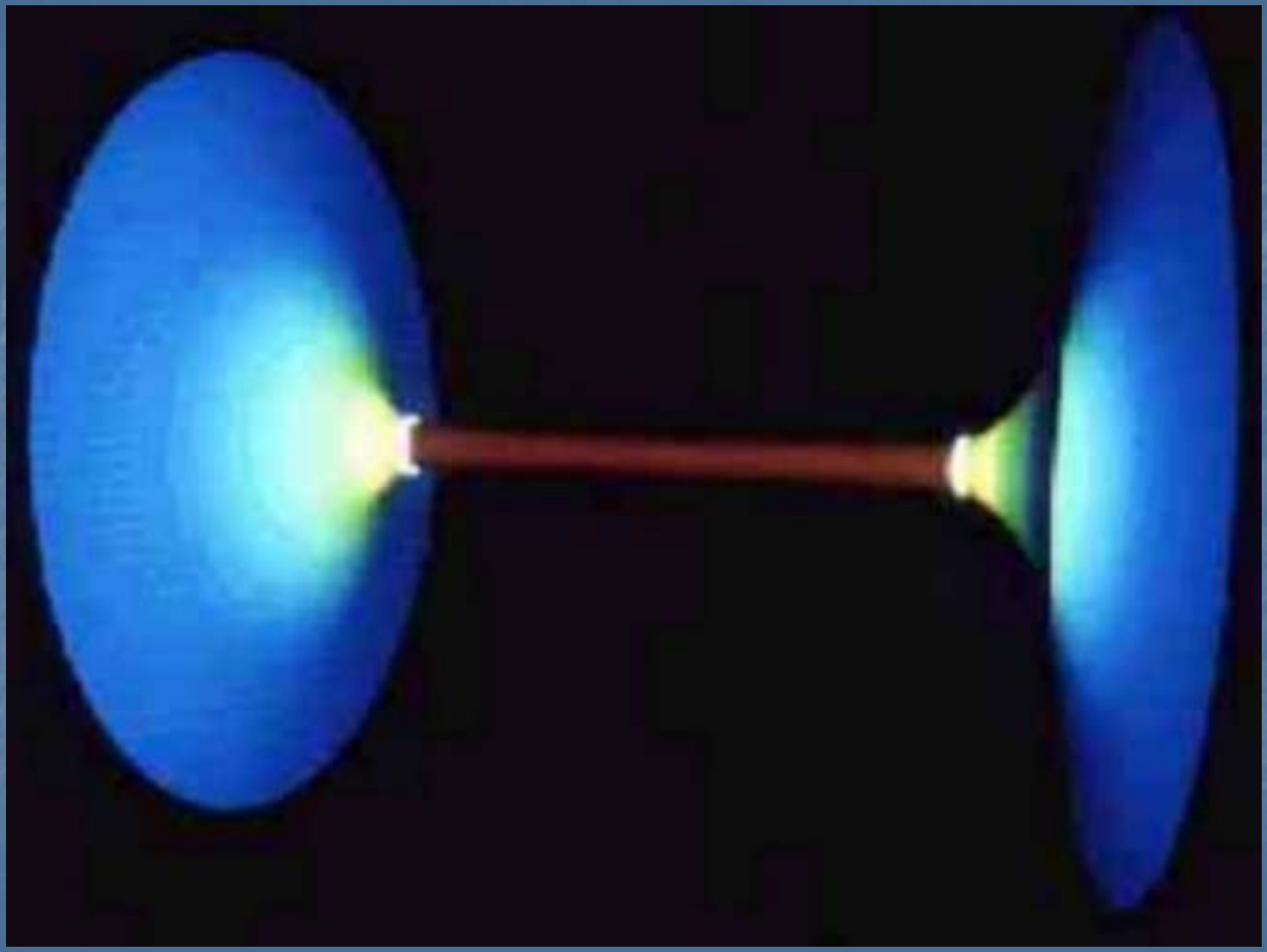
Alexander Shatskiy

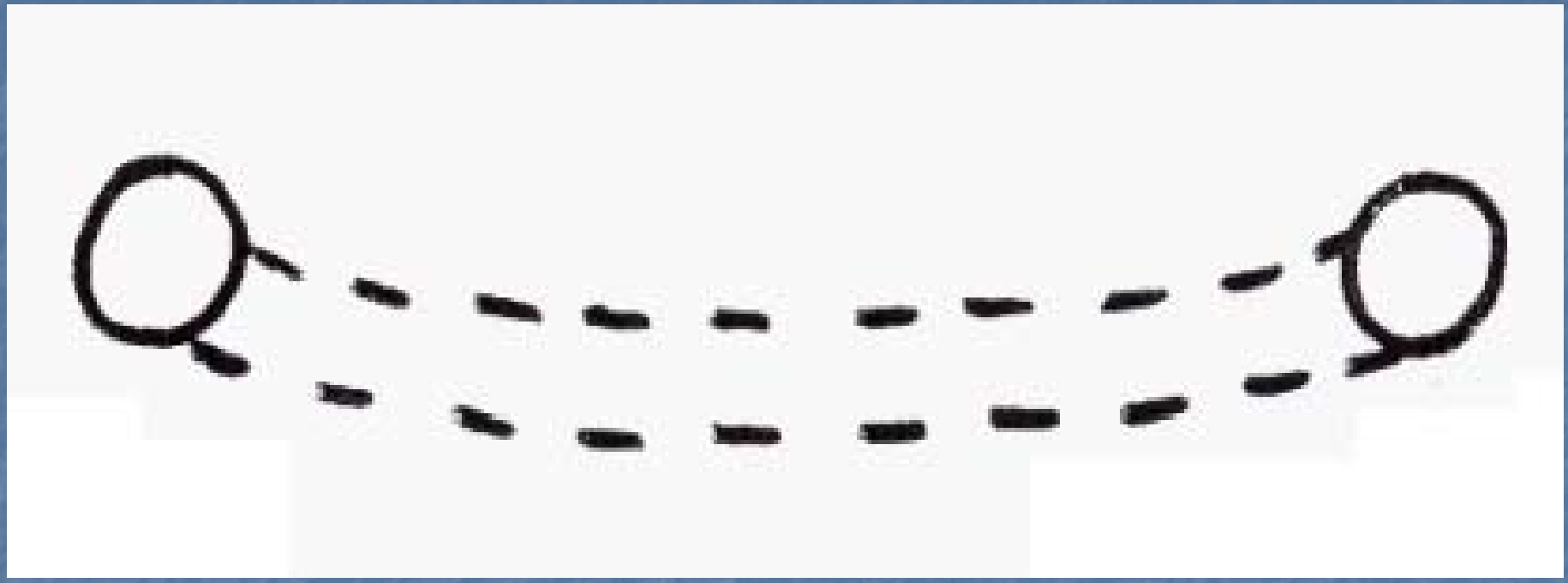
We propose a hypothesis that there are wormholes in the Universe.

This hypothesis can explain some observational facts and predict new effects.

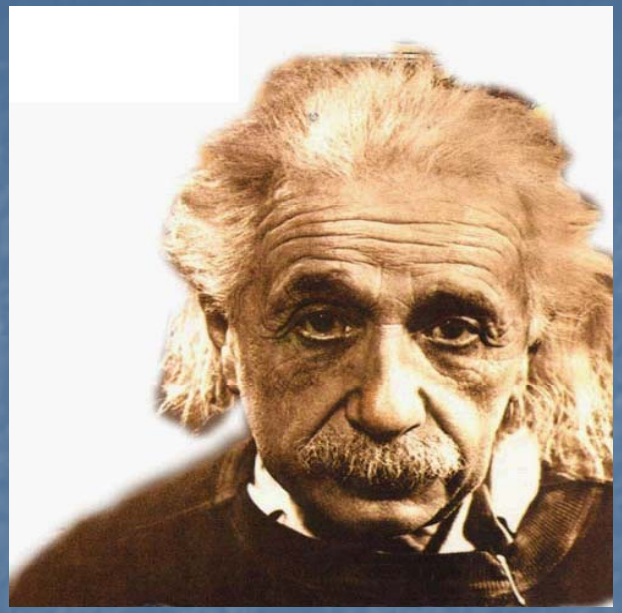


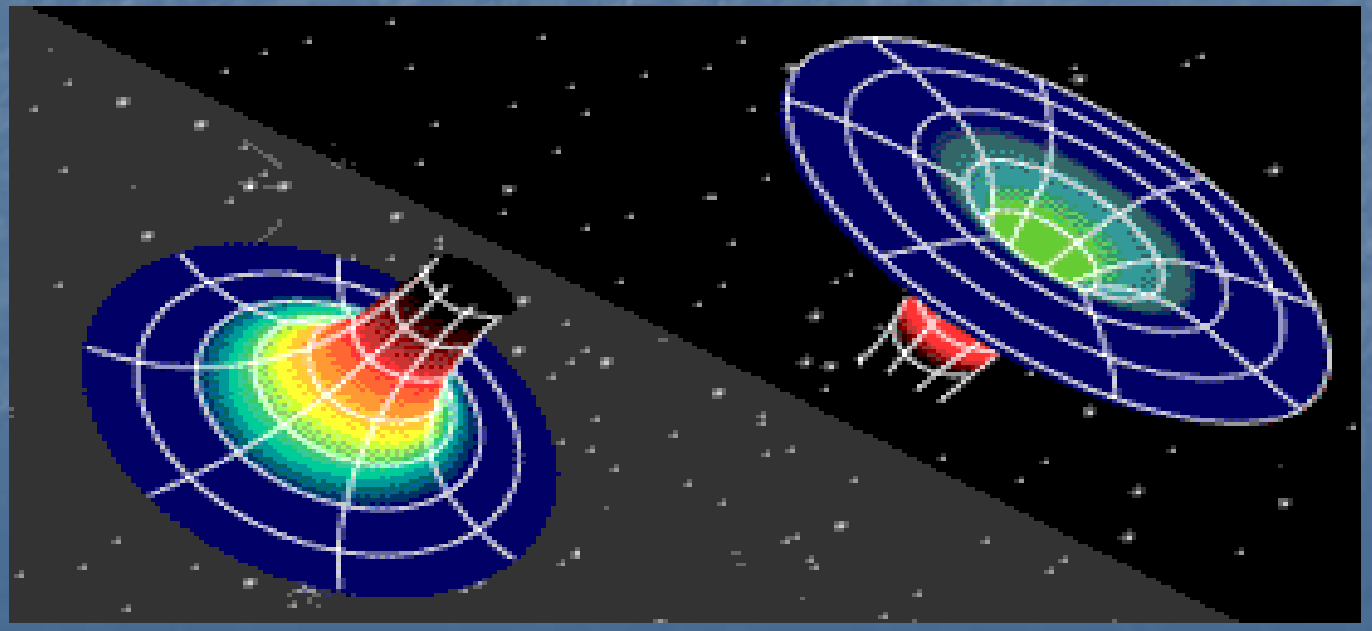






Einstein-Rosen BRIDGE 1935





Exotic matter

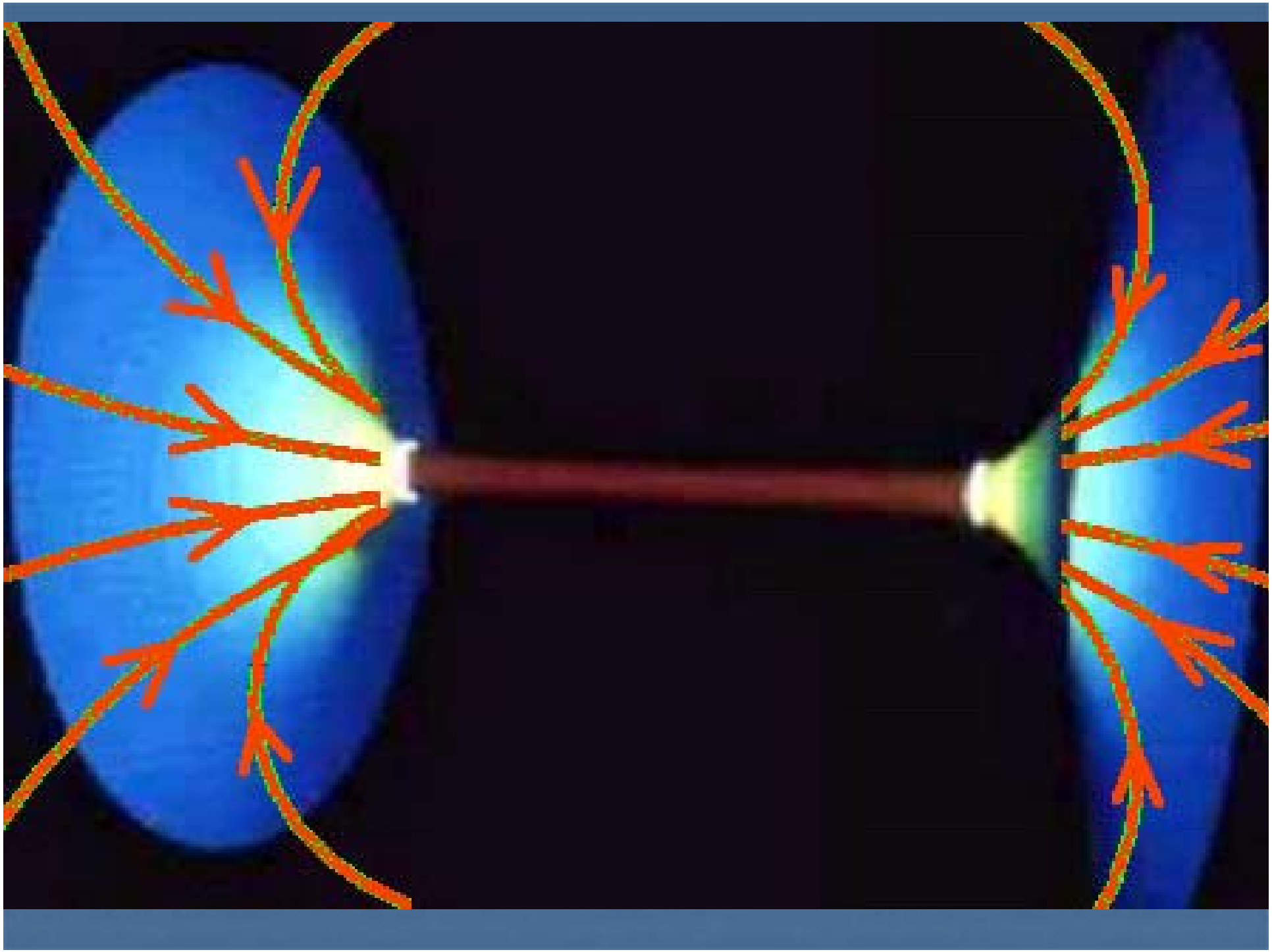
$$\varepsilon + p_{\|} < 0$$

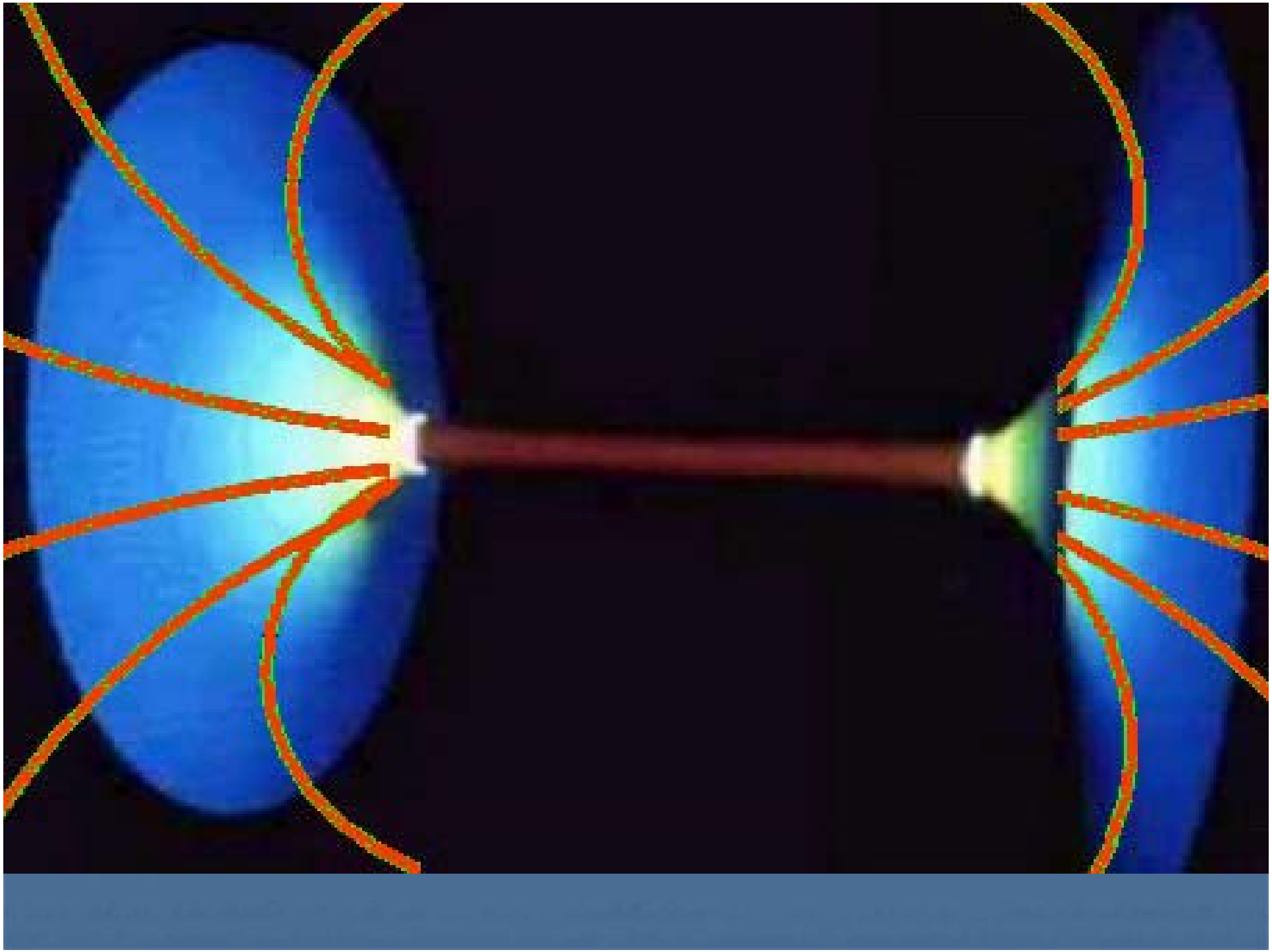
where ε - energy density,

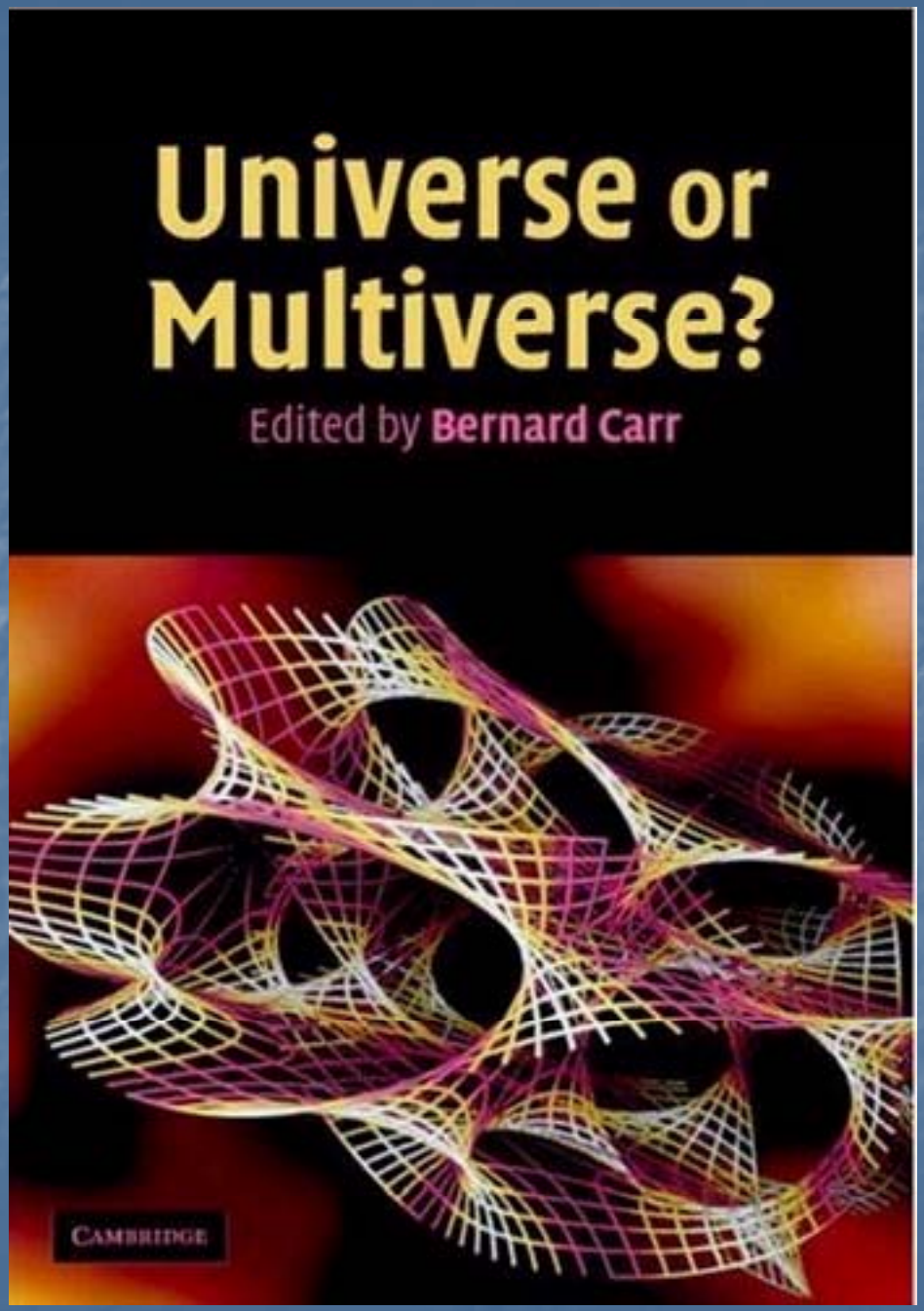
$p_{\|}$ - radial pressure

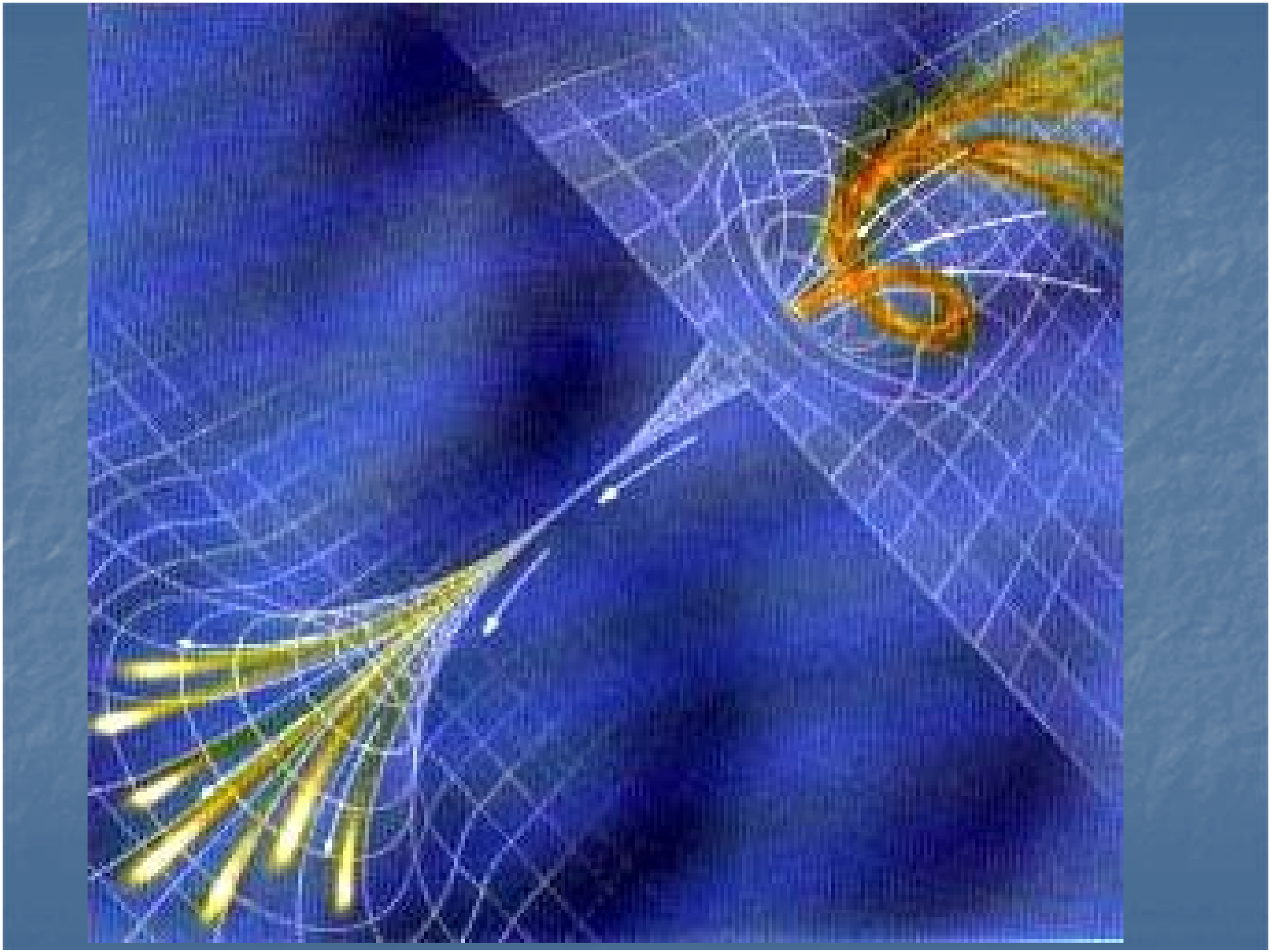
Scalar field (radiation)

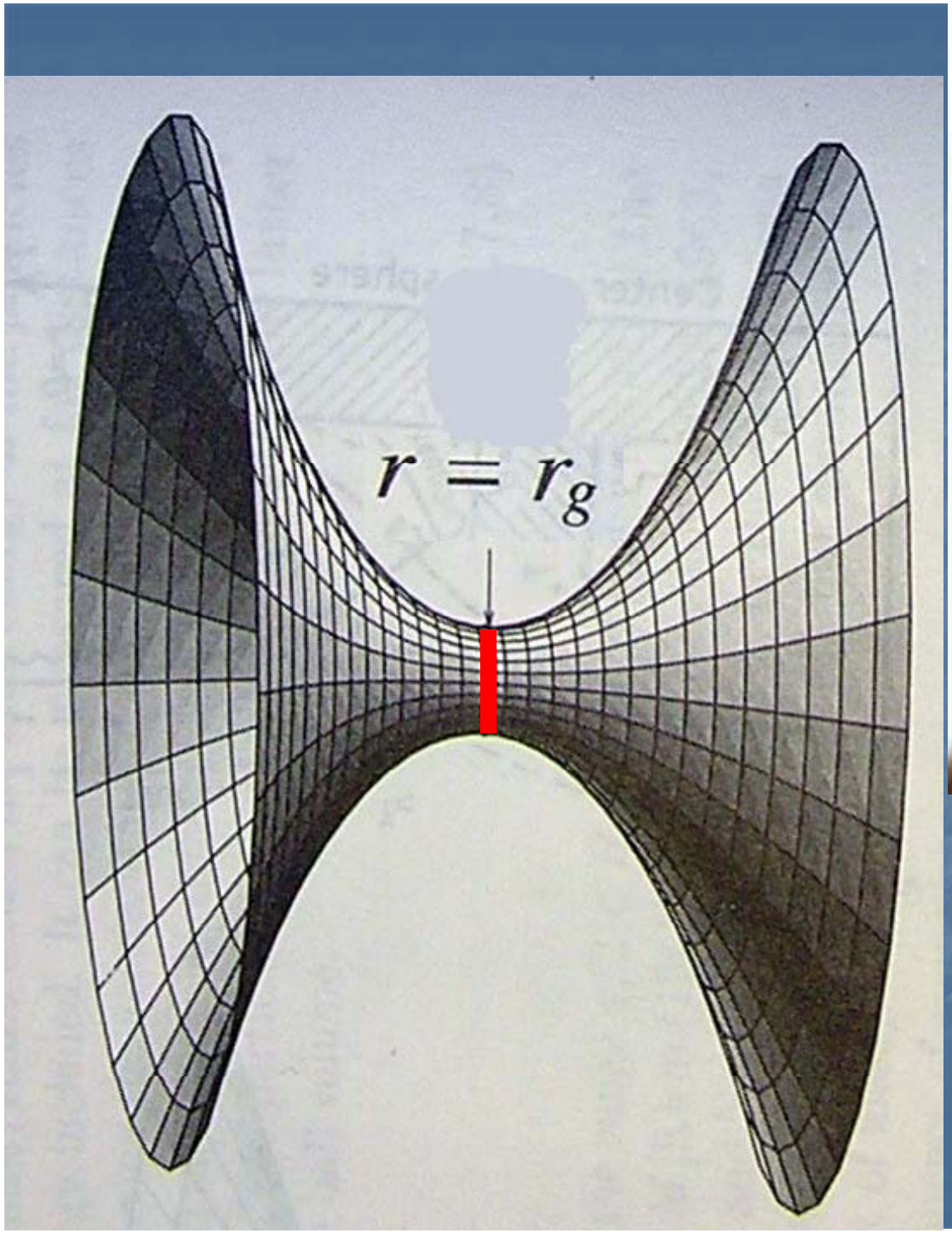
$\varepsilon<0$

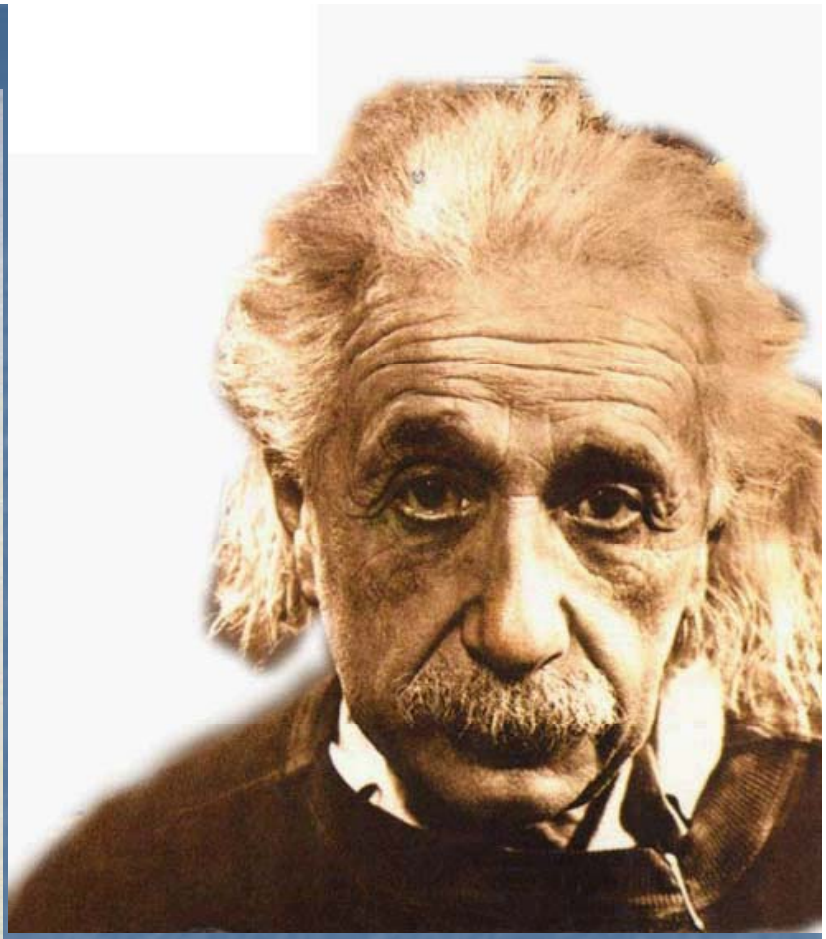


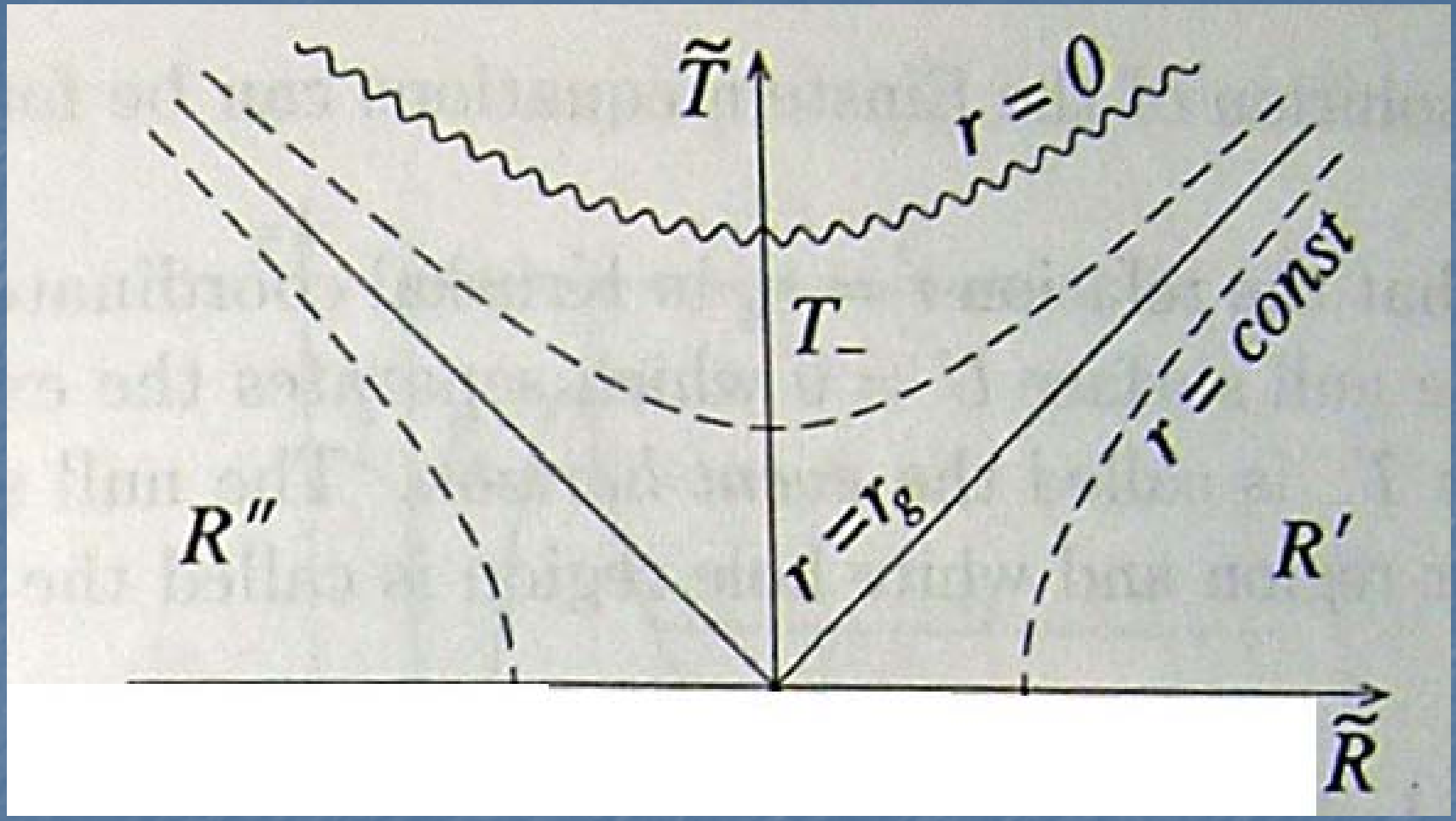


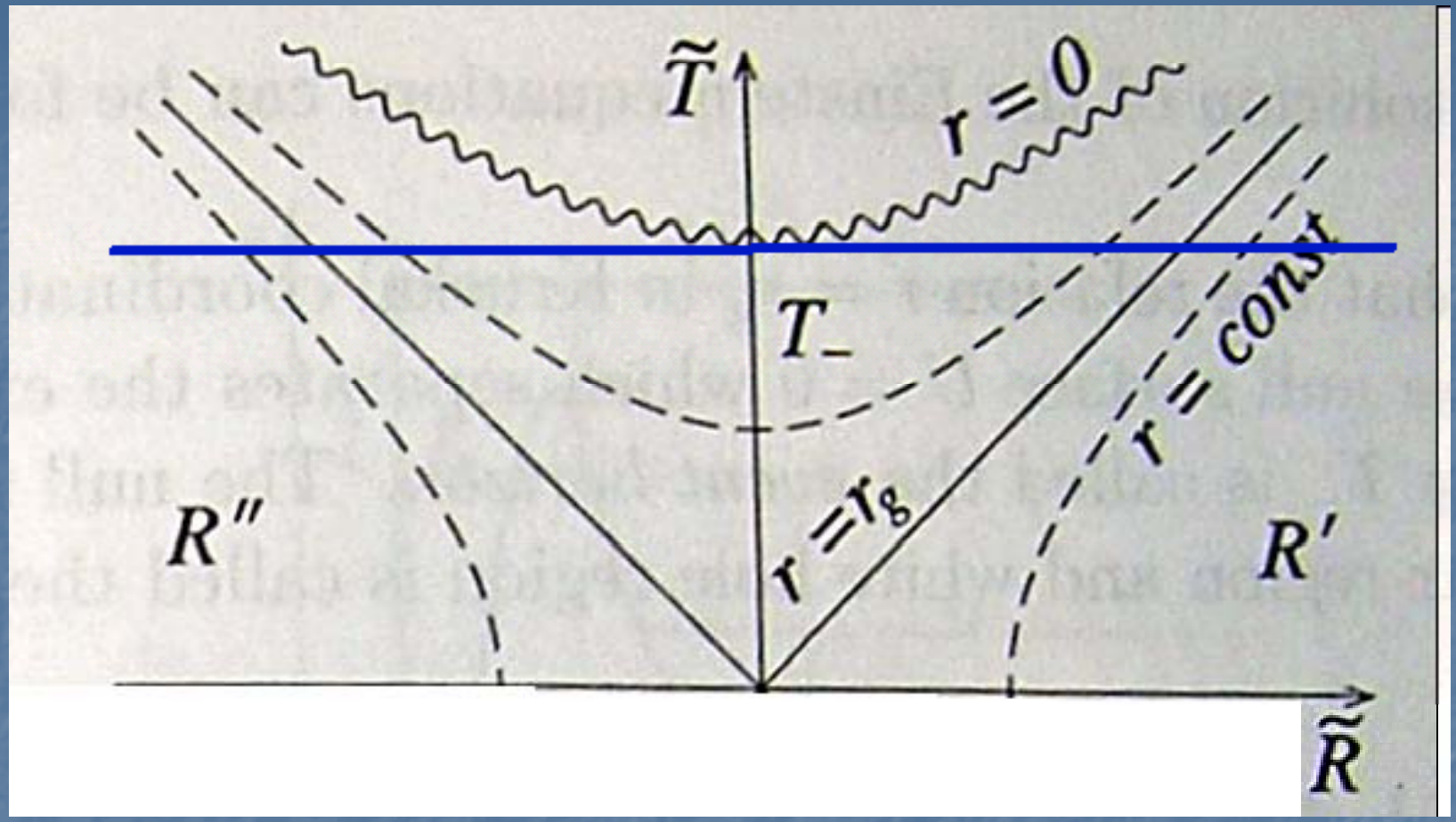

Universe or
Multiverse?
Edited by Bernard Carr
CAMBRIDGE

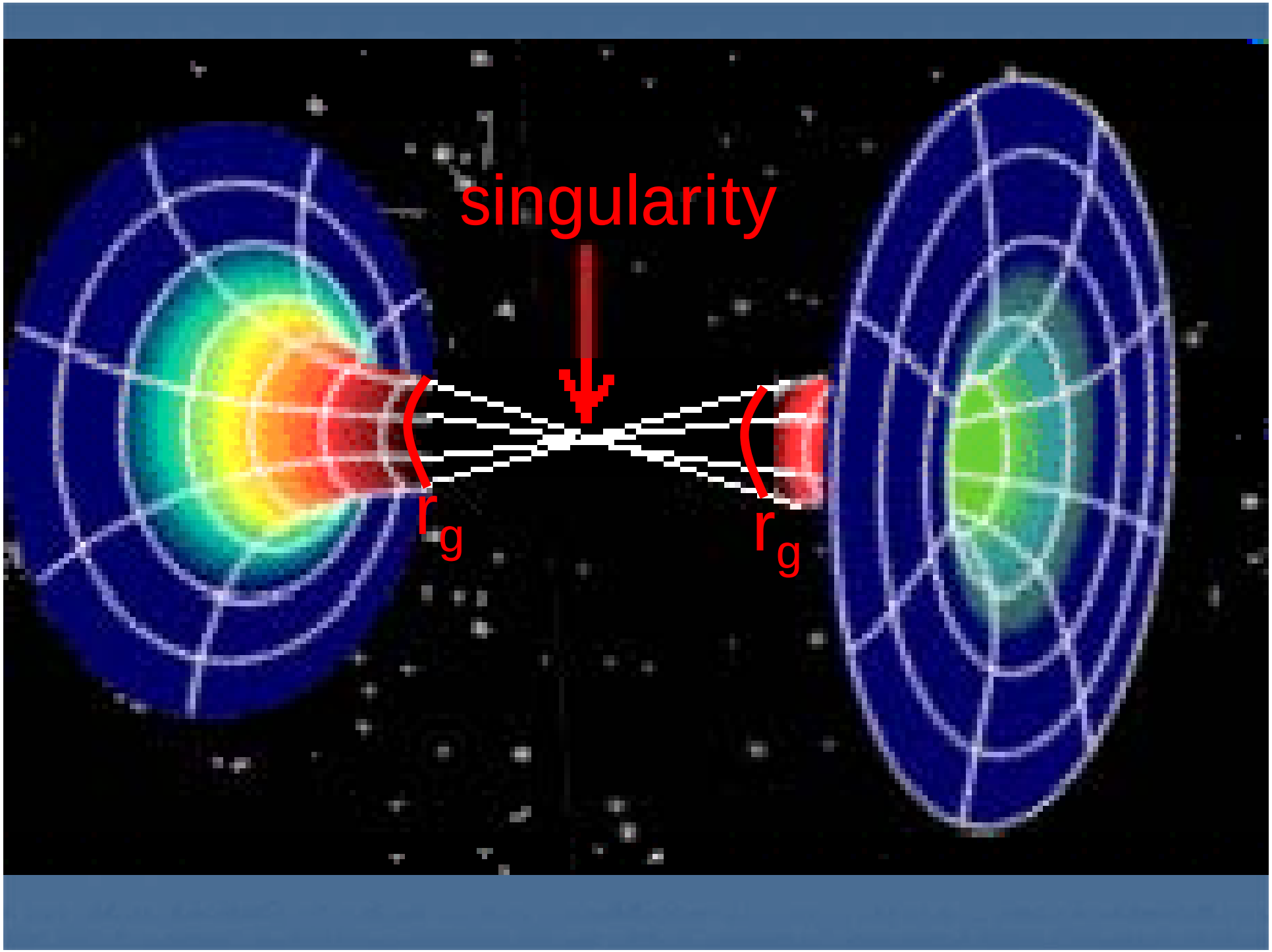


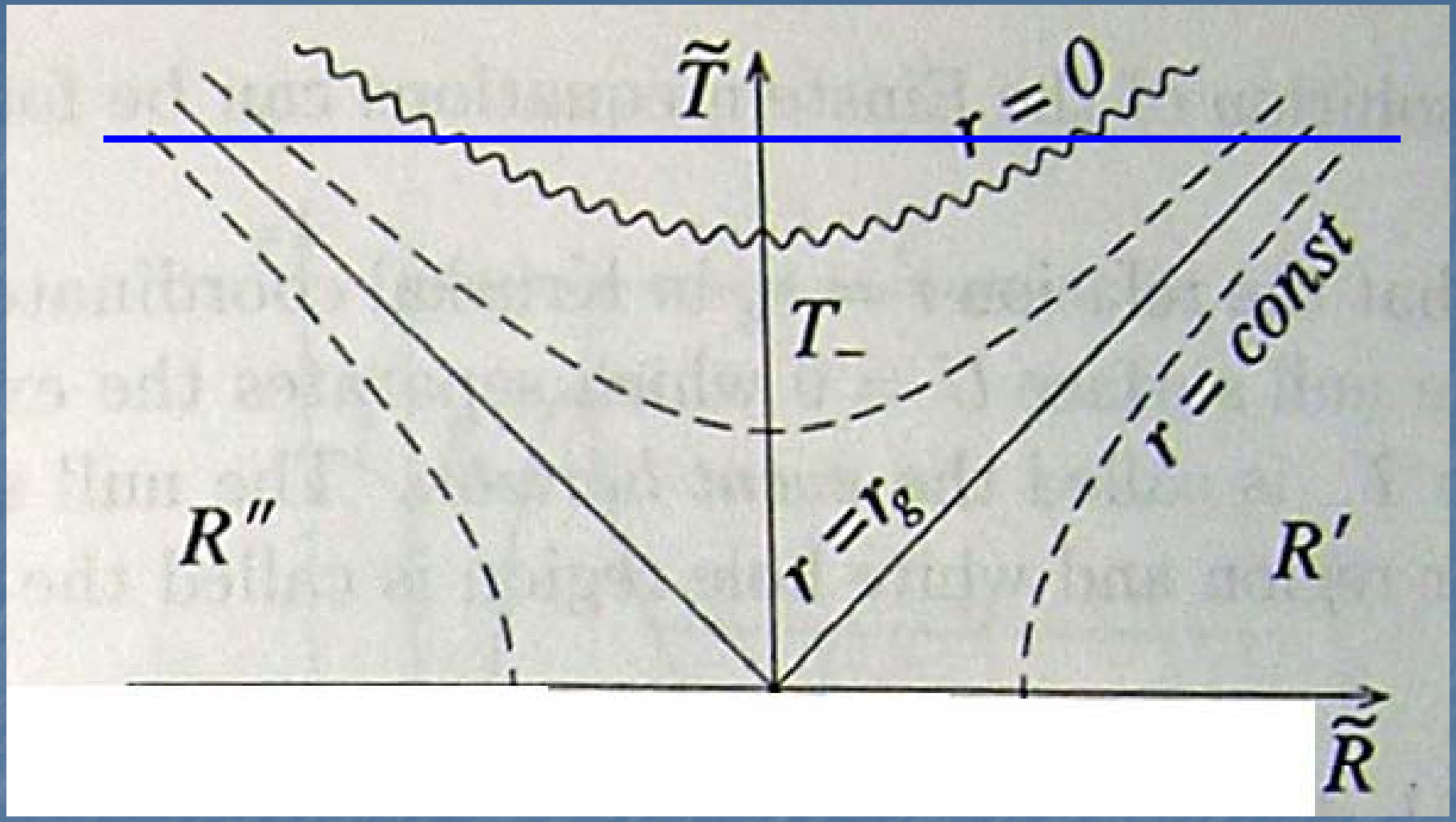

$r = r_g$

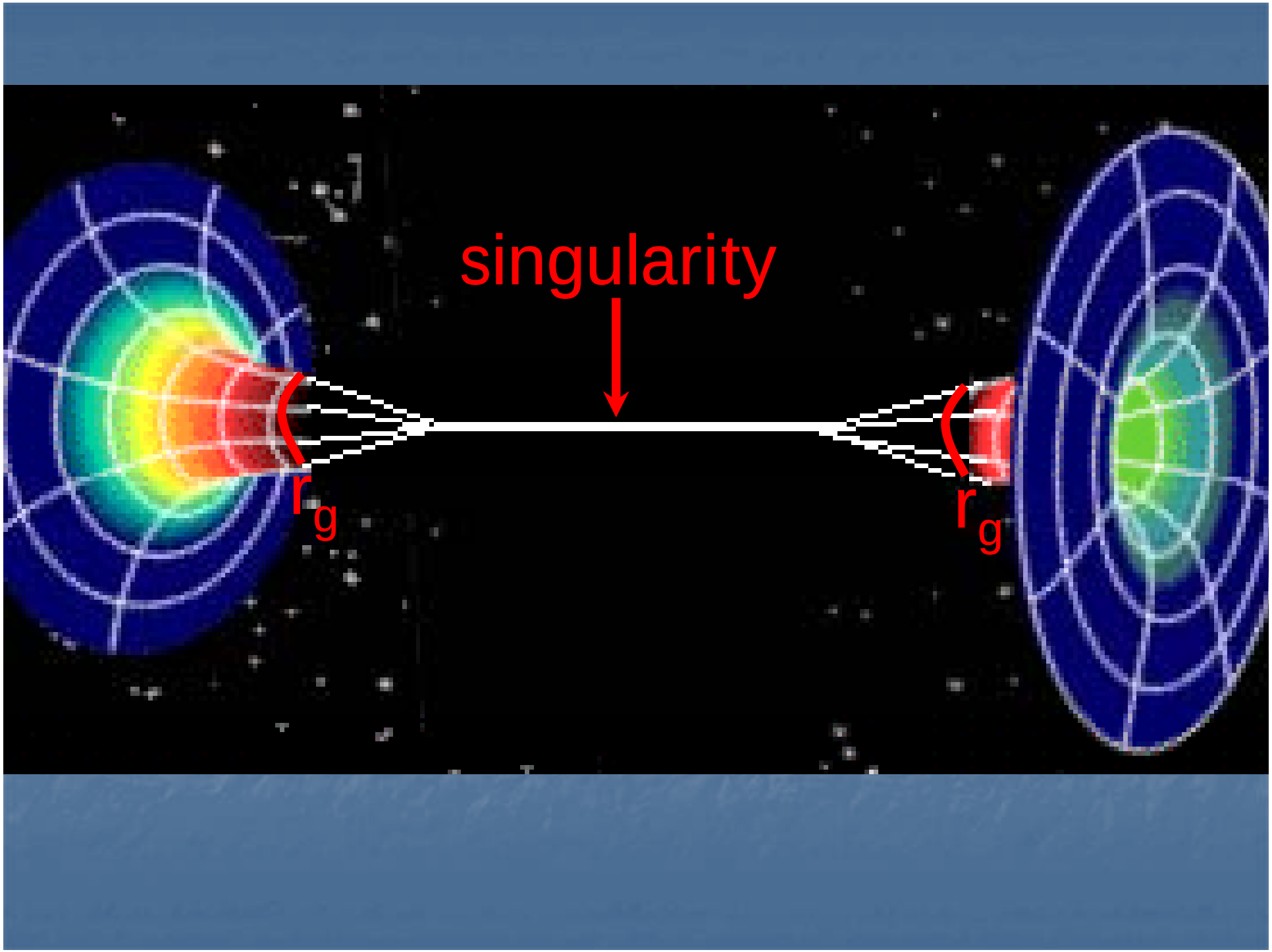



$\tilde{T}$
$r = 0$
T_-
$r = const$
$r = r_g$
R''
R'
$\tilde{\tilde{R}}$

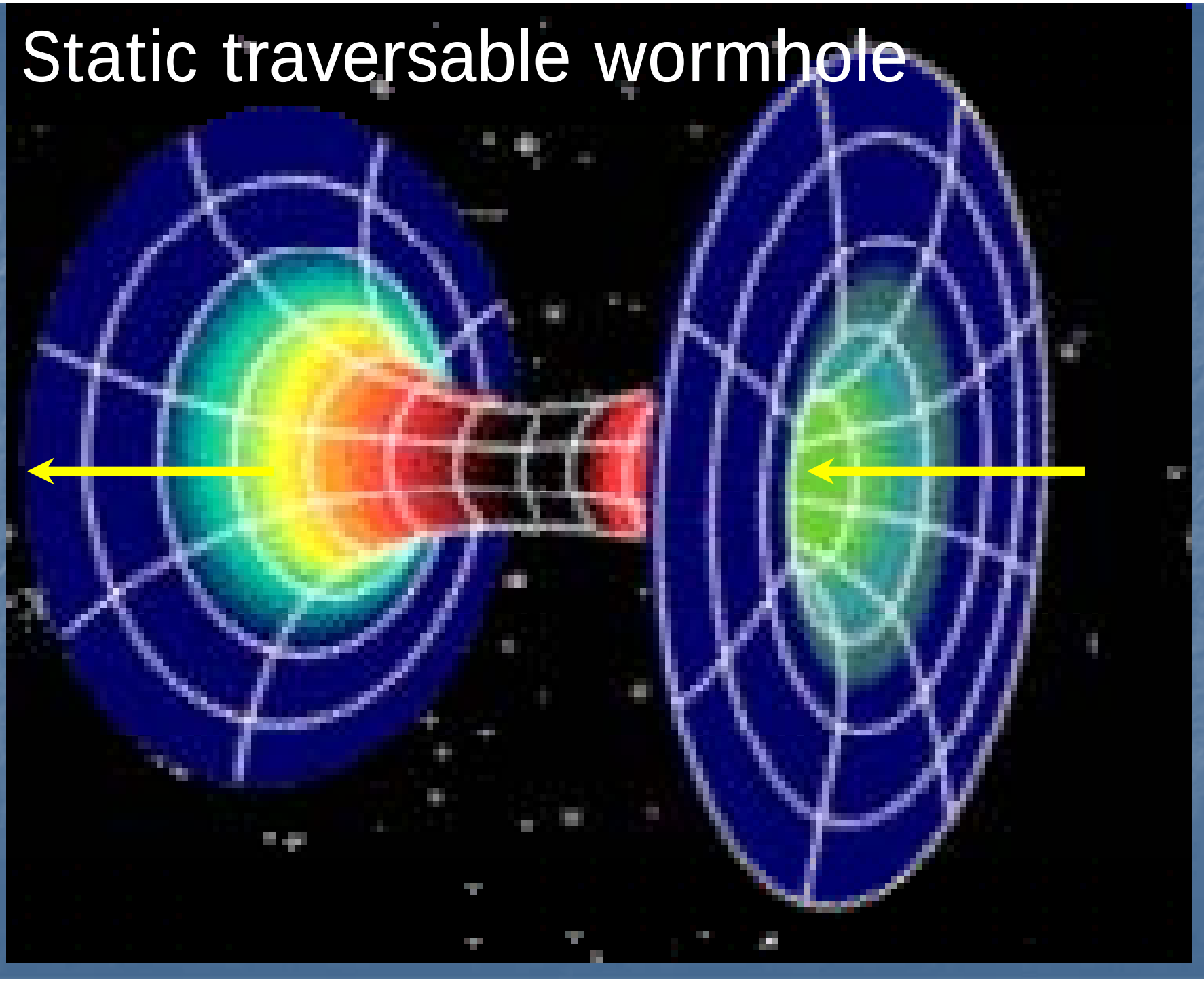

$\tilde{T}$
r = 0
T_
r = const
r = r_g
R''
R'
$\tilde{R}$

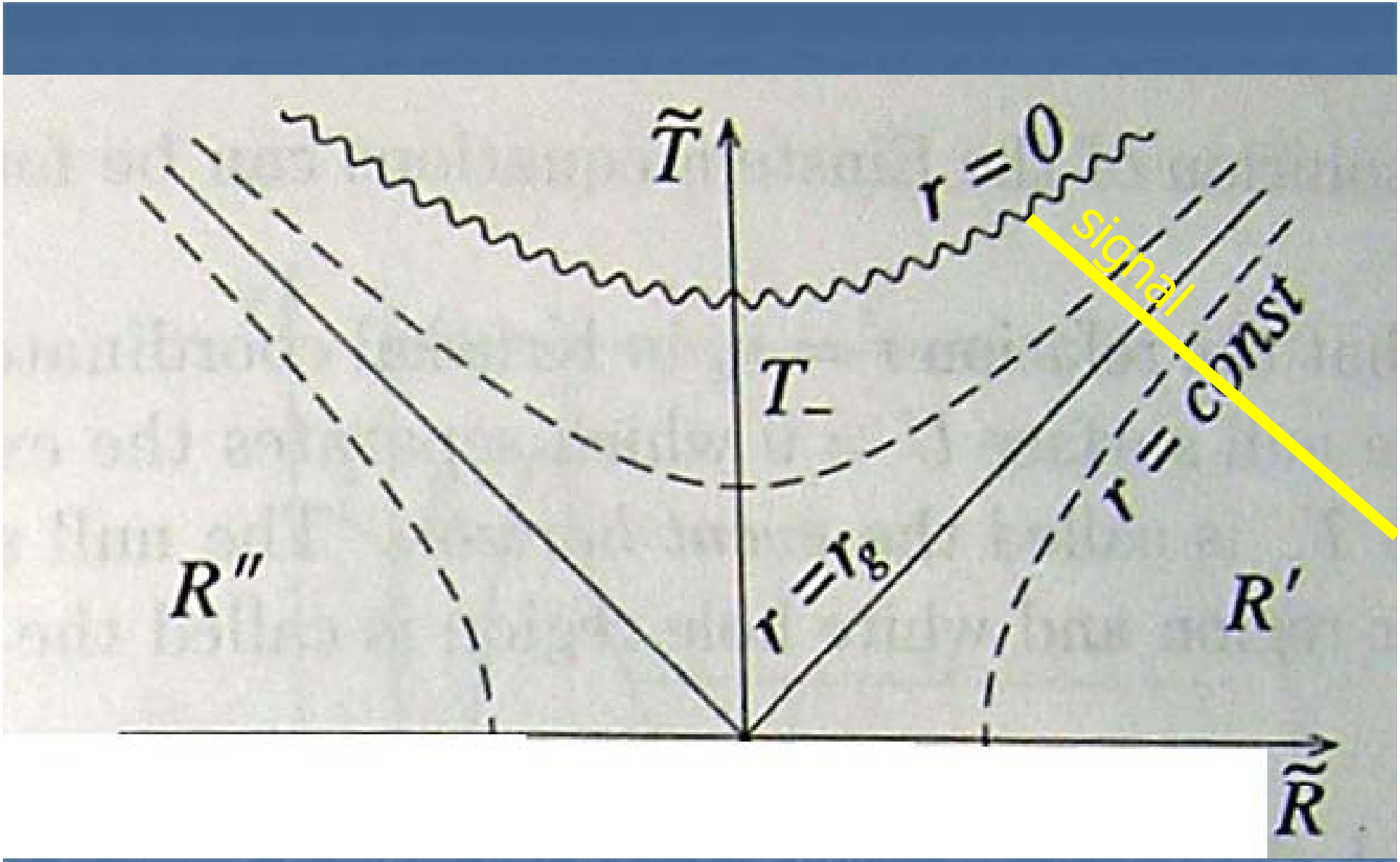

singularity
r_g
r_g

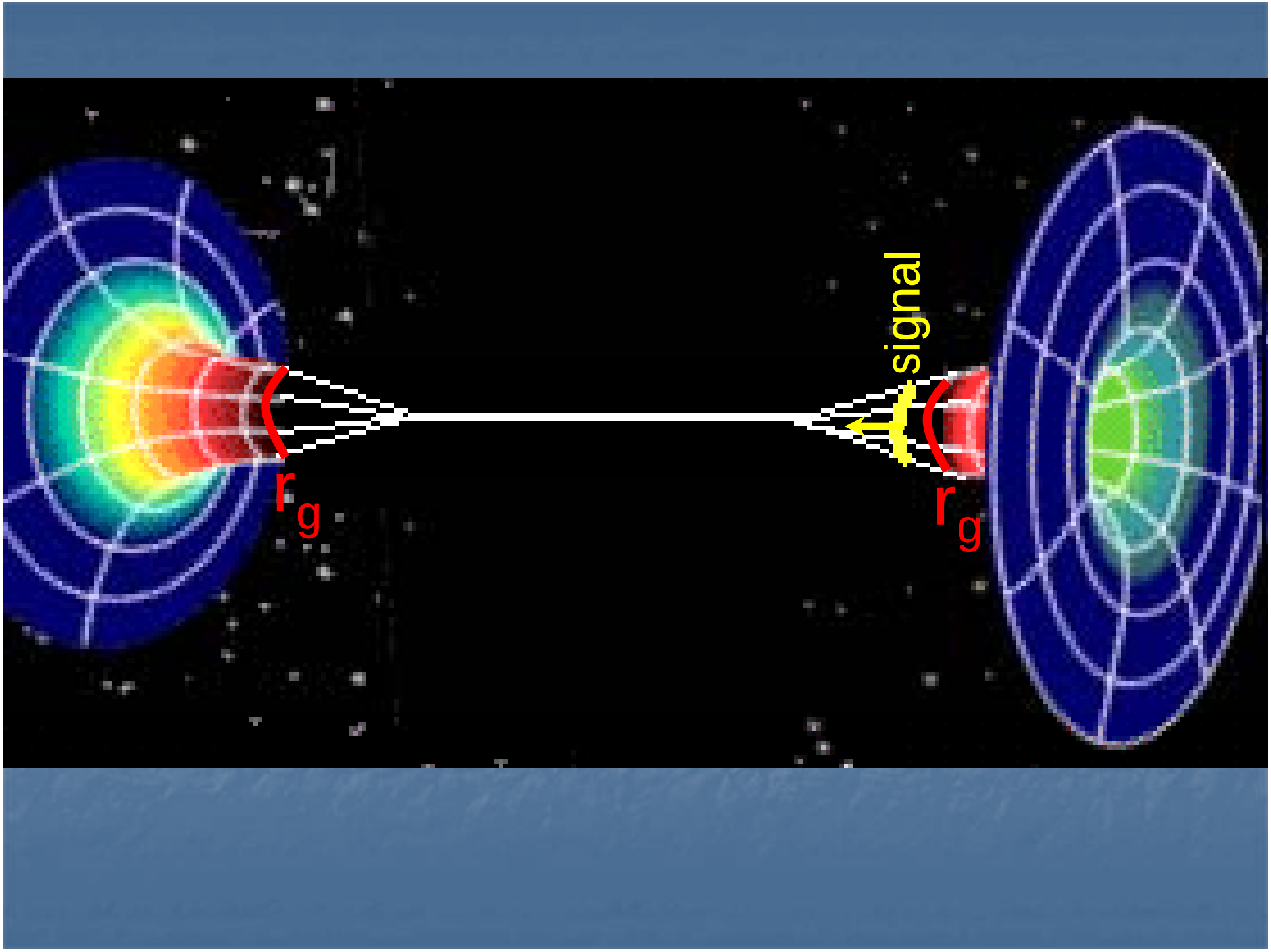

$\tilde{T}$
$r = 0$
T_-
$r = const$
$r = r_g$
R''
R'
$\tilde{R}$

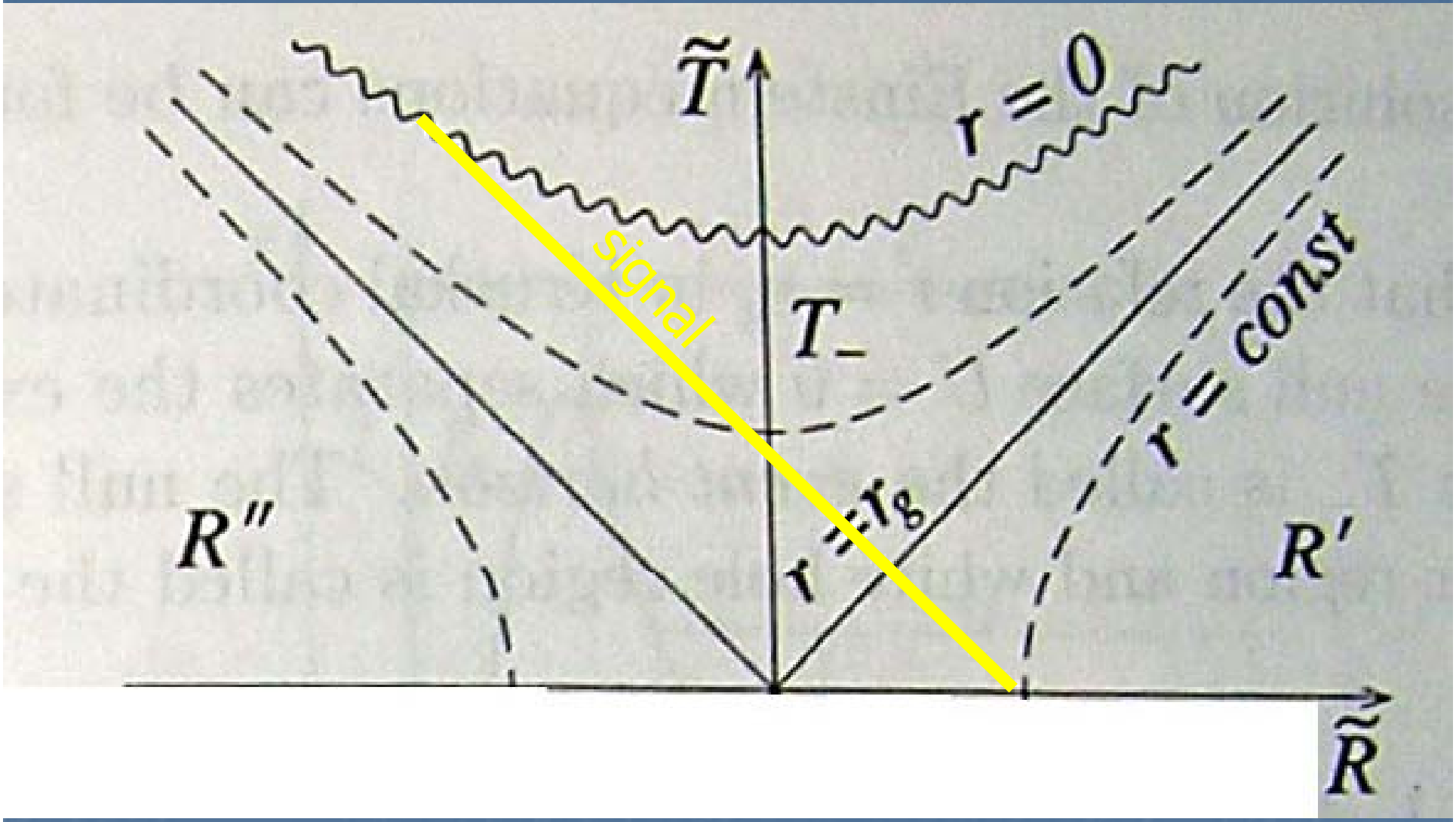

singularity
r_g
r_g

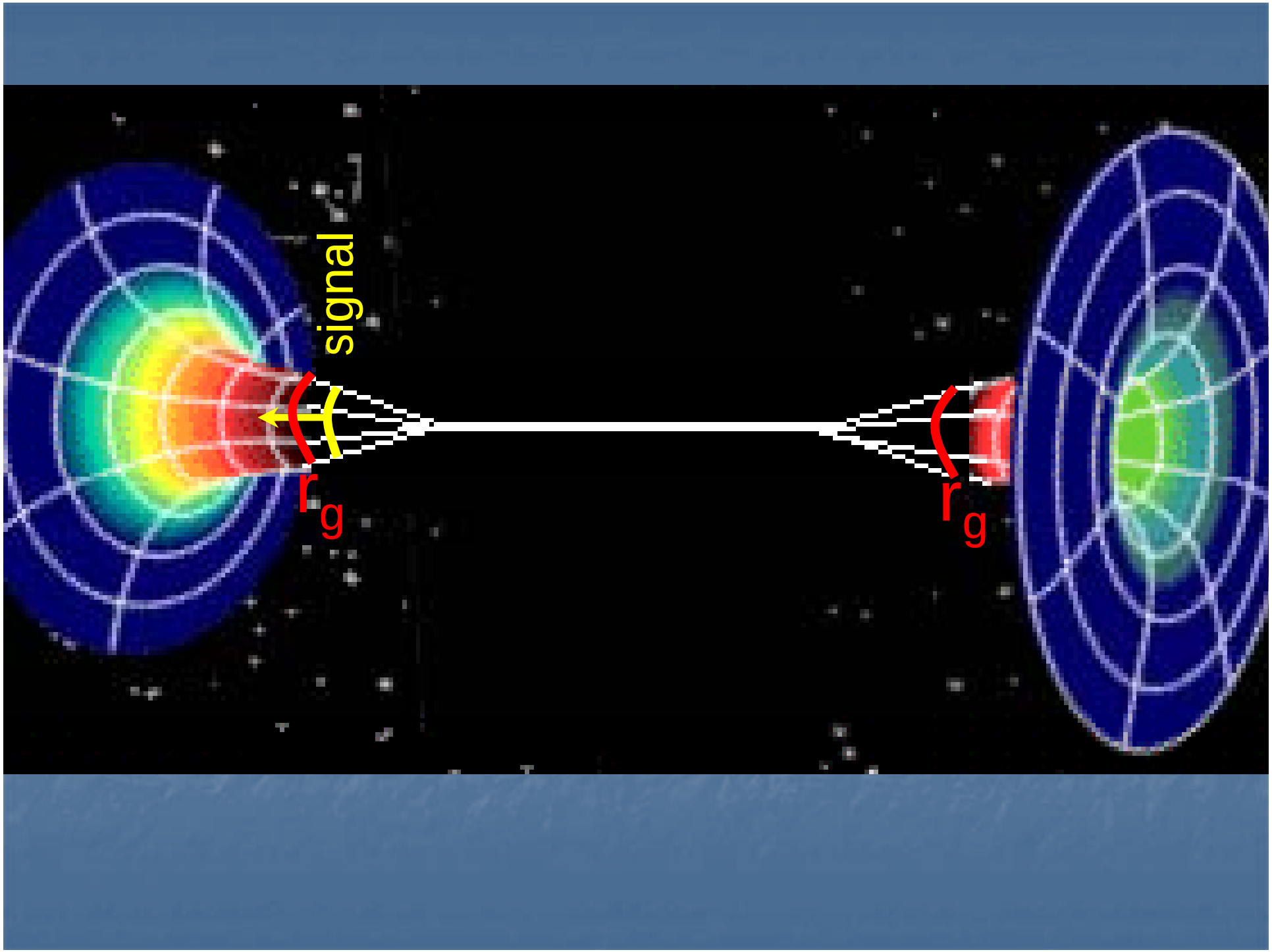
Static traversable wormhole

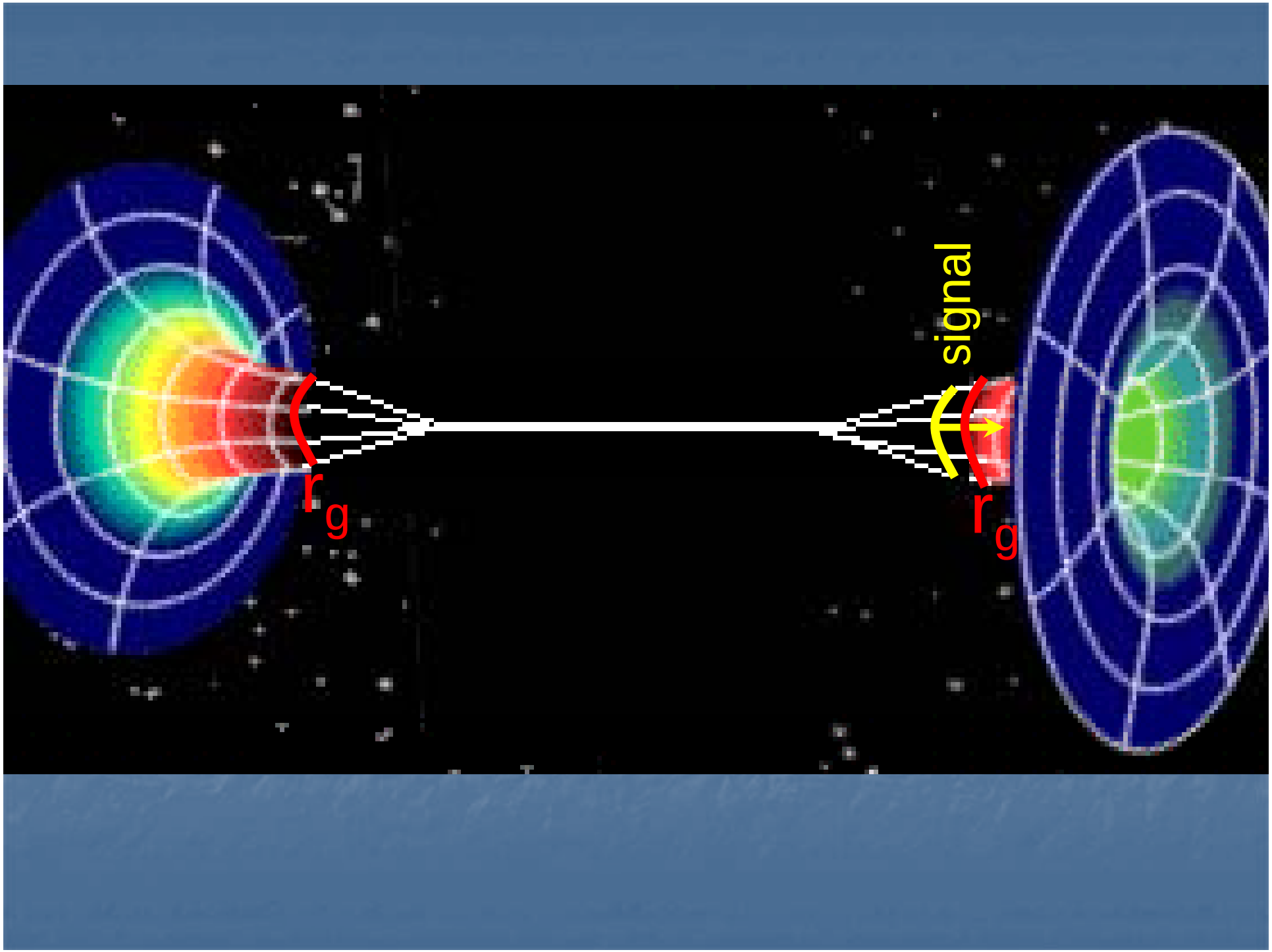


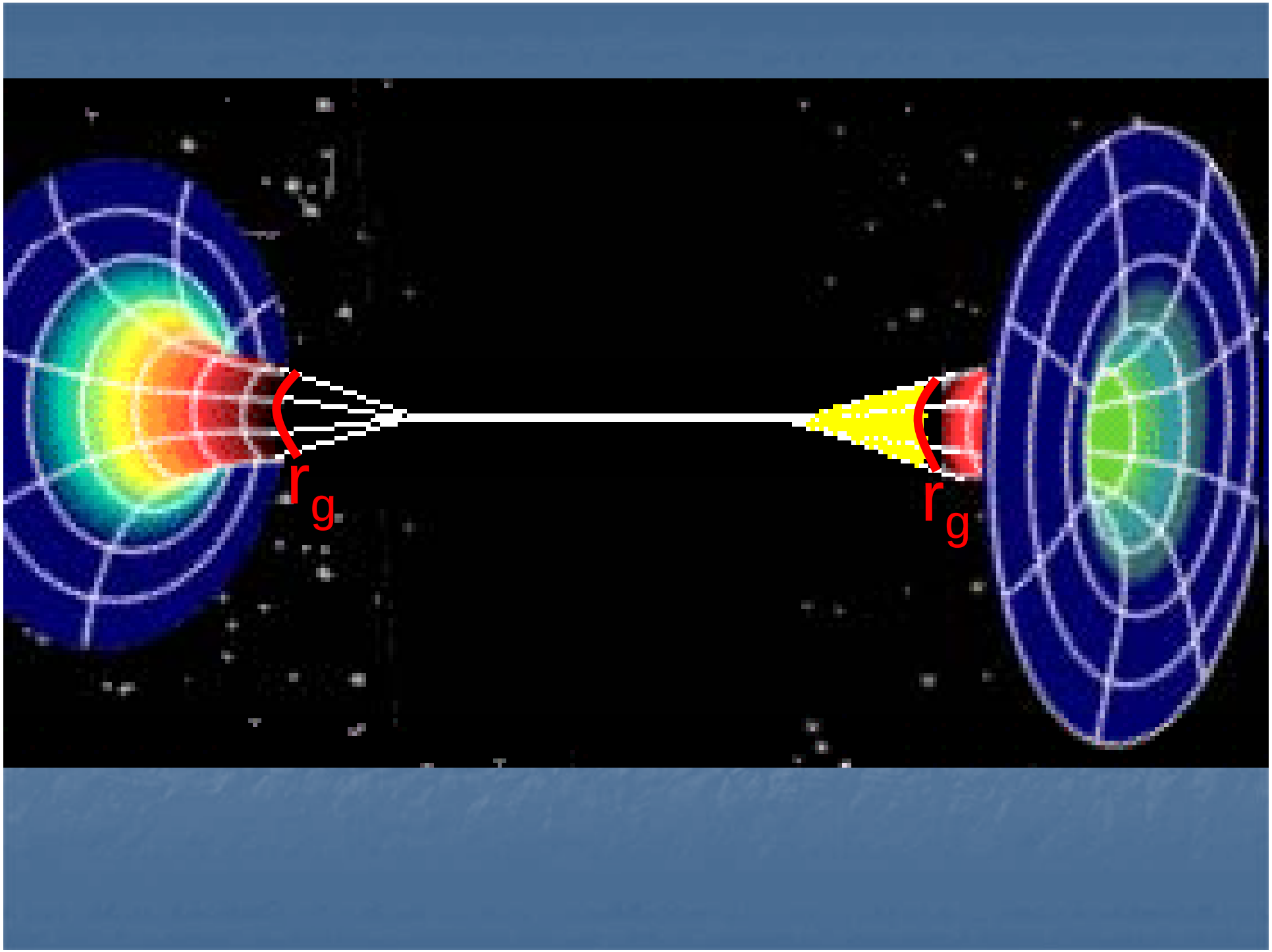

$\tilde{T}$
$r = 0$
signal
T_-
$r = const$
$r = r_g$
R''
R'
$\tilde{R}$

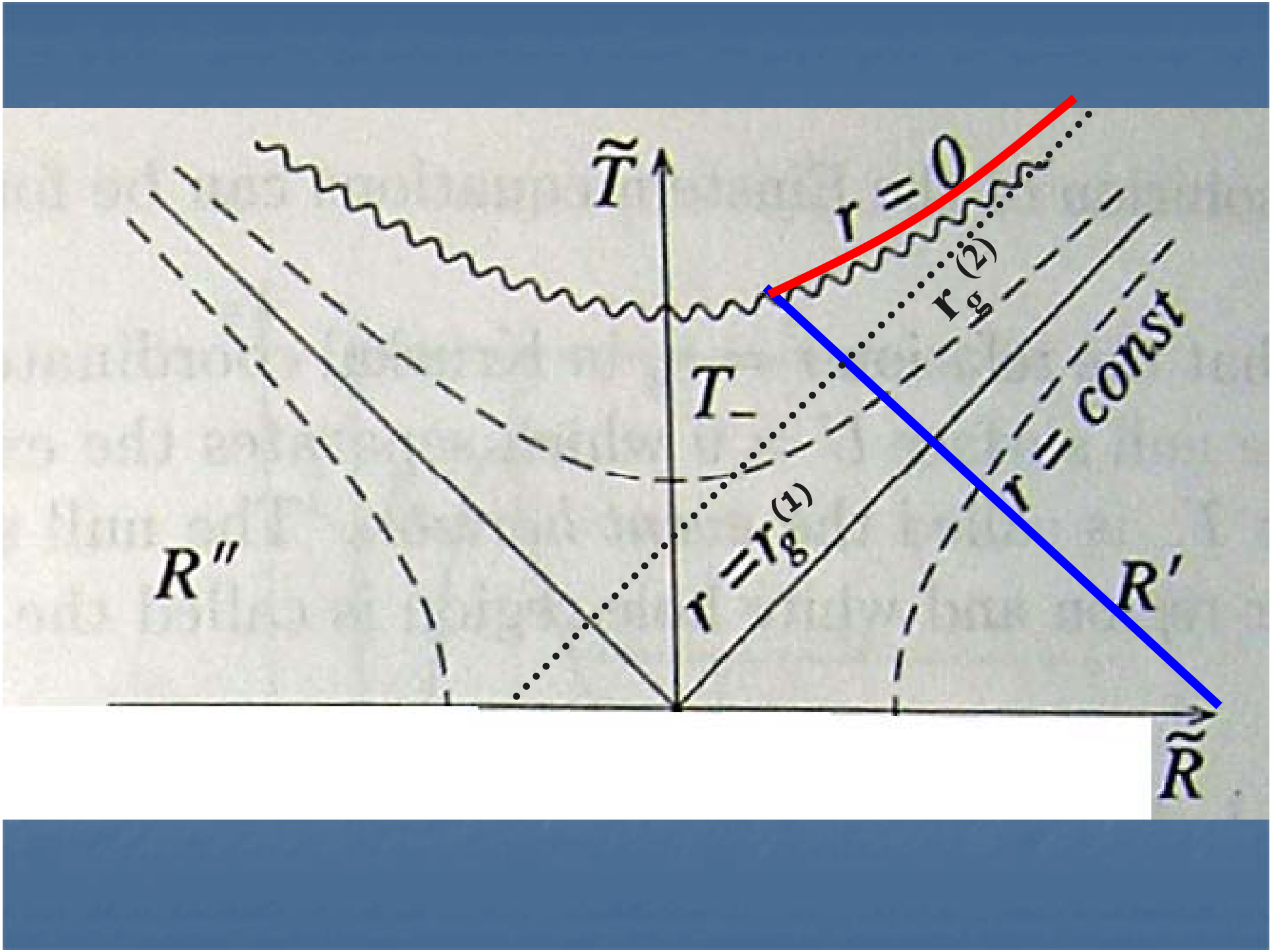

signal
r_g
r_g

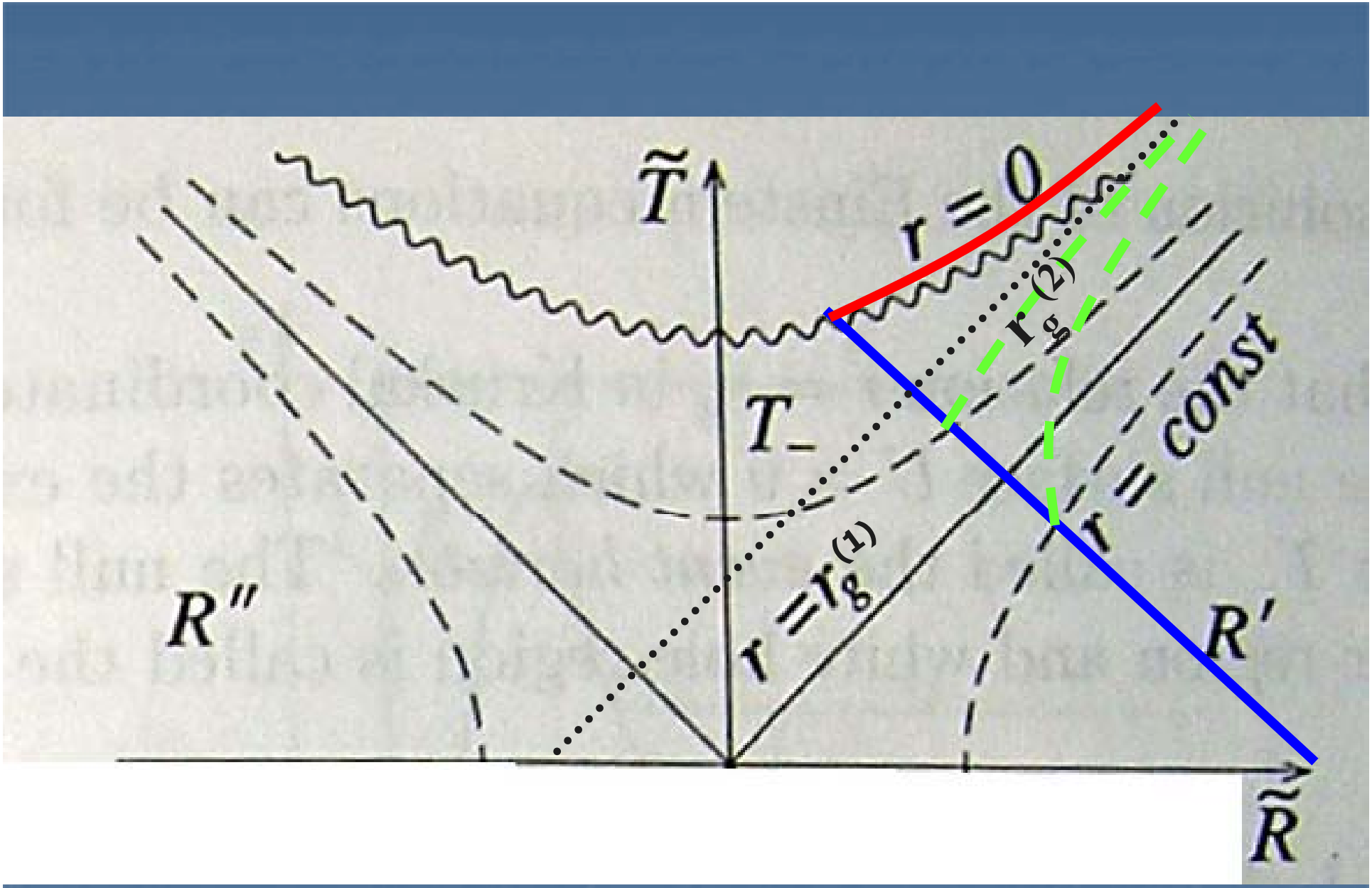

$\tilde{T}$
$r = 0$
signal
T_-
$r = const$
$r = r_g$
R''
R'
$\tilde{R}$

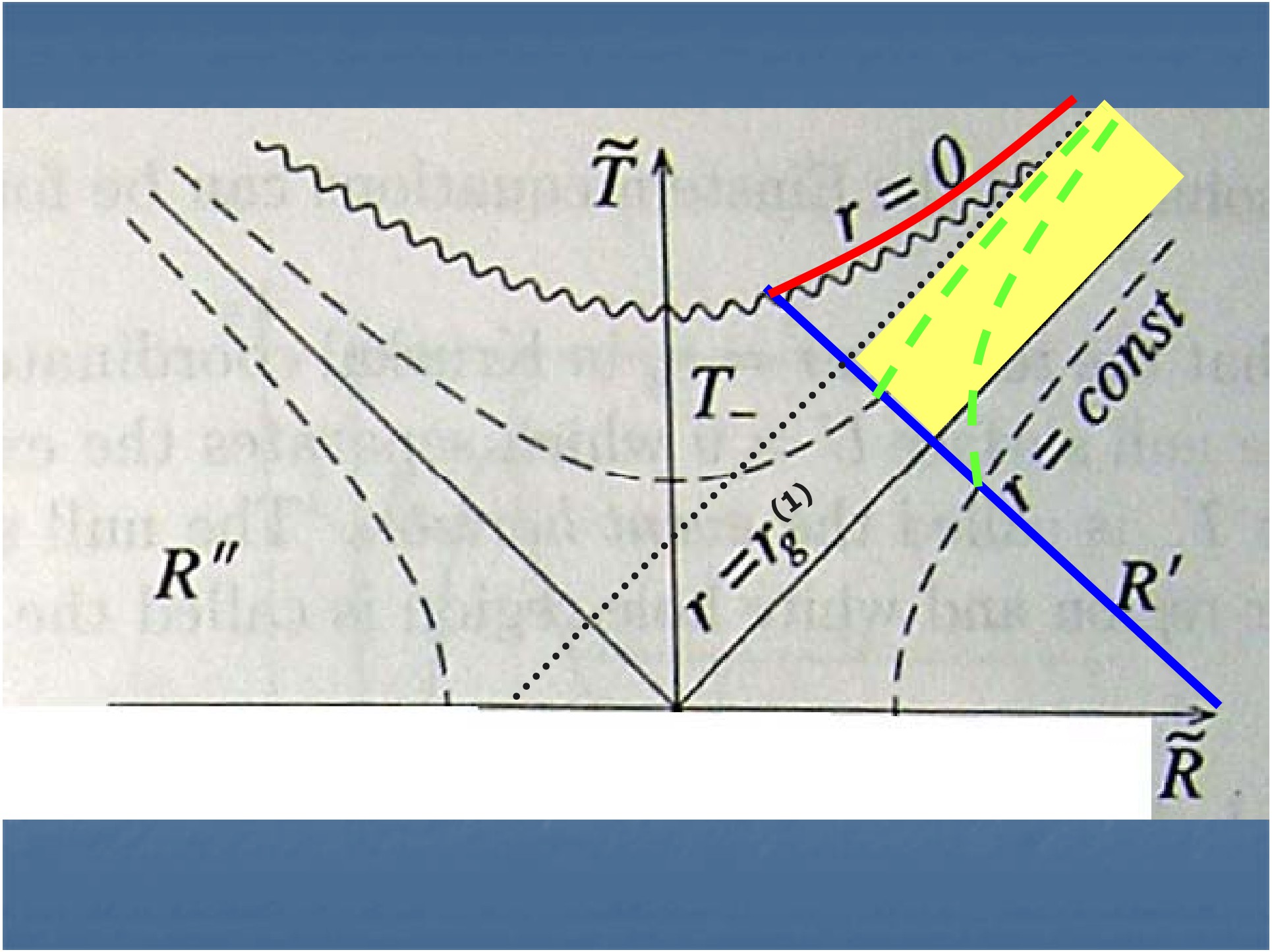

signal
r_g
r_g

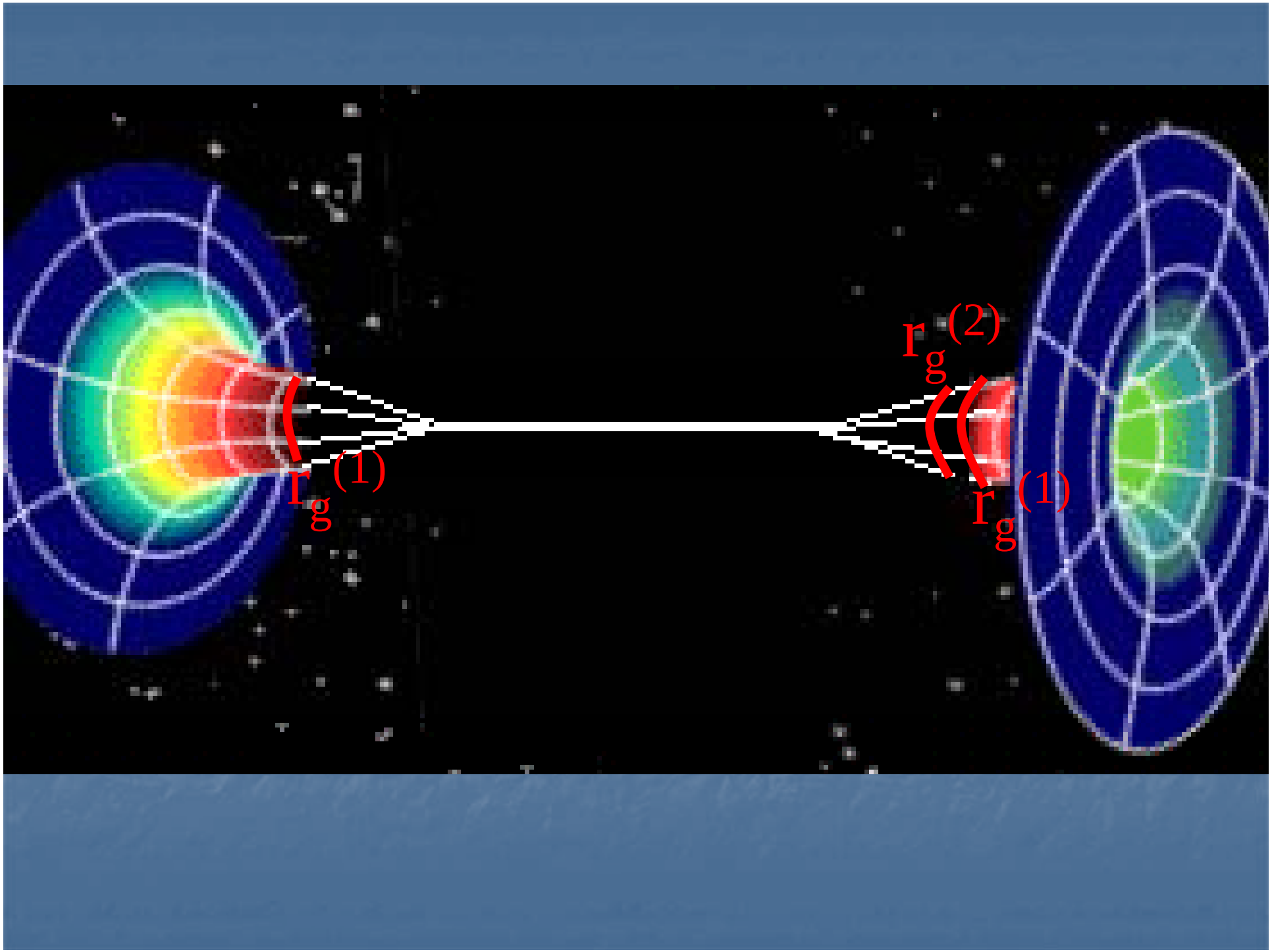

signal
r_g
r_g


r_g
r_g

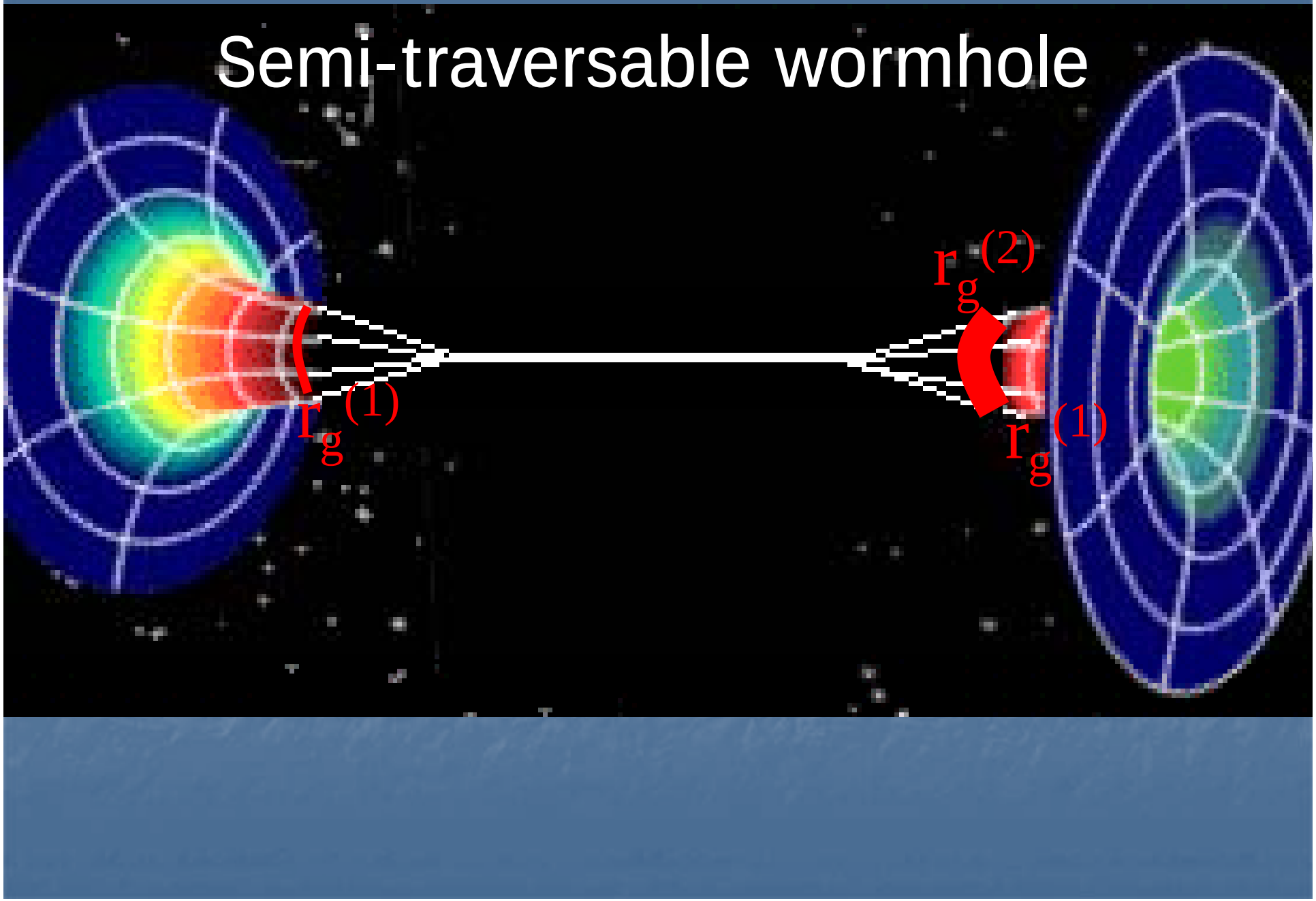

$\tilde{T}$
$r = 0$
$r_g^{(2)}$
T_-
$r = const$
$r = r_g^{(1)}$
R''
R'
$\tilde{R}$

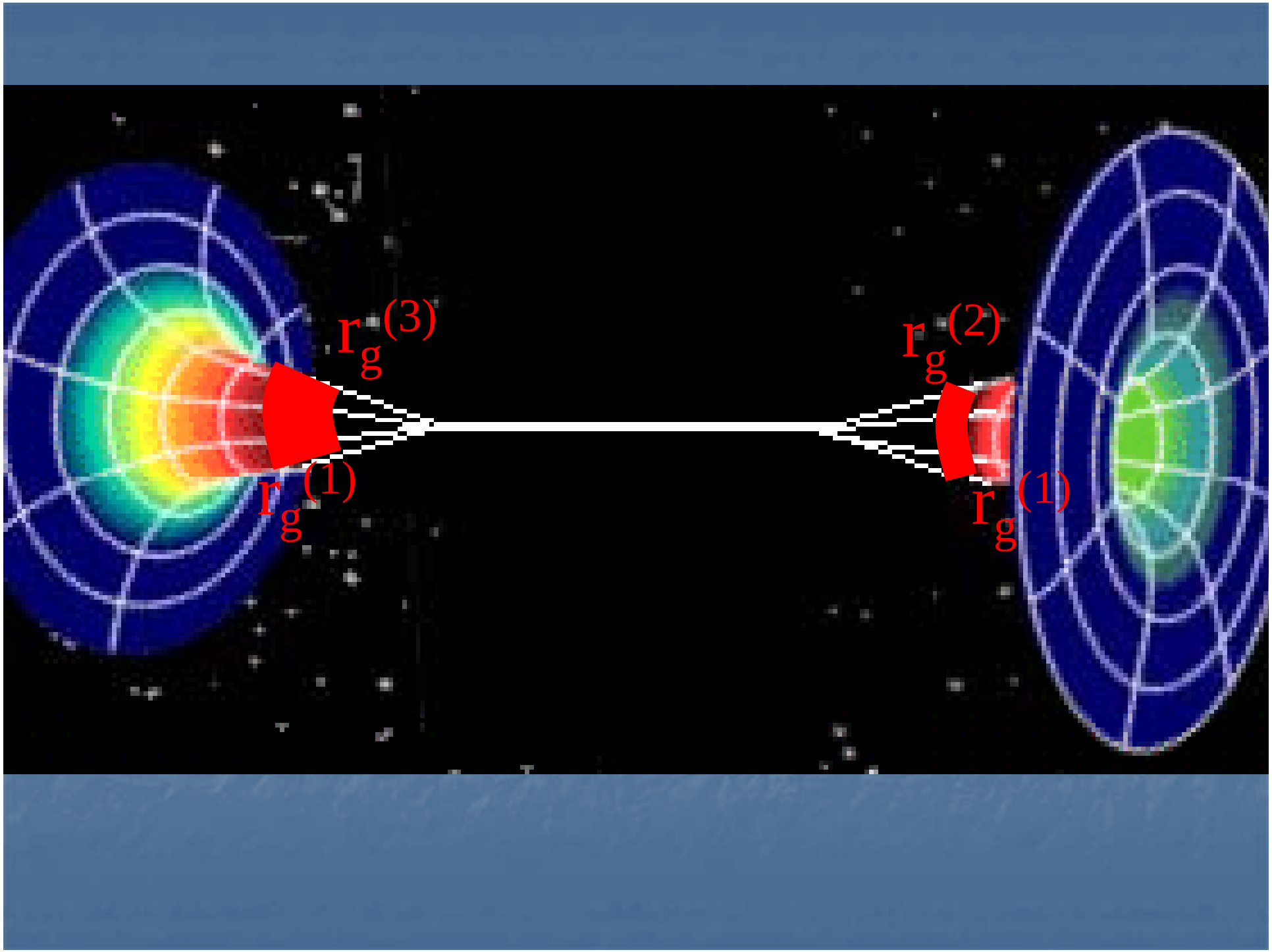

$\tilde{T}$
$r = 0$
$r_g^{(2)}$
T_-
$r = const$
$r = r_g^{(1)}$
R''
R'
$\tilde{R}$

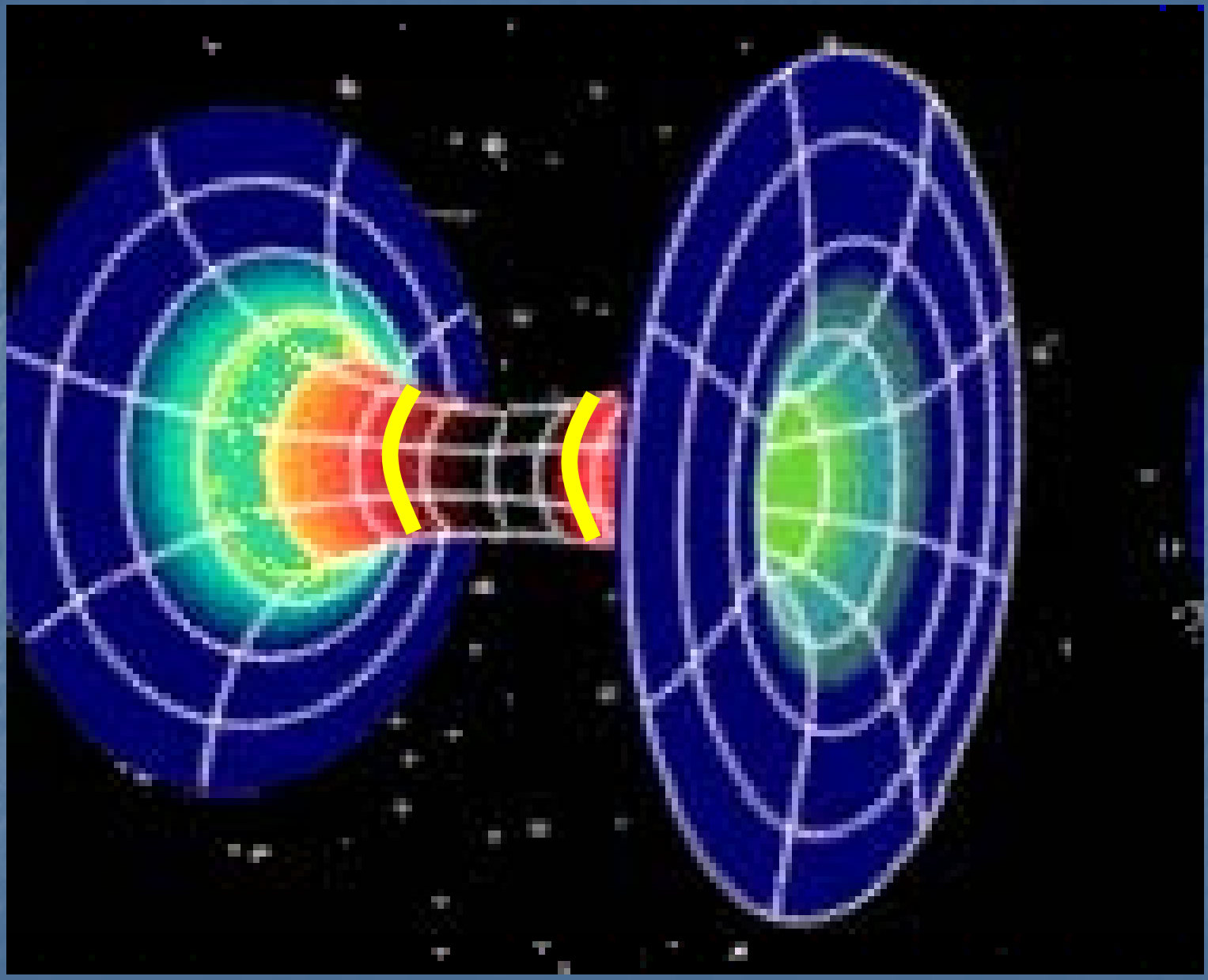

$\tilde{T}$
$r = 0$
T_-
$r = const$
$r = r_g^{(1)}$
R''
R'
$\tilde{R}$


$r_g^{(2)}$
$r_g^{(1)}$
$r_g^{(1)}$

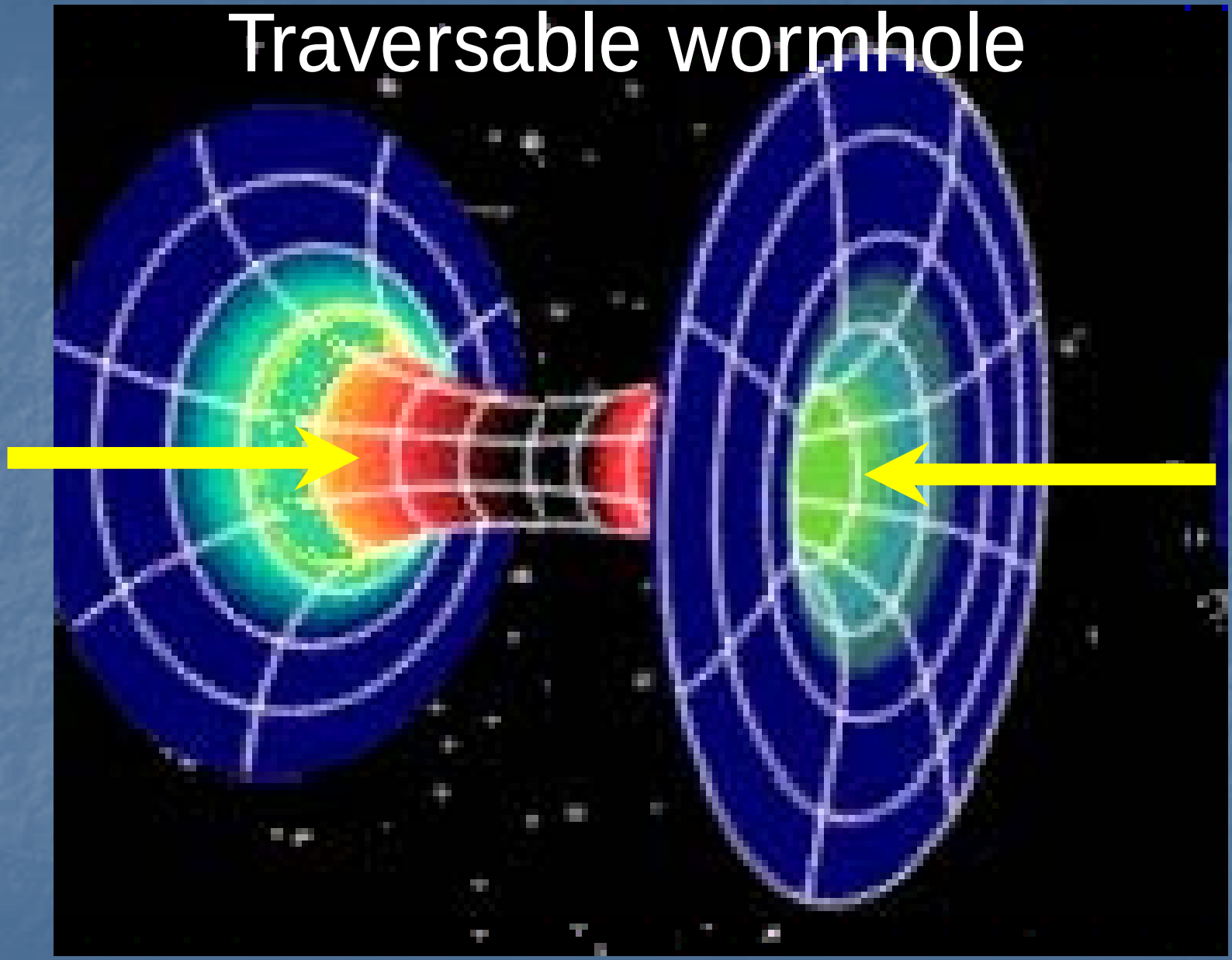
Semi-traversable wormhole




$r_g^{(3)}$
$r_g^{(2)}$
$r_g^{(1)}$
$r_g^{(1)}$



Traversable wormhole



Various methods of proof that some objects are WHs (or remnants of them)

a) monopole magnetic field
b) There is not horizon (oscillations of a radiation source: BLLac 0716+714; radiation flux with a blue Doppler shift; some peculiarities of the gravitational lensing
c) One can see a structure at a scale smaller then gravitational radius

Quasar Q0957+561
Sagittarius A*

Parameters of the throats of magnetic WHs

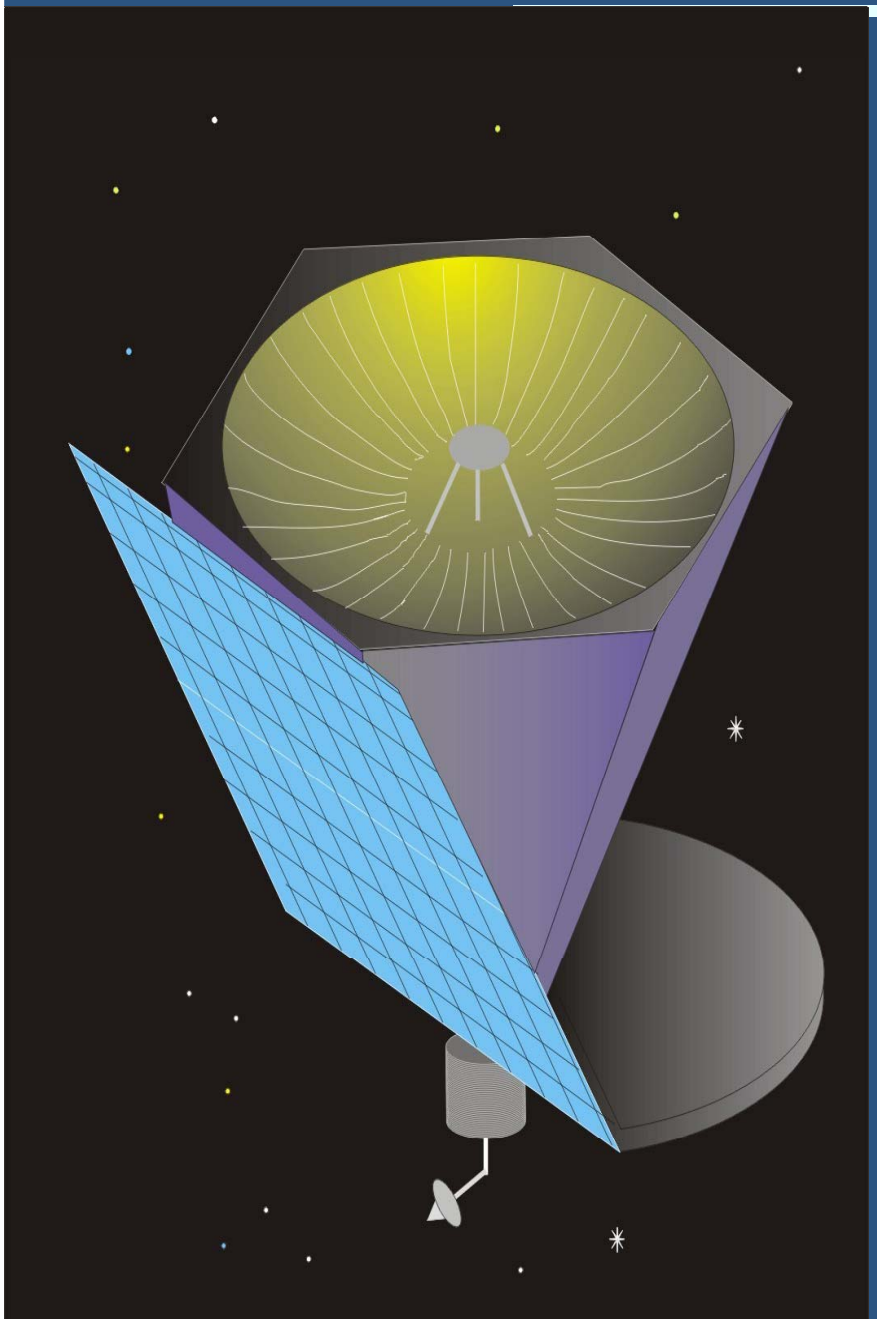
$M_\infty = 2M_0$	r_0, cm	H_0, G
6×10^{42} g $= 3 \times 10^9 M_\odot$ (quasar)	4.5×10^{14}	7.8×10^9
10^{39} g $= 5 \times 10^5 M_\odot$	7.4×10^{10}	4.4×10^{13}

RADIOASTRON

PARAMETERS

Band (GHz)	0,327	1,665	4,830	18-25
Band width (MHz)	4	32	32	32
Fringe size (μas) [base line 350 000 km]	540	106	37	7,1-10
Min. cor. flux (mJy) [RMS, with upgrated VLA, 300s integration time]	10	1,3	1,4	3,2

MILLIMETRON.



12 m cryogenic mirror.

λ = 0,01-20 mm.

Bolometric sensitivity

$5*10^{-9}$ Jy (σ)

(λ=0.3 mm, 1 hour int.).

Space-ALMA VLBI

sensitivity 10^{-4} Jy (σ)

(λ=0.5 mm, 300 s int.),

fringe size up to

nanoarcseconds.

Thank you!