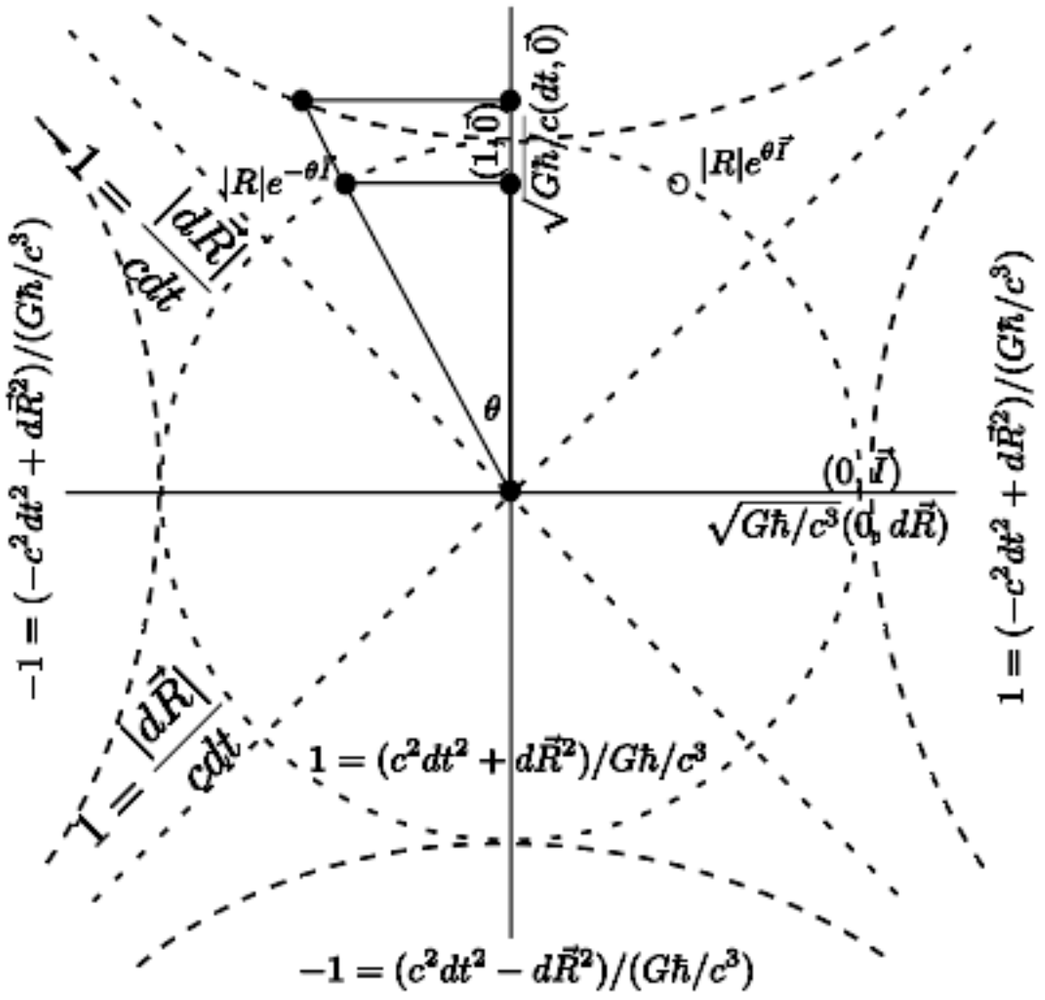
Spacetime Trig Functions



Distance & Velocities

$d = |dR|$

$s = \frac{1}{c}\frac{d\vec{R}}{dt} = \infty$

$d = sinh(\theta)$

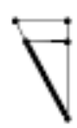
$= \gamma\beta = \frac{\beta}{\sqrt{1-\beta^2}}$

$d = c|dt|$

$s = \frac{1}{c}\frac{d\vec{R}}{dt} = \vec{0}$

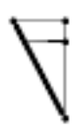
$d = cosh(\theta)$

$= \gamma = \frac{1}{\sqrt{1-\beta^2}}$



$d = \sqrt{c^2dt^2 + dR^2}$

$s = \frac{1}{c}\frac{d\vec{R}}{dt} = \vec{\beta}$



$d = \sqrt{cosh(2\theta)}$

$= \frac{\sqrt{1+\beta^2}}{\sqrt{1-\beta^2}}$

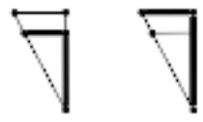
Ratios

$sin(\theta) = \frac{dR}{\sqrt{c^2dt^2 + dR^2}}$

$= \frac{1}{\sqrt{\beta^{-2}+1}}$

$cos(\theta) = \frac{cdt}{\sqrt{c^2dt^2 + dR^2}}$

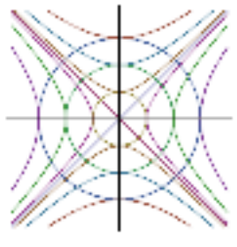
$= \frac{1}{\sqrt{1+\beta^2}}$



$tan(\theta) = \frac{1}{c}\frac{d\vec{R}}{dt} = \vec{\beta}$

A unit circle, parabola, & lightcone

Euclidean



Polar Coordinates

	Hyperbolic	Trigonometric
Sine	$(e^{(dt,\vec{0})/\sqrt{G\hbar/c}} - e^{(-dt,\vec{0})/\sqrt{G\hbar/c}})/2$	$(e^{(0,\vec{R})/\sqrt{G\hbar/c^3}} - e^{(0,\vec{R})^*/\sqrt{G\hbar/c^3}})/2$
Cosine	$(e^{(dt,\vec{0})/\sqrt{G\hbar/c}} + e^{(-dt,\vec{0})/\sqrt{G\hbar/c}})/2$	$(e^{(0,\vec{R})/\sqrt{G\hbar/c^3}} + e^{(0,\vec{R})^*/\sqrt{G\hbar/c^3}})/2$