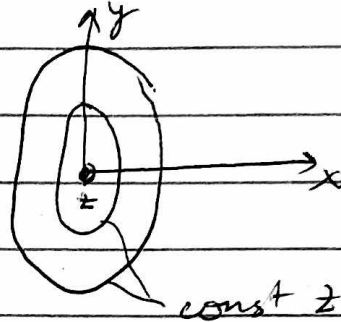


Sphere, at rest $x^2 + y^2 + z^2 = 1$

moving $\frac{x^2}{1-\beta^2} + y^2 + z^2 = 1$



looking from a distance along z,

Suppose image from $z=0$ slice arrives @ $t=0$,
Then, from other slices its emitted at times $t = \frac{z}{c} \in (-\frac{1}{c}, \frac{1}{c})$.

Thus, images of slices are

$$\frac{(x - vt)^2}{1 - \beta^2} + y^2 + z^2 = 1$$

or $\frac{(x - \beta z)^2}{1 - \beta^2} + y^2 + z^2 = 1$

now, for fixed y , extremize x , to find envelope

$$x = \beta z \pm \sqrt{(1 - y^2 - z^2)(1 - \beta^2)}$$

$$\frac{\partial x}{\partial z} = \beta \pm \frac{z \sqrt{1 - \beta^2}}{(1 - y^2 - z^2)} = 0$$

$$\beta^2 = \frac{z^2 (1 - \beta^2)}{1 - z^2 - y^2}$$

$$\beta^2(1-z^2-y^2) = z^2(1-\beta^2)$$

$$z^2 = \beta^2(1-y^2)$$

$$\hookrightarrow \pm X = \beta^2\sqrt{1-y^2} + \sqrt{(1-y^2 - \beta^2(1-y^2)^2)(1-\beta^2)}$$

$$= \beta^2\sqrt{1-y^2} + (1-\beta^2)\sqrt{1-y^2} = \sqrt{1-y^2}$$

$\hookrightarrow x^2 + y^2 = 1$ for image
of Lorentz contracted
sphere