The Metric for the The Poincaré Universe.

Main assumptions are equivalent to the following: The Universe consists of the points inside a sphere of radius R such that the length of a measuring rod at distance r from the center is given by $\ell = k(R^2 - r^2)$. We let $k = 1$ as our standard unit of measurement. Since the distance $d(A, B)$ between two objects A and B is measured by seeing how many times the standard unit divides into the distance $d(A.B)$, it follows that the length of a rod from r to $r + \Delta r$ will be approximately $\frac{\Delta r}{R^2 - r^2}$. So then the length $\ell(r_1, r_2)$ of a path along a radial ray from r_1 to r_2 will be:

$$\begin{aligned}
\ell(r_1, r_2) &= \int_{r_1}^{r_2} \frac{1}{R^2 - r^2} dr \\
&= \int_{r_1}^{r_2} \Big(\frac{\frac{1}{2R}}{R + r} + \frac{\frac{1}{2R}}{R - r} \Big) dr \\
&= \frac{1}{2R} (\ln(R + r) - \ln(R - r)) \Big|_{r_1}^{r_2} \\
&= \frac{1}{2R} \Big(\ln \Big(\frac{R + r_2}{R - r_2} \Big) - \ln \Big(\frac{R + r_1}{R - r_1} \Big) \Big) \\
&= \frac{1}{2R} \ln \Big(\frac{(R + r_2)(R - r_1)}{(R - r_2)(R + r_1)} \Big).
\end{aligned}$$

So the radius of the Universe would appear to be:

$$\begin{aligned}
\int_0^R \frac{1}{R^2 - r^2} dr &= \frac{1}{2R} \ln \Big(\frac{(R + R)R}{(R - R)R} \Big) \\
&\to \infty.
\end{aligned}$$