## Answer on Question 55063, Physics / Astronomy | Astrophysics

## Question:

Measurements of many extragalactic sources have shown that they typically have brightness temperatures of TB = 1011 K and S = 1 Jy. Approximately what size telescope is needed to resolve these sources? How does that compare with the VLBA?

## Solution:

$$Sv = Iv\Omega = \frac{2kT_b}{\lambda^2} \times \frac{\pi\theta^2_s}{4}$$

Where $\theta_s$ is the source angular diameter. If $\theta_s \approx \theta_{FWHM} \approx \frac{\lambda}{D}$, then:

$$\frac{\lambda^2}{D^2} = \frac{2\lambda^2 S_v}{\pi k T_b} \Rightarrow D = \left(\frac{\pi k T_b}{2S_v}\right)^{\frac{1}{2}} = 1.5 \times 10^7\, m \approx D_\oplus = 1.3 \times 10^7\, m$$

So the Earth is just big enough for ground-based telescopes to image and resolve the brightest compact synchrotron sources!