Astronomy + Cosmologies 17 May 2001 Zita

If Betelgeuse became a gamma ray burster (GRB) would it kill us all?

distance to Betelgeuse = d = 400 ly = _____ m

GRB output $\mathcal{L}_{GRB} \sim \frac{10^{45} J}{min} \sim 10^{43}$ Watts,

First: How big is Betelgeuse? Sun

temp: $T_B \sim 4000k$ $T_\odot \sim 6000k$

$\mathcal{L}_B \sim 4 \times 10^4 \mathcal{L}_\odot$ $\mathcal{L}_\odot \sim 4 \times 10^{26} W$

$R_B \sim$ _____ $R_\odot \sim 7 \times 10^8$ m

Ch 5. $Flux = \frac{Power}{Area} = \frac{\mathcal{L}}{4\pi R^2} = \sigma T^4 \rightarrow \mathcal{L} = 4\pi\sigma R^2 T^4$

$$\frac{\mathcal{L}_{Betelgeuse}}{\mathcal{L}_{Sun}} = 4 \times 10^4 = \frac{T_B^4 R_B^2}{T_\odot^4 R_\odot^2} = \left(\frac{4000}{6000}\right)^4 \left(\frac{R_B}{R_\odot}\right)^2$$

Solve for $\frac{R_B}{R_\odot} = 2 \times 10^2 \left(\frac{6}{4}\right)^2 =$ _____

Now compare the flux received at Earth (a distance d away) to the flux output at GRB-Betelgeuse's surface:

$\frac{F_{here}}{F_{at\,B}} = \frac{\mathcal{L}_B / 4\pi d^2}{\mathcal{L}_B / 4\pi R^2} = \frac{R_B^2}{d^2} =$ _____ less

So we'd receive _____ $\times 10^{43} W =$ _____

refs: Universe p. 583, 674, 676, 475, 763