Notes by Simon Kristen

α Centauri is 4.3 lyrs away. $4.3 \cdot \frac{4}{3} yr \approx 5.73 yr$

Spaceship travels at $\frac{3c}{4}$. Time on board elapses at a rate $\frac{1}{\gamma}$ relative to earth.

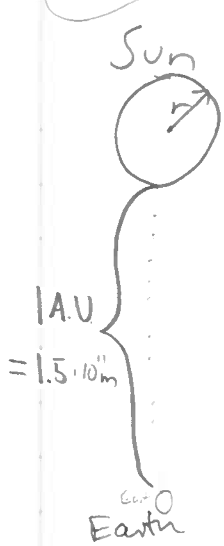
$\tau = 5.7 yr \frac{1}{\gamma} = 3.79 yr$ (Eigentime) $\gamma = \frac{1}{\sqrt{1 - v^2/c^2}} = \frac{1}{\sqrt{7/16}} = \frac{4}{2.64} = 1.51$

Length contraction $\frac{4.3 lyr}{\gamma} = 2.85 lyr$ $\frac{2.85 lyr}{3.79 yr} = \frac{3}{4} c$ q.e.d.

$c\tau = \sqrt{\Delta s^2}$ $\Delta s^2 = \Delta ct^2 - (\Delta \vec{r})^2 = 5.73^2 - 4.3^2 = 3.79^2$

proper time (Eigentime) q.ed

$\Delta s^2 = \Delta ct^2 - \Delta x^2 - \Delta y^2 - \Delta z^2$



$4\pi r_\odot^2$

$r_\odot = 7 \cdot 10^8 m$ (photosphere)

$M_\odot = 2 \cdot 10^{30} kg$

$\frac{1.3 kW}{m^2} \cdot 4\pi (A.U.)^2 =$

Total power output $= 3.7 \cdot 10^{26} W \approx 60 MW/m^2$

Bose-Einstein gas of photons

$$dn(E, E+dE) = \frac{g}{e^{(E-\mu)/kT}-1} \qquad \mu=0 \qquad \frac{g}{e^{E/kT}-1}$$

$\frac{dn}{Vol}$ $\quad P(E)$ $\qquad g = \frac{Vol \cdot 4\pi p^2 dp}{h^3}$

$$E^2 = m^2c^4 + p^2c^2$$

$$\frac{dn}{Vol} = \frac{8\pi p^2 dp}{h^3} \cdot \frac{1}{e^{E/kT}-1}$$

$E = pc$

Photon → $E = hf$

$U(E) = \frac{\text{energy}}{\text{Volume}}$

$$\frac{dn}{Vol} = \frac{8\pi E^3 dE}{h^3 c^3} \cdot \frac{1}{e^{E/kT}-1}$$

$$du(E) = \frac{8\pi h f^3 df}{c^3} \cdot \frac{1}{e^{hf/kT}-1}$$

$$|df| = -\frac{c}{\lambda^2} d\lambda$$

We conclude that the temperature of the sun is 5800 K.

$$= \frac{8\pi h \cancel{df}}{\lambda^3} \cdot \frac{1}{e^{hf/kT}-1}$$

Hydrogen atom

$$E_{n,l} = -R_y \frac{1}{n^2}$$

$E = -R_y \;\Big|\; hf = \Delta E = E_3 - E_2 = R_y\left(\frac{1}{4}-\frac{1}{9}\right)$

↓

656 nm absorption line

etc.

$E_2 = -R_y \frac{1}{4}$

$E_3 = -R_y \frac{1}{9}$

$p + p \to d + e^+ + \nu_e + 0.42\ \text{MeV}$

$d + p \to {}^3He + \gamma$

${}^3He + {}^3He \to {}^4He + 2p$

$4p \to {}^4He$
$+ 2e^+$
$+ 2\nu_e \to$ escape
$+ 23.7\ \text{MeV}$

$\boxed{\text{2 MeV more through annihilation with } e^-}$