# How many suns are needed to throw a dude against a wall?

An excellent question. First some assumptions:

1. The dude has mass of 70kg.
2. The dude must travel into the wall at 10$\text{ms}^{-1}$. This is akin to an Olympic sprinter running straight into a wall at the end of the 100m track. This is suitably hilarious for our purposes.

So how much momentum is needed? Applying science, we discover that:

$$\begin{aligned} \text{Momentum} = \text{p} =& mv \\ =& \ (70) \times (10) \\ =& 700 \text{ kg m s}^{-1} \end{aligned}$$

Sweet! This is not a large number at all. How many photons does this need? We need to make another assumption:

3. The sun is yellow.

The yellow light the sun emits has a wavelength of $\lambda$ = 570nm, which means that by using science thought up by an awesome scientist named Planck:

$$\begin{aligned} p_{\text{photon}} =& \frac{h}{\lambda} \\ =& \frac{6.63 \times 10^{-34}}{570 \times 10^{-9}} \\ =& \ 1.16 \times 10^{-27} \text{ kg m s}^{-1} \end{aligned}$$

This is looking less promising, ladies and gentlemen. We need to make another assumption:

4. The dude absorbs all the photons fired at him. He's clearly done something bad to have the light cannon used on him, so he must be evil. He is therefore wearing black, and thus this is a reasonable assumption.

Dividing the momentum required by the momentum per photon, we get the number of photons required:

$$\begin{aligned}\frac{p}{p_{\text{photon}}} =& \frac{700}{1.16\ 10^{-27}}\\ =&6.03 \times 10^{29}\end{aligned}$$

This is a seriously big number of photons! We now need to make another few assumption:

5. Our suns are in a magic chamber in the light cannon that reflects all of the photons they emit at the unfortunate dude in question.
6. We want the dude to be thrown at the wall within a tenth of a second of us pulling the trigger and opening the little door at the end of the cannon to shine the light at the dude.

To give the dude this much energy in a tenth of a second, we need to be beaming $6.03 \times 10^{30}$ photons per second! Thankfully, the sun is a photon producing machine, but how many photons does it produce? Using the gnarly science of the Stefan-Boltzmann Law we can find out! $\mathrm{P}_{\text{unit}}$ is the power emitted by the Sun per unit area. T is the temperature of the Sun and $\sigma$ is a magic number called the Stefan-Boltzmann Constant:

$$\begin{aligned}P_{\text{unit}} =& \sigma T^4\\ =&5.67 \times 10^{-8} \times (6000)^4\\ =&73.5 \times 10^6 \mathrm{W}\end{aligned}$$

That is a lot of lightbulbs! We now want the total power emitted by the Sun, so:

$$\begin{aligned}P_{\text{total}} =& \text{Area}_{\text{sun}} P_{\text{unit}}\\ =&6.09 \times 10^{18} \times 73.5 \times 10^6\\ =&4.48 \times 10^{26} W\\ =&4.48 \times 10^{26} J\ s^{-1}\end{aligned}$$

Now we want to know how many photons this is per second. Using our assumption that the Sun is yellow once more and yet more excellent physics:

$$
\begin{aligned}
E =& \frac{nhc}{\lambda} \\
n =& \frac{E\lambda}{hc} \\
=& \frac{4.48 \times 10^{26} \times 570 \times 10^{-9}}{6.63 \times 10^{-34} \times 3 \times 10^{8}} \\
=& 1.28 \times 10^{45} \text{ photons per second}
\end{aligned}
$$

We therefore only need a tiny fraction of the sun - only 4.7 $\times 10^{-15}$ of the (surface area of the) Sun. This would still weigh 641000 tons, and be 95 meters across! Surely not even T-Rex will be able to lift this weapon!

Hopefully this has been most informative for everyone wanting to build light cannons, giving an insight into their practicalities. Next time, join me for an investigation into the Fourier Transforms of the screams of small children and how they can be used to play orchestral music!