P3323 pressure
November 18, 2016

Consider the plane wave

$$\begin{aligned}\tilde{\mathbf{E}}(\mathbf{r},t) &= \tilde{E}_0 e^{i(\mathbf{k}\cdot\mathbf{r}-\omega t)}\hat{\mathbf{n}} \\ \tilde{\mathbf{B}}(\mathbf{r},t) &= \frac{1}{c}\hat{\mathbf{k}}\times\tilde{\mathbf{E}}\end{aligned}$$

Th Poynting vector (energy/(area-second))

$$\mathbf{S} = \frac{1}{\mu_0}\mathbf{E}\times\mathbf{B}$$

and the intensity is the time average of the Poynting vector

$$I = \langle S\rangle$$

The momentum density

$$E = \epsilon_0\mathbf{E}\times\mathbf{B}$$

and

$$\langle\mathbf{g}\rangle = \frac{1}{c^2}I.$$

1. If the light falls at normal incidence on a perfect absorber, it delivers momentum to the surface. What is the pressure in terms of $\langle\mathbf{g}\rangle$?

2. Sunlight is normally incident on the earth with intensity 1300 W/m^2. If all of the radiation is absorbed, what pressure does it exert?