

76. The energy density of an electromagnetic wave is given by $u = u_E + u_B$. From the discussion in §34-4, $u_E = u_B = \frac{1}{2}\varepsilon_0 E^2$, so $u = 2u_E = \varepsilon_0 E^2$. Upon averaging over time this becomes

$$u_{\text{avg}} = \varepsilon_0 \overline{E^2} = \varepsilon_0 E_{\text{rms}}^2 .$$

Combining this equation with Eq. 34-26 in the textbook, we obtain

$$I = \frac{1}{c\mu_0} E_{\text{rms}}^2 = \frac{1}{c\mu_0} \frac{u_{\text{avg}}}{\varepsilon_0} = \frac{c^2 u_{\text{avg}}}{c} = cu_{\text{avg}}$$

where $c^2 = 1/\varepsilon_0\mu_0$ is used.