4.6: Radiation Pressure

Recall equation 1.18.5 and the conditions for which it is valid. It was derived for isotropic radiation. In the atmosphere, radiation is not isotropic; there is a net flux of radiation outwards. Therefore the radiation density must go inside the integral sign. We can also write the equation in terms of specific intensity, making use of equations 1.15.3 and 1.17.1. The equation for the radiation pressure then becomes

$$P = \frac{1}{c} \int_{4\pi} I \cos^2 \theta \, d\omega, \tag{4.6.1}$$

where by now we are used to the abbreviated notation.

If the radiation is isotropic, this is not zero; it is $4\pi/(3c)$. In the expressions for J and for P, the power of $\cos\theta$ is even (0 and 2 respectively) and one can see both physically and mathematically that neither of them is zero for isotropic radiation. One the other hand, the expression for F has an odd power of $\cos\theta$, and it is therefore zero for isotropic radiation, as expected.