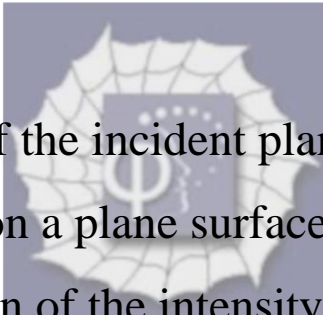


567.

**Problem 41.42 (RHK)**

*We have to prove that for a plane wave at normal incidence on a plane surface the radiation pressure on the surface is equal to the energy density in the beam outside the surface; and that this relation holds no matter what fraction of the incident energy is reflected.*

**Solution:**



Let the intensity of the incident plane wave be  $I$ . It is given that it falls on a plane surface at normal incidence. Let  $f$  be the fraction of the intensity of the incident radiation that is absorbed. The intensity of the reflected wave will therefore be  $I(1 - f)$ . The energy density in the beam outside the plane surface will be the sum of energy density in the incident component of the plane wave, which is  $I/c$ , and the energy density in the reflected component of the wave, which is  $I(1 - f)/c$ . Therefore, the energy density in the beam outside the plane surface will be  $I(2 - f)/c$ .

We have calculated in problem **566**. Problem 41.41 (RHK) that the radiation pressure on an object that absorbs a fraction  $f$  of the incident radiation falling normally on it and reflects fraction  $(1 - f)$  is  $I(2 - f)/c$ . Therefore, the total energy density outside the plane surface will be equal to the radiation pressure on the surface, irrespective of the fraction  $f$ .

