Solar radiation and earth energy balance

1) **Paul's Demo**

2) Magnitude of Solar Radiation
(Estimate of the power of Garden lights)

2) Earth energy balance

Solar radiation

- Solar constant ~1.4 kW/m^2

(incoming radiation POWER per unit area).

Or more accurately annual average solar constant S = 1367 W/m^2

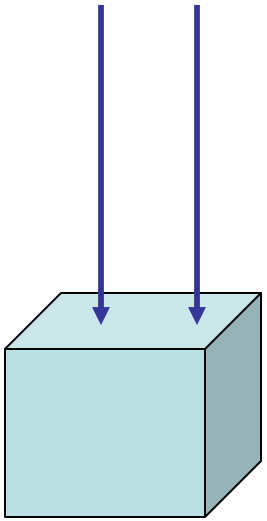
Q4 (from last lecture)

For a garden light to be on for a whole night, estimate how many watts (at most) can it have?

1) 0.1 W;
2) 5 W;
3) 60 W;
4) 200 W

Power as a function of the incident angle

Effectively, P / A is equal to S cos (theta).



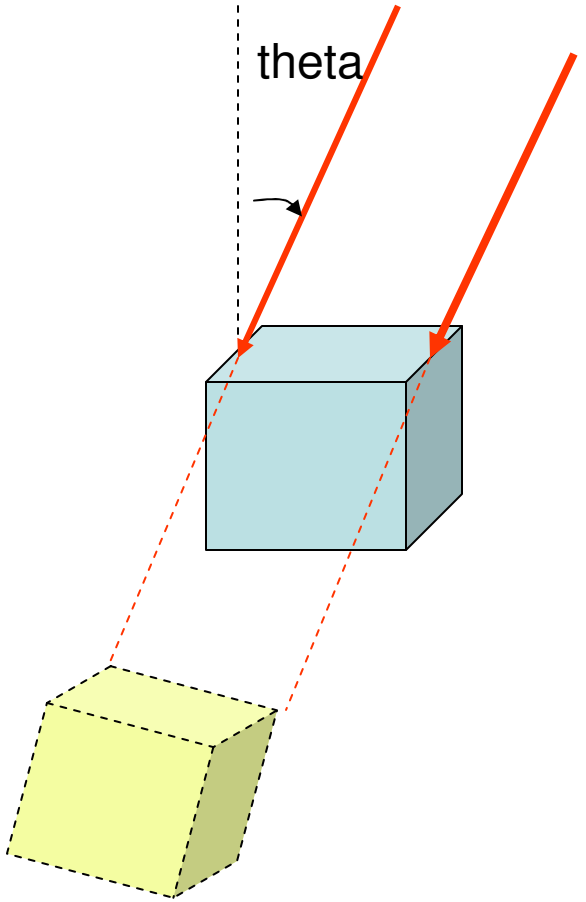
P=S A

$$P = S \times A \times \cos\theta;$$

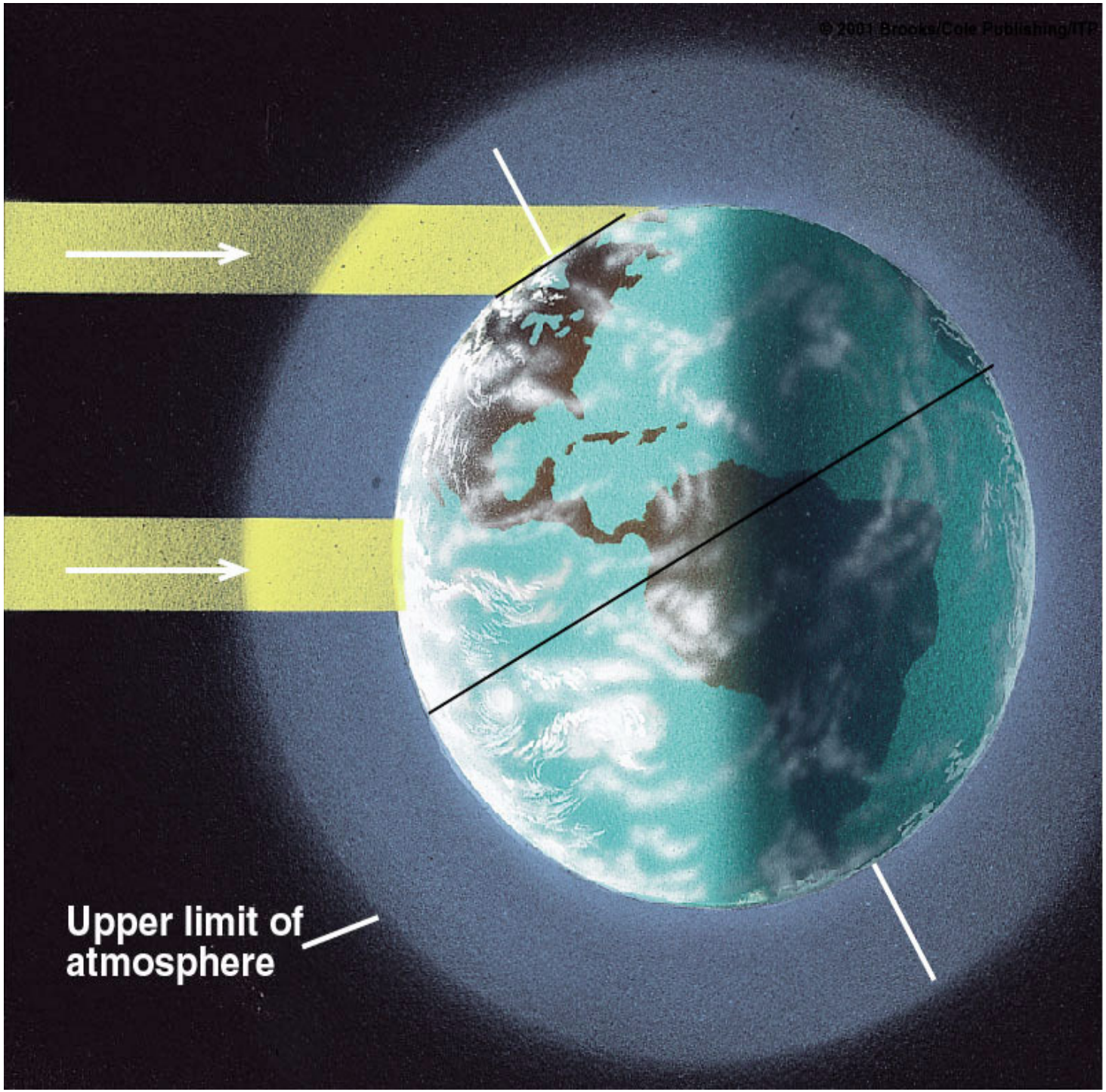
$$S: \quad solar \quad const.$$

$$A: \quad area$$

$$\theta: incident \quad angle$$



Energy per square meter decreases at lower sun angles and shorter daylight periods.



Energy Balance of the Earth

- Incoming energy flux: Solar energy;
- Internal heat (won't be considered);

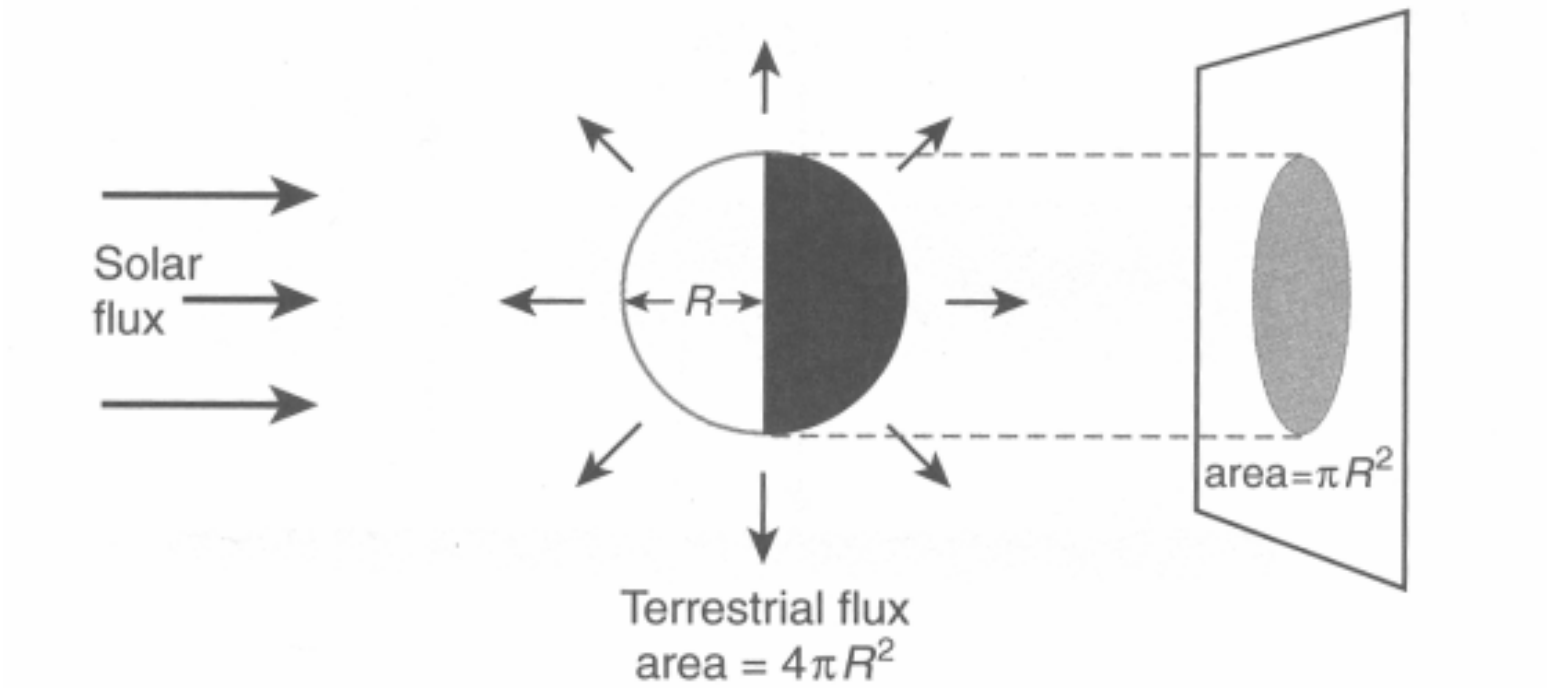
- Outgoing energy: Radiation by the earth.

Reflection coefficients or Albedo

- Overall average reflection coefficient of an object: Albedo
- Albedo of the Earth is about A = 0.3 which means that the Earth as a whole reflects 30% of solar radiation.

Total power of the incoming radiation

$$P_{in} = (1\text{-}A)\, S\, \pi\, R_{Earth}^2$$



Example from Roland B. Stull, Meteorology for Scientist and Engineers