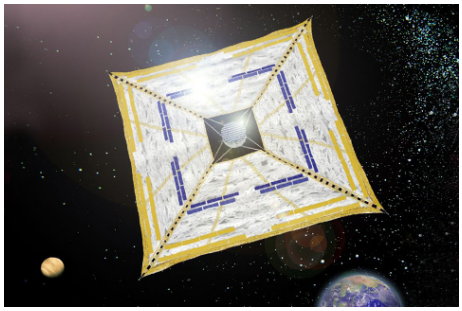
1 Solar Sail



The first spacecraft using a solar sail for propulsion was launched in 2010. Its name is IKAROS. It has a square sail with dimensions 14 m x 14 m. Assume that the sail's mass is 2 kg and it reflects 100% of incident photons. When IKAROS is loaded with other equipment, the total mass of the vehicle is 10 kg. The sail is orientated to receive maximum light from the sun.

(a) Calculate the momentum of the photons that come from the sun and hit the solar sail in 1 second. Assume a solar intensity of 1300 J/(s.m^2).

(b) How much momentum will be transferred from solar photons to IKAROS in one day? Give a numerical answer in units of kg.m/s (assume a constant solar intensity).

(c) What is the change in the solar sail's velocity in one day? (assume that acceleration is only caused by sunlight).

2 Human Vision

None **(Q4M.5 from textbook)** Suppose you are standing in the dark and facing a 20 W LED bulb 100 m away. If the diameter of your pupils is about 8 mm under these conditions, about how many photons of *visible* light enter your eye every second?