

Physics 780. Problem set 1

September 17, 2018

Due: Monday, October 1, 2018

Problem 1.1. (Stix, p.10) Use the Rayleigh-Jeans approximation for an estimate of the entire solar irradiance above any given wavelength. Show that about 0.07% of the Sun's energy is emitted in the far infrared at $\lambda > 10\mu\text{m}$.

Problem 1.2. The Helioseismic and Magnetic Imager (HMI) on Solar Dynamics Observatory obtains full-disk images of the Sun in Fe I 6173 Å line using a 14 cm lens. The effective focal length is 495 cm. Determine the angular resolution of the instrument, the image size on the instrument CCD, and the contrast of a 1 arcsec feature. The angular diameter of the Sun is 32 arcmin.

Problem 1.3 Calculate the angular resolution (in arcsec) of the 4m DKIST Solar Telescope for observations of the H-alpha line. Determine the size of the smallest solar features that can be seen with this telescope.

Problem 1.4 (Stix, p.100) Estimate the spectral resolution of Leonard Higgins's spectrohelioscope described in <http://spectrohelioscope.org/>. The telescope objective is 5", the focal length is 108", the diffraction grating is $2'' \times 2''$, and has 1200 grooves per mm. Compare the spectral resolution with the width (FWHM) of the H_α line.