

UNIVERSITY OF KANSAS
Department of Physics and Astronomy
Astrophysics I (ASTR 691) — Prof. Crossfield — Fall 2026

In-Class Problems 1

As always, be sure to: show your work, circle or highlight your final answer, list units, use the appropriate number of significant figures, and write your name.

1. **Sunlight [10 pts].** Consider a planet with radius and mass R_P , M_P orbiting a distance a from its host star (with effective temperature T_{eff} , radius R_* , and mass M_*).
 - (a) What is the flux F incident on the planet from its star?
 - (b) What is the flux F at the surface of the star?
 - (c) What is the total amount of power from the star that is incident on the planet? What fraction of the star's total luminosity is this?
 - (d) If the star emits most of its light at visible wavelengths, what is the approximate flux density F_λ incident on the planet?
 - (e) What is the angular radius of the star as seen from the planet, in radians?
 - (f) What is the solid angle (angular area) of the star as seen from the planet, in steradians?
 - (g) What is the approximate intensity (surface brightness), I_λ , of this star as seen from the planet?
 - (h) Discuss how the F , F_λ , and I_λ values you calculated each depend on the distance to the star.
2. **Flux From A Nearby Star [8 pts].** Alpha Centauri A is one star in the triple-star Alpha Centauri system ($d=1.3$ parsecs away), and it is a fairly similar star to our Sun (for this problem, assume it is identical to the Sun).
 - (a) Roughly how many times weaker is the stellar flux from this star (F_*) that hits the Earth, relative to the Solar flux from the Sun that reaches the Earth ($F_\odot$)? First give your answer in terms of d and other symbolic values; then also give an actual number. [5 pts]
 - (b) Roughly how many times weaker is the stellar flux density from this star ($F_{\nu,*}$) that hits the Earth, relative to the Solar flux density from the Sun that reaches the Earth ($F_{\nu,\odot}$)? First give your answer in terms of d and other symbolic values; then also give an actual number. [5 pts]