

Stellar Atmosphere and Structure

Problem Set #20230921, due in two weeks

If you look up something in the literature or from the web, make sure you make proper citations.

- (a) What are the spectral type and apparent magnitude of Alpha Lyr (Vega)? (b) What is the expected absolute magnitude on the basis of its spectral type? What is its bolometric luminosity? (c) What is the distance to Vega estimated from its apparent magnitude? What is it measured directly by parallax (and its error)? How and why do these differ? (d) What is the expected diameter of this star in km, in R_{\odot} and in au? What is then the expected angular diameter seen from Earth? Estimate if the stellar disk can be resolved by the JWST?
- (a) What is the solar metallicity (Z value)? (b) List the six most abundant chemical elements of the Sun, and those of the Earth. (c) Why is the Earth chemically so much different from the Sun?
- (a) List the brightness in Jansky of the star Vega from optical (UBVRI) to near-infrared (JHKL) to mid- and far-infrared wavelengths (at 12, 25, 60 and 100 microns). (b) Plot its spectral energy distribution and compare it (there is no need to fit the data) with a blackbody radiation of 10,000 K. You may refer to that given in <http://vizier.u-strasbg.fr/vizier/sed/>. (c) The discovery of excess emission beyond mid-infrared came as a surprise (Aumann et al. 1984, ApJL, 289, L23) for this spectrophotometric “standard” star. Offer an explanation for the infrared excess.