

Solar Physics, Exercise 4

15 February 2017 at 14-16 in D116

Submit by 14 February 2017 12:00

1. (a) Show that the Schwarzschild criterion can be given as

$$\frac{d \ln T}{d \ln P} > \left(\frac{\partial \ln T}{\partial \ln P} \right)_s,$$

where the right-hand side is the adiabatic temperature gradient, ∇_a .

- (b) Show that in an ideal gas, the Schwarzschild criterion reads

$$-\frac{dT}{dr} > \frac{\gamma - 1}{\gamma} \frac{\mu g}{\mathcal{R}}.$$

2. Confirm Eq. (5.25); show that the gradients appearing in Eq. (5.23) make no contribution.
3. During January 2014 a number of sunspots covering a wide range of latitudes was registered on the Sun. Observe the sunspots using continuum spectra images taken by SDO spacecraft in continuum spectrum:
<https://sdo.gsfc.nasa.gov/data/aiahmi/>
<https://heliviewer.org/>
Choose 5-6 sunspots from lowest to highest latitudes observed during January 2014, estimate rotation period from these observations at different latitudes, visualize your findings by sketching a plot of rotation rate dependence on latitude.
Do your observations confirm the concept of differential solar rotation?