Solar Physics 2010: Exercises to Lectures 12 and 13
Due Date: 24. June 2010 at 13:15

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1 Maximum Field Strength

Estimate the maximum possible field strength for a flux tube in the thin tube approximation in the photosphere at $\tau_{500\mathrm{nm}} = 1$.

2 Flux Tube Shape with Height

Assuming hydrostatic equilibrium and a constant pressure scale height, calculate the magnetic field strength and the tube diameter as a function of height and magnetic flux.

3 Inclined Fluxtubes

Flux tubes are buffeted by convective motions. How does the inclination angle of a flux tube due to these motions depend on its diameter? Hint: Compare drag forces and buoyancy.

4 Wavelength Dependence of Umbral Intensity

The observed intensity of a sunspot umbra increases toward longer wavelengths (see Fig. 8.27 in Stix's book). Explain this behavior and calculate its wavelength dependence to first order in λ.