UNIVERSITY OF CALIFORNIA, SANTA BARBARA
Department of Physics

Physics 233 **Exercise 1 (Due Wed. Jan 15)** Winter 2014

1. **Milne Relation:** Consider the general relationship between recombination and photoionization cross sections. The recombination of electrons with velocity between v and v + dv is balanced by photoionization by photons with frequencies in the range ν to $\nu + \mathrm{d}\nu$, where $\frac{1}{2}\ \mathrm{mv}^2 + \mathrm{h}\nu_\mathrm{T} = \mathrm{h}\nu$ and $\mathrm{h}\nu_\mathrm{T}$ is the energy of the level in which the electron is captured.

Show that the recombination cross section to this particular level ($\mathrm{h}\nu_\mathrm{T}$) can be written in terms of the photoelectric absorption cross section from the same level as

$$\sigma_{Rec} = \frac{\omega_i}{\omega_{i+1}} \frac{h^2\nu^2}{m^2c^2v^2} \ \sigma_{P.I.} \quad ,$$

where ω_i and ω_{i+1} are the relevant weighting functions for the atom (or ion) and its first (next) ionization state.