# OSCILLATION FREQUENCIES OF SOLAR MODELS

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Abstract. Two precision solar models have been constructed with the Iben evolution program, one with no diffusion of the internal atomic nuclei, and another that includes the effects of gravitational settling, thermal diffusion, and concentration gradient diffusion on the element abundances. The opacity at the bottom of the convection zone was increased 15-20 percent (within its theoretical uncertainty) to allow a few microhertz agreement with the observed solar p-mode frequencies. The original helium mass fractions of the mixtures were 0.291 and 0.289 for the no-diffusion and diffusion models, respectively. The diffusion model evolved to a surface Y=0.256 at the solar age, and the original Z value of 0.0200 decreased to 0.0179. Agreement of asymptotic theory l=0 and 2 p-mode frequency separations and those directly calculated with nonadiabatic theory is good, and there is good agreement with observations also. Calculation of g-mode solutions shows that they do not have equal period spacings until high radial order. Nonadiabatic solutions for these g-modes modes enable us to predict their relative surface visibility. For l=1-5, the lowest order modes seem to be more detectable assuming that they all have the same kinetic energy. Our high helium results in high central temperatures that give over 9 SNUs from the B and 1.5 SNUs from the Be reactions, but a lower more conventional helium abundance would reduce this B neutrino flux by maybe two SNUs. Models with iron condensed-out deeper than the convection zone, and with the presumed WIMPs to cool the central regions and reduce the SNU flux, agree less well with the p-mode frequency separations.

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