Modelling the M-S-C Giants Spectral Sequence

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We present pressure-dependent line-by-line LTE model atmospheres for cool red giants ($T_{\rm eff} < 4000$ K) in spherical geometry. The models are computed using the atmospheric code PHOENIX, and they constitute an extension of the existing cool dwarf grids of Allard & Hauschildt (1995, *ApJ*, 445, 433) to the pressure regimes of red giants. The grid covers C/O ratios ranging from 0.27 to 1.02 with otherwise solar metallicity. We find our models comparable to those of Kurucz in regimes where the plane-parallel approximation is valid, with the exception of the predicted strength of TiO bands as expected from the use of different TiO opacity sources. Departures from LTE in the Ti I lines are investigated for some selected models across the grid, but only modest NLTE effects are found in the abundance of the important absorber TiO. The models are used to construct a spectral sequence of M, S and C type giants for which both optical and infrared spectra are available. Colors of the combined dwarf and giant model grids are presented in the Wing eight-color system which reveals a clear separation of dwarf and giant stars, and of giants in carbon abundance and gravity, providing ideal grounds for the study of the chemical evolution of giants.

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