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The Temperature of the Supergiant α Per [1]

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Abstract. We compare observed fluxes from the ultraviolet (IUE) through J and K with recent Kurucz model atmospheres to determine a temperature for the F5 Ib supergiant α Per. The two most important advances in this study as compared with previous work are the use of well calibrated ultraviolet fluxes and the use of models with an appropriate microturbulence.

1. Introduction

There are many questions in astrophysics which require a temperature derived from the entire spectral energy distribution. As a first step in determining a temperature scale for Cepheids and non-variable supergiants, we have determined the temperature for the F5 Ib supergiant Alpha Per.

2. Data

Observations of α Per, as well as a number of other nonvariable supergiants, have been assembled including International Ultraviolet Explorer satellite (IUE) spectra and B, V, R, I, J, and K as discussed by Evans, et al. (1993). Because α

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Per is located in a cluster, and because its angular diameter has been measured, its log g is known observationally, as is the microturbulence in the atmosphere. We adopt a reddening E(B–V) = 0.04 mag from the stars closest to α Per in the cluster (Gray, 1991). These data are discussed in detail by Evans, et al. (1995), as is the process of determining the temperature.

3. Models

The observed energy distribution of α Per was compared with model atmospheres consistent with the observed values of gravity and microturbulence. Because supergiants have microturbulence higher than the standard value of 2 km s^{-1}, one of us (JBL) computed a series of fully line blanketed model atmospheres using the Atlas 9 code of Kurucz. For the broad-band comparisons, the model atmospheres were convolved with standard filter sensitivity functions (Evans, et al. 1995). The ultraviolet flux is sensitive to gravity and microturbulence, as well as temperature. Because we cannot resolve this degeneracy using the energy distributions, we fix log g at 1.5 and microturbulence at 4 km s^{-1} (as observed), and derive the temperature from the best fit to the energy distribution (6270 K).

4. Discussion

The rms deviation to the fit (0.065 mag) is reasonable considering that the data are assembled from many sources which are calibrated in different ways. This uncertainty corresponds to a temperature range of $\pm$ 120 K. The temperature derived from the distance to the cluster and angular diameter is within this range. Temperatures have recently been determined in several studies using the infrared flux method (Blackwell, et al. 1991, McWilliam, 1991). The differences in the temperatures between this study and the others can be attributed to the different reddenings.

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