Declaration

The work presented in this thesis was carried out at the Astrophysics Research Institute, Liverpool John Moores University. Unless otherwise stated, it is the original work of the author.

While registered as a candidate for the degree of Master of Philosophy, for which submission is now made, the author has not been registered as a candidate for any other award. This thesis has not been submitted in whole, or in part, for any other degree.

David Hyder

Astrophysics Research Institute

Liverpool John Moores University

146 Brownlow Hill

Liverpool

L3 5RF

UK

Abstract

The information we can gather about chemical composition and evolutionary status of stars comes from the detection and analysis of the photons that are emitted, and comparisons with theoretical predictions. The relative abundances of elements within the Sun provide the baseline against which the elemental abundances of all other stars, galaxies and the interstellar medium are based upon. Libraries of model atmospheres and stellar spectra have been previously computed using ATLAS9 based upon the solar metallicity and chemical composition values calculated by Grevesse & Sauval (1998), used as the standard until Asplund *et al.* (2009) produced a new determination of the chemical composition of the Sun. This new value for the total metallicity of the Sun is lower than that which was previously determined, and the abundances of elements such as carbon, oxygen and nitrogen are different, which has significant implications for the analysis of the spectroscopy of stellar populations.

In this project new opacity distribution functions have been calculated using the Asplund *et al* (2009) abundances for several metallicities ranging from -2.5 to +0.5, and these have been used to produce new grids of ATLAS9 model atmospheres and synthetic spectra for stars with effective temperatures of 3500 K to 80000 K and log g from 0.0 dex to 0.5 dex, for both normal and alpha enhanced stars. Comparisons of the synthetic spectra produced by the old and new models show that there is very little difference in the energy distribution in stars hotter than 4500 K. Investigations into the bolometric corrections and colour indices show some differences with the U-B, B-V and u-b indices from the new ODFs being slightly redder for effective temperatures below 4500K, but above this there are no significant differences. Comparisons between the bolometric corrections and colour indices calculated using the new abundances and the empirically derived values show a good general agreement for main sequence stars regardless of the metallicity, but less so for giant stars.

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