Binary Contamination in the SEGUE sample: Effects on SSPP Determinations of Stellar Atmospheric Parameters

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(Submitted on 29 Jan 2010)

Using numerical modeling and a grid of synthetic spectra, we examine the effects that unresolved binaries have on the determination of various stellar atmospheric parameters for SEGUE targets measured using the SEGUE Stellar Parameter Pipeline (SSPP). To model undetected binaries that may be in the SEGUE sample, we use a variety of mass distributions for the primary and secondary stars in conjunction with empirically determined relationships for orbital parameters to determine the fraction of G-K dwarf stars, as defined by SDSS color cuts, that will be blended with a secondary companion. We focus on the G-K dwarf sample in SEGUE as it records the history of chemical enrichment in our galaxy. To determine the effect of the secondary on the spectroscopic parameters, we synthesize a grid of model spectra from 3275 to 7850 K (~0.1 to 1.0 \msun) and [Fe/H]=-0.5 to -2.5 from MARCS model atmospheres using TurboSpectrum. We analyze both "infinite" signal-to-noise ratio (S/N) models and degraded versions, at median S/N of 50, 25 and 10. By running individual and combined spectra (representing the binaries) through the SSPP, we determine that ~10% of the blended G-K dwarf pairs with S/N>=25 will have their atmospheric parameter determinations, in particular temperature and metallicity, noticeably affected by the presence of an undetected secondary. To account for the additional uncertainty from binary contamination at a S/N~10, uncertainties of ~140 K and ~0.17 dex in [Fe/H] must be added in quadrature to the published uncertainties of the SSPP. (Abridged)

Comments:	68 pages, 20 figures, 9 tables
Subjects:	**Solar and Stellar Astrophysics (astro-ph.SR)**
Cite as:	**arXiv:1002.0001v1 [astro-ph.SR]**

Submission history

From: Katharine Schlesinger [view email]
[v1] Fri, 29 Jan 2010 22:34:48 GMT (202kb)

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