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# The Herbig Ae Star HD 101412⋆

## An Abundance Study

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**Abstract.** We take advantage of the extremely sharp spectral lines of the Herbig Ae star HD 101412 to do a detailed abundance study. We find departures from the solar abundances typically of a factor of two to three. Generally volatile elements are normal or enriched, while refractory elements are depleted. Zinc is a significant exception, being depleted by an order of magnitude. Because the material of this study has been accepted for publication, and is available on line as arXiv:1008.1601, we confine ourselves to brief remarks.

**Key words:** Stars: chemically peculiar – Stars: abundances – Stars: individual (HD 101412) – Stars: pre–main–sequence

## 1 General Remarks

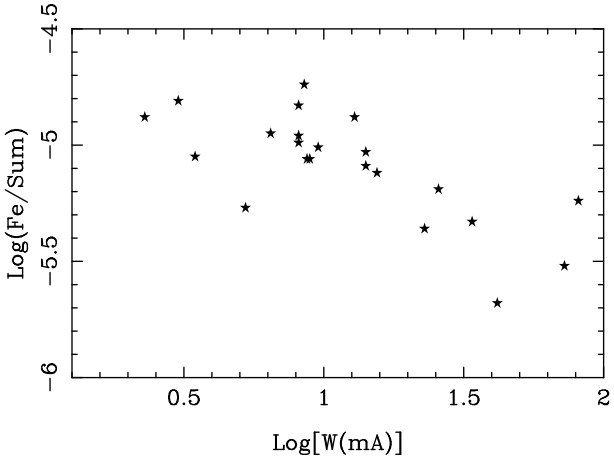


Figure 1: Abundance vs. $W_\lambda$ [mA] for zero microturbulence.

Uncertain reddening makes it difficult to use photometry to reliably determine $T_{\rm eff}$ and $\log(g)$ for this star. Ionization equilibrium and the wings of the Balmer lines give relations between these

⋆ Based on observations obtained at the European Southern Observatory, Paranal and La Silla, Chile (ESO programmes 077.C–0521(A), 081.C–0410(A) and 383.C–0684(A)

variables. We follow Acke & Waelkens (2004), and use excitation to break this degeneracy. The resulting temperature (8300 K) is significantly cooler than has been generally assumed (Guimarães et al., 2006; Castilho et al., 2009) — both used 10000 K. The lower $T_{\rm eff}$ leads directly to the lower abundances found for the involatile elements. We note that the temperatures adopted for young stars are often based on the spectral types. MK types cannot be reliably assigned for late B or early A stars if the calcium abundance is abnormal.

Abundances derived from the stronger lines of Fe, Ca, Ti, give systematically lower abundances than the weaker lines, *even when zero microturbulence is assumed* (Fig. 1). We attribute this *anomalous saturation* to an abnormal atmosphere, plausibly heated by the material infalling from a disk.

It has often been assumed that the sharp spectral lines of HD 101412 are due to the "pole–on" line of sight. A newly–discovered period of 42 days (Mikulásek et al., *in preparation*) means that other viewing angles are possible.

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