Contrib. Astron. Obs. Skalnaté Pleso **38**, 463 – 464, (2008)

Heavy elements in the hot-Am star HR 3383

G.M. Wahlgren[1,2] and D.S. Leckrone[2]

[1] *Catholic University of America, Washington DC, USA*
[2] *NASA-GSFC, Code 667, Greenbelt MD, USA 20771*

Received: December 4, 2007; Accepted: December 14, 2007

Abstract. The ultraviolet spectrum of the hot-Am star HR 3383 is analyzed through synthetic spectrum fitting for identification of lines from post iron-group elements. Spectral lines for a number of ions are detected for the first time in this star.

Key words: stars: chemically peculiar – stars: abundances – techniques: spectroscopic – ultraviolet: stars

1. Spectrum analysis of HR 3383

HR 3383 (HD 72660, A1 V) is a bright, hot-Am star that has been studied previously at ultraviolet (UV) and optical wavelengths. Its sharp-lined spectrum displays a strong Fe II spectrum along with spectral lines of very heavy elements (Pt, Au, Hg), thereby presenting itself as an interesting analog of the HgMn phenomenon at a slightly cooler effective temperature. The sharp-lined spectrum also makes it one of a few prototypes for UV studies in laboratory atomic spectroscopy.

We have undertaken to model the UV spectrum of HR 3383, emphasizing the search for spectral lines of post iron-group elements. The identification and analysis of these lines can be problematic since their oscillator strengths and structures are often highly uncertain or lacking. We use high-resolution spectra obtained with the *Hubble Space Telescope* Goddard High Resolution Spectrograph (GHRS) and the Space Telescope Imaging Spectrograph (STIS) instruments. The GHRS spectra extend over the wavelength interval 1630 − 1902 Å at a resolving power of approximately $R = 80\,000$, while the STIS spectrum covers the range 2128 − 2887 Å at $R = 110\,000$. For both data sets the signal-to-noise ratio in the continuum is typically higher than 100.

The spectra were fitted using the SYNTHE synthetic spectrum code (Kurucz, 1993 a) and an input model atmosphere generated with the ATLAS9 code (Kurucz, 1993 b) for parameters $T_{\rm eff} = 9750\,$K, $\log g = 4.0$, micro-turbulent velocity $= 2.0\,{\rm km\,s^{-1}}$, and $v \sin i = 6.0 \pm 0.5\,{\rm km\,s^{-1}}$. The chemical composition of iron-group elements was constructed from synthetic spectrum fitting at optical wavelengths (unpublished). The linelist employed is that of Kurucz (1993 a), which we have altered by adding lines and correcting existing atomic data.

There is a remarkable difference in the quality of the spectrum fits on either side of 2000 Å. The poorer quality of the fitting for wavelengths shorter than

2000 Å can be attributed, in part, to the paucity of laboratory analyses for the atomic data. For wavelengths longer than 2000 Å the spectrum fitting is generally good, with the spectrum being dominated by lines from iron-group elements. Strong unidentified lines exist, and there are many weak features that are not fitted by the calculations due to the lack of atomic data.

From the line identification analysis, we consider the post iron-group ions to be placed in one of three categories.

- Ions with positive identification from spectrum fitting or identification of multiple lines: Sr II, Y II/III, Zr II, Mo II, Sn II, Hf II, Pt I/II/III, Au II/III, Hg II, Pb II.
- Ions with highly probable identification, but which have highly uncertain or no atomic data for spectrum synthesis. Multiple lines can be identified or there is a link to the above ions: Ge I/II, Zr III, Ru II/III, Pd III, Ag II/III, Sb II, Ce III, Eu III, Gd III, Yb III, Au I, Hg I/III, Tl II/III, Bi I/II.
- Ions with tentative identification (few lines, weak features): Se I, Sr III, Nb II, Mo I, Rh II, Cd II, Te I/II, Ce IV, Pr I/II, Gd II, Tb II, Dy II, Ho II, Er III, Tm III, Yb II, Lu III, W I/II, Re I/II, Os I/II, Ir I/II, Pb I.

The identification of lines from certain ions implies an abundance enhancement in HR 3383 typically in the range of +1.0 to +1.5 dex, with respect to the solar system value, as exemplified by the elements barium (+1.1 dex, Varenne, 1999), molybdenum (+1.2 dex) and hafnium (+1.7 dex, Lundqvist *et al.*, 2006). The similarity of the abundance enhancements for heavy elements is not consistent with abundance enhancements found in cool HgMn stars, such as χ Lupi A. Documenting the differences in abundance patterns for hot-Am stars and cool HgMn stars will provide valuable data for testing theories that aim to explain spectrum anomalies. We continue to model the UV spectrum of HR 3383 to derive its chemical composition, and as a by-product, to produce a spectral atlas that will serve to guide analyses of similar stars.

Acknowledgements. GMW would like to acknowledge funding from NASA grant NNG06GJ29G.

References

Kurucz, R.L.: 1993 a, *SYNTHE, CD-ROM* No. 18
Kurucz, R.L.: 1993 b, *ATLAS9, CD-ROM* No. 13
Lundqvist, M., Nilsson, H., Wahlgren, G.M., Lundberg, H., Xu, H.L., Jang, Z.-K., Lecrone, D.S.: 2006, *Astron. Astrophys.* **450**, 407
Varenne, O.: 1999, *Astron. Astrophys.* **341**, 233