DISCUSSION (Cowley and Johansson)

ADELMAN: Co-adding of spectra is an important technique for improving the signal-to-noise ratio for non-variable stars. Those who are interested should look at my paper on co-adding of Dominion Astrophysical Observatory spectrograms, which is a poster paper at this Colloquium. I want to make two comments about this technique. First, stars which do not have sharp lines do not have to be observed with high resolution. One can do better by observing them with lower resolution and co-adding the spectra. Second, it is a waste of valuable telescope time to obtain inferior data if better data can be obtained by requesting it from another observer.

Jeff Fuhr at the US National Bureau of Standards has given me some data on gf-values for Fe I, Fe II, Ti II, and Co II, and has authorized me to distribute it here. There are many NBS publications available which would interest everyone working on atomic spectra; Drs. W. Martin, J. Fuhr, and R. Zalubas are glad to give these free to anyone who requests them. They only ask that you write to them on your institution's official stationery when you request it. Their address is:

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HUBENÝ: I would like to show you an example which illustrates the problem of misidentification in IUE spectra. Hubený, Štefl & Harmanec (Bull. Astr. Inst. Czech., 36, p. 214, 1985) show that blends of numerous Fe III lines produce two fictitious lines, closely simulating the strong resonance lines of C IV, for moderately and rapidly rotating B3 to B8 stars. Even at lower temperatures this can be a problem, because one gets what looks like C IV lines, but shifted about 100 km/s. This effect is seen in many Be stars! Here [shows slide] the fictitious blend is due to Fe II.

SEVERNY: You did not mention the possibility of astrophysical determination of gf-values using stars with known chemical composition. We have had problems analysing UV spectra obtained with Astron, because Kurucz and Peytremann gf-values are sometimes wrong by factors of 10^3 to 10^4. What is your opinion of this method?

COWLEY: This is certainly an important method. However, if there are additional unknown lines which are blends, we can make many errors with this method, as Dr. Hubený has just pointed out. Like all things, it has its good and bad parts. In general I prefer to use the NBS critically evaluated gf-values when they are available. Of course, there are many lines for which gf-values are not known, and we have to use the astrophysical method.

JOHANSSON: I'm glad to see that the data we are producing at Lund is of good help for your spectral analysis of stars. We have worked on Fe II since 1974, and this work is continuing. We are analysing the entire IUE region, in collaboration with Dr. Baschek in Heidelberg. We hope to produce a new multiplet table for Fe II. We are also working on other

C. R. Cowley et al (eds.), Upper Main Sequence Stars with Anomalous Abundances, 103–104.

iron-group elements. If you want some laboratory line lists, we can send these to you. In some wavelength regions there is a severe lack of atomic data for the iron-group.

COWLEY: I have one small additional comment on the Kurucz (1981) Fe II calculations. In the region discussed in my paper, the strongest contributions came from transitions to certain odd upper levels which had not been properly described quantum-mechanically in his work. These oscillator strengths are almost certainly greatly overestimated, and contribute roughly 10% to the general absorption there. Undoubtedly, that absorption belongs someplace, but not precisely at the wavelengths where it was calculated.

ARTRU: Even for Si II, which is considered to be a relatively well-known atomic spectrum, about 30% of the multiplets (many of them strong) have no known gf-values. About 25% are missing in the Kurucz & Peytremann list, because in Si II there are many doubly excited levels which have mixed configuration effects. So, even for a 'simple' ion like Si II there are problems.

DISCUSSION (Johansson and Cowley)

HUBENÝ: From the practical point of view, it would be nice to know that lines originating between newly found energy levels are generally weaker than previously known lines from well-established levels. Is there such a hope at present, or in the near future?

JOHANSSON: We know already that a great number of Fe II lines, which are not available in the literature, have log gf ≈ -1 and lower excitation potentials around 7 - 8 eV. They appear as strong absorption features in the IUE region. For Cr II, no lines below 1780 Å are available in existing compilations. We now know of about 1000 new lines in this region with the strongest lines around 1430 Å. The gf values for these lines are certainly not more than one order of magnitude less than the gf values for the resonance lines. The conclusion is that a lot of predicted lines will have intensities comparable to those of 'well-established' lines.

https://doi.org/10.1017/S0252921100091296 Published online by Cambridge University Press