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THE PROBLEM OF THE Fe II TEMPLATE IN AGNs

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Abstract. In order to make a template for fitting and subtracting the Fe II emission lines in the H_β wavelength range, we applied an approximate relation for the Fe II line relative intensities as a function of temperature. Using the obtained relative intensities we fitted the H_β wavelength range of several AGNs. We found a good fit of the redshelf of H_β with our Fe II template.

1. Introduction

The Fe II template offers a handly tool in studying the warm emitting gas in Broad Line Regions (BLRs) of active galactic nuclei. Several papers were published to study the Fe II template in UV and optical regions (see e.g. Vestergaard and Wilkes 2001, and references therein). One of the frequently investigated problem is the Fe II template in the H_β wavelength range, since the template contributes to the red wing of H_β and before an analysis of the H_β line profile is made, the template has to be subtracted (see e.g. Popović et al. 2001).

The aims of this paper are: 1) to estimate the contribution of Fe II template to the red part of H_β wavelenght range; 2) to find a suitable intensity ratio of Fe II template which can be used for subtraction of redshelf from H_β line.

2. Observations

We use HST observations obtained with the Space Telescope Imaging Spectrograph (STIS), covering the wavelength range 2900-5700 Å for three AGNs 3C120, Mrk 493 and I Zw1. The grating G430L, was used to cover the observed spectral range as a whole. The dispersion of the spectra was 2.747 Å/pixel. The spectra were reduced by the HST team. We transform the wavelength scale to zero redshift taking into account the cosmological red-shifts of the observed AGNs (e.g. Véron-Cetty and Véron 2000). After that we estimate and subtract the continuum, taking as the reference wavelengths: 3750 Å, 3900 Å, 4050 Å, 4200 Å, 4450 Å, 5100 Å, and 5600 Å.

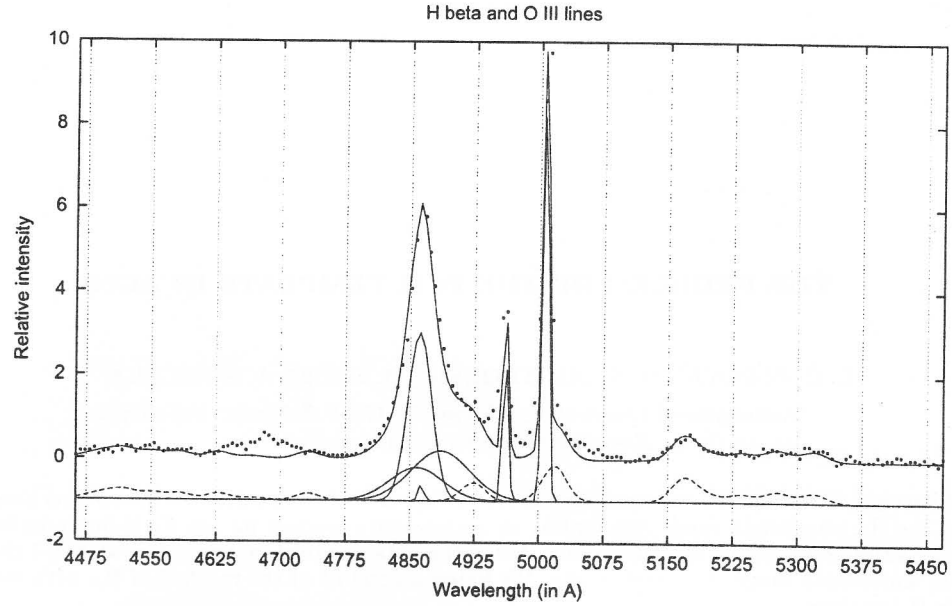

Fig. 1: The wavelength range of 3C 120 H_β line fitted with Fe II template and Gaussian functions for H_β and [OIII] lines. The dots represent observations, and the solid line the best fit. The Gaussian components and Fe II template decomposition are presented at the bottom (dashed line).

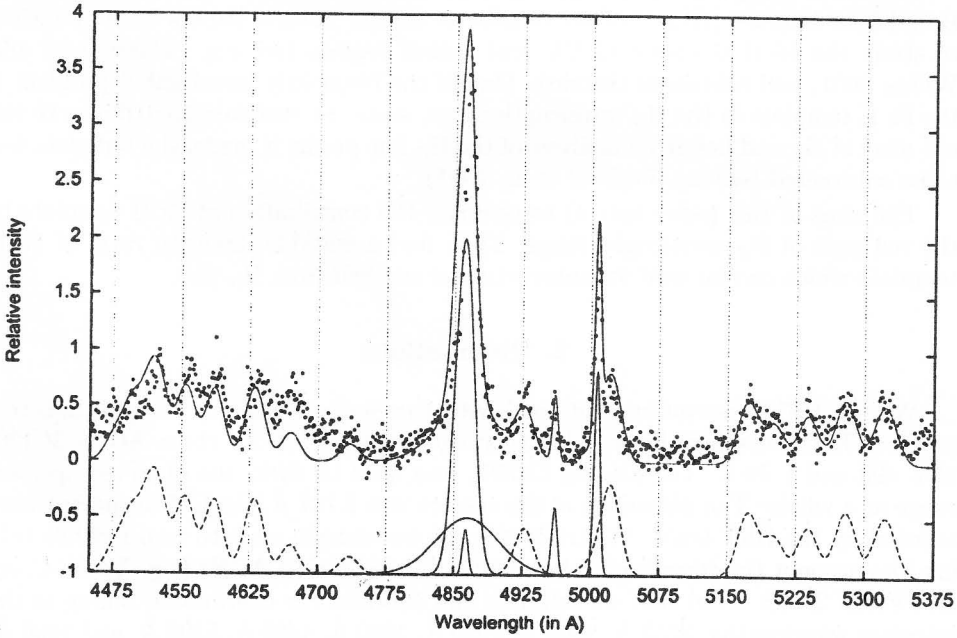

Fig. 2: The same as in Fig. 1, but for Mrk 493.

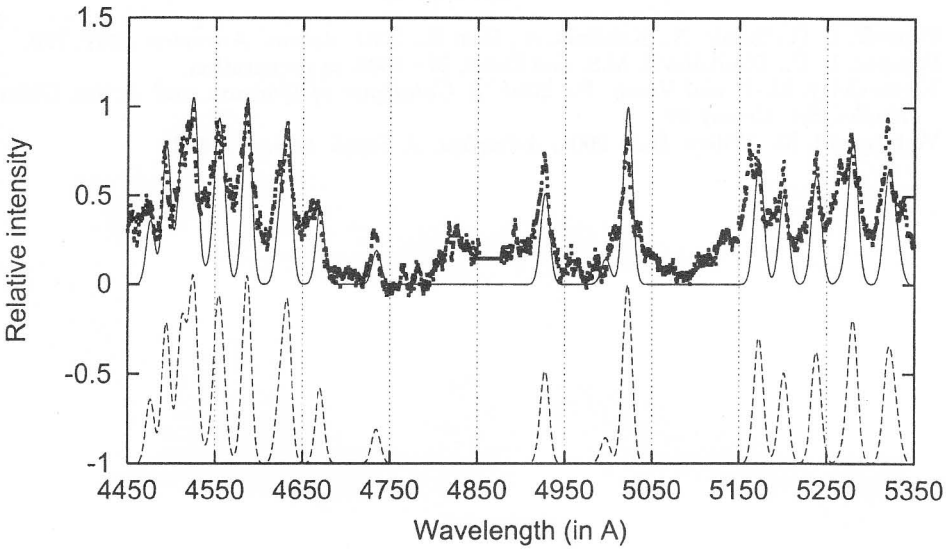

Fig. 3: The same as in Fig. 1, but for I Zw1

3. The intensity ratio of Fe II template

First we have indentified the Fe II lines which are present in the spectra of I Zw 1 and we found that the three types of transitions are present, where the lower levels are $3d^5 4s^2\ ^6S$, $3d^6(^3F2)4s\ ^4F$ and $d^6(^3G)4s\ ^4G$.

We selected the lines from these three types, assuming that the intensity ratio within the transitions which have the same lower level is

$$\frac{I_1}{I_2} = (\frac{\lambda_2}{\lambda_1})^3 \frac{f_1}{f_2} \cdot \frac{g_1}{g_2} \cdot e^{-(E_1 - E_2)/kT},$$

where I_1 and I_2 are intensities of the lines, λ_1 and λ_2 are transition wavelengths, f_1 and f_2 are oscillator strengths, g_1 and g_2 are the corresponding statistical weights, E_1 and E_2 are energies of upper levels, k is the Boltzman constant and T is the electron temperature.

We have assumed that each of lines can be represented by a Gaussian with the width and shift (w and d) and for all Fe II lines w/λ and d/λ are the same. It means that all Fe II lines from template originate from the same region with the same kinematical properties. The results of our fit are shown in Figs. 1-3.

4. Conclusion

As one can see from Figs. 1-3, our approximation for Fe II template in the H_β wavelength range can satisfactorily fit the template and can be used for subtracting the template from the red wing of Sy 1 and QSO H_β lines. The detailed discussion will be given elsewhere (Popović et al. 2002).

References

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