# Emitting gas regions in Mrk 493: An extensive Fe II line emission region

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**Motivation**

Mrk 493, a narrow-line Seyfert 1 galaxy (NLS1), has a strong Fe II emission. It was shown by Boroson & Green (1992, ApJS, 80, 109) that a strong anticorrelation between the strengths of the [OIII] and Fe II exists in the optical spectra, with NLS1 as a class showing the strongest Fe II and weakest [OIII] emission. The observed line widths and absence of forbidden emission suggests that Fe II is formed in the dense broad-line region (BLR), but photoionization models cannot account for all of the Fe II emission. The 'Fe II discrepancy' remains unsolved, though models which consider non-radiative heating, with an overabundance of iron are promising (talk of Joly on this conference). We performed 3D spectroscopic observations of Mrk 493 in order to (i) find the structure of the Fe II emitting region and possible connection with other emitting regions and (ii) map of circum-nuclear emitting gas.

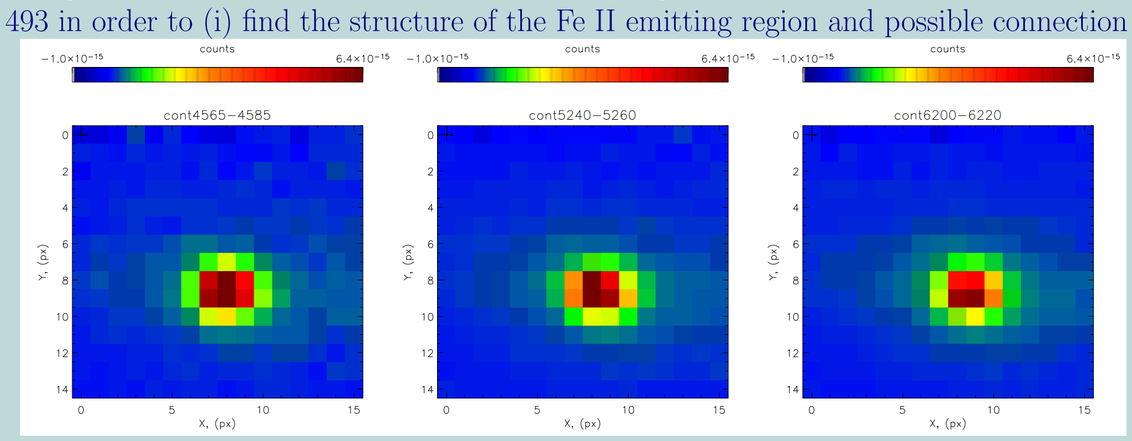


Figure 1: The maps of the continuum intensity constructed from MPFS spectra in the wavelength range (from left to the right) 4565-4585 Å, 5240-5260 Å and 6200-6220Å.

## Observations

Mrk 493 was observe in August 2002 and May 2004 with the integral-field MultiPupil Fiber Spectrograph (MPFS), mounted at the primary focus of the SAO RAS 6-m telescope (Afanasiev, Dodonov & Moiseev 2001, in Proc. Int. Conf. Stellar Dynamics, p. 103). The MPFS takes simultaneous spectra from 256 spatial elements that presents an area of $16 \times 16''$ on the sky (see full description at http://www.sao.ru/hq/lsfvo/devices.html). We observed in spectral interval from 4500 Å to 7100 Å with resolution of 7-8 Å (in 2002) and from 4350 Å to 5900 Å with resolution of 4.5Å(in 2004).

## Results

Here we give preliminary results of the spectra analysis:

- we detect a strong difference in the slopeof the optical continuum emission intensity across the nucleus part (see Fig. 1 and 3).

- we found that there is a strong Fe II emission in an extensive region around Sy 1 nucleus (around 4"x4" around the nucleus, see Fig. 2). The maximum of the Fe II emission corresponds to the optical center of Mrk 493.

- the continuum ratio of the the red (6000 Å) and blue part (4750 Å) is in the correlation with the intensity ratio of H$\alpha$/H$\beta$ across the nucleus part (see Fig. 4).

Moreover, we fitted the Fe II and H$\beta$ lines in nucleus region in order to compare the kinematic parameters of the Balmer and Fe II line emitting region with the H$\beta$ emitting region (Fig. 5). We found that the broad H$\beta$ can be decomposed into two components (broad - $W_B$ and intermediate $W_I$) which indicating the random velocity of emitting gas around $W_B$ =2400 km/s and $W_I$ =600 km/s. On the other side, the widths of Fe II lines indicate the velocity gas in the Fe II emission region around $W_{FeII}$ =800 km/s, that is closer to the intermediate region. This indicates that Fe II lines originate in an intermediate line region as it was mentioned in Popović et al. (2004, A&A, 423, 909).

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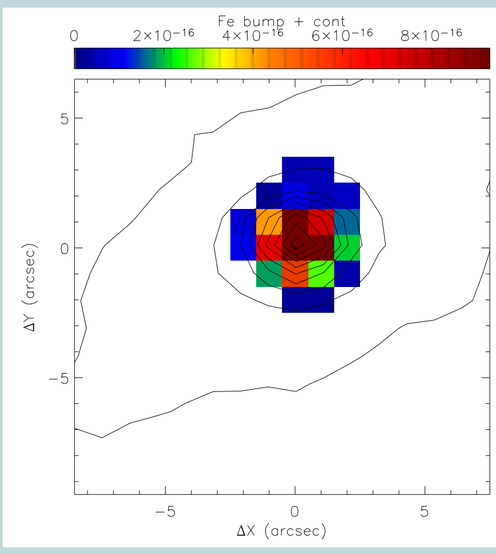


Figure 2: The map of the Fe II line intensity and contours of the continuum around 4900 Åacross the Mrk 493 nucleus (observations with higher spectral resolution in 2004 yr.)

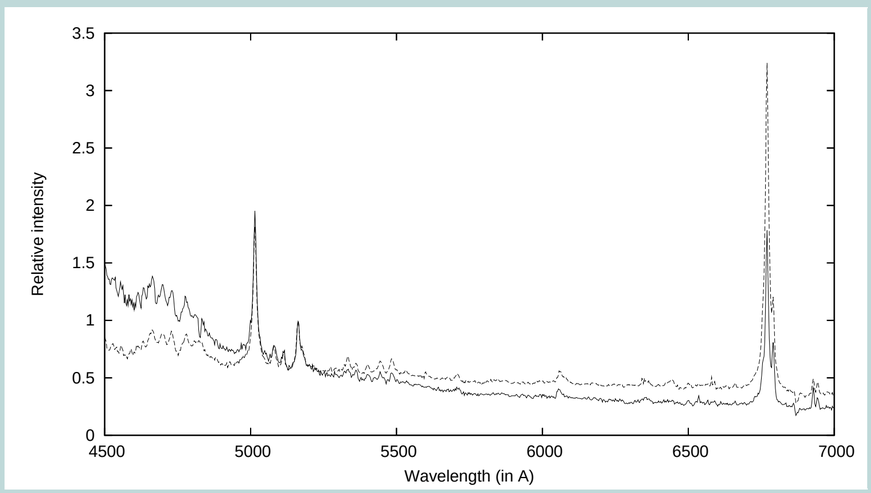


Figure 3: Comparison the spectra from different pixels of Mrk 493. The spectra is normalized to the maximum of the H$\beta$ line

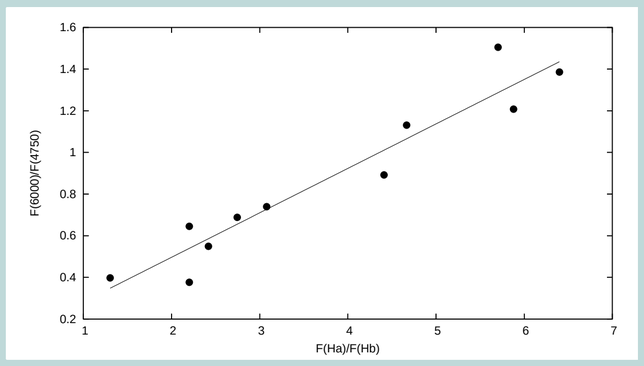


Figure 4: The continuum ratio measured at 6000 Å and 4750 Å as a function of the H$\alpha$/H$\beta$ flux ratio across the Mrk 493 nucleus part.

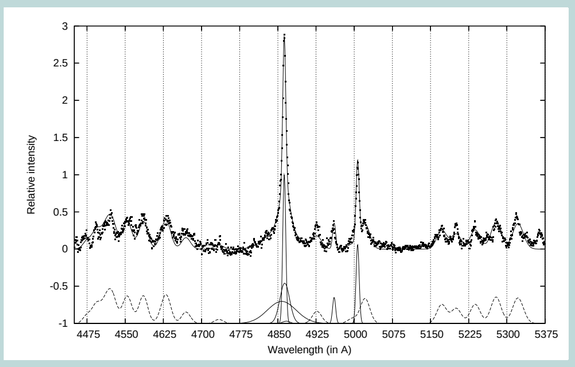


Figure 5: The decomposition of the Mrk 493 spectra.