The properties of Fe II emission region in Active Galactic Nuclei

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Optical Fe II (λλ4400-5500 Å) emission lines - what makes them interesting?

- **Mechanism excitation which produce Fe II emission?**

  Fe II emission region heated by an additional non-radiative mechanism (shocks)? (Collin & Joly 2000, Joly et al. 2008)

- **Geometrical place of Fe II emission region in AGN structure ?**

  - Fe II lines arise in same emission region as broad component of Hβ line (Boroson & Green 1992);

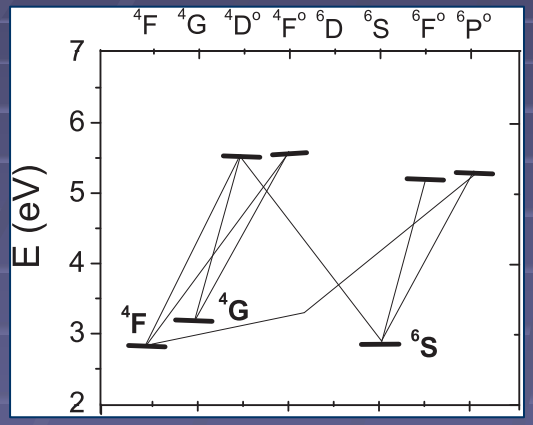
  - In Intermediate Line Region (ILR), which is placed between Narrow and Broad Line Region (Chen Hu et al. 2008).

- **Unexplained correlations between Fe II lines and some AGN properties !**

  anticorrelation: EW Fe II vs. EW [O III]
  EW Fe II vs. FWHM Hβ
  correlation: EW Fe II vs. Hβ asymmetry
  . . . (Boroson & Green 1992)

Fe II template

- We identify the 35 lines which describe 75 % of Fe II emission in λλ4400-5500 Å range and separated them in three groups according to their lower level of transition:



$3d^6\ (^3F2)4s\ ^4F$

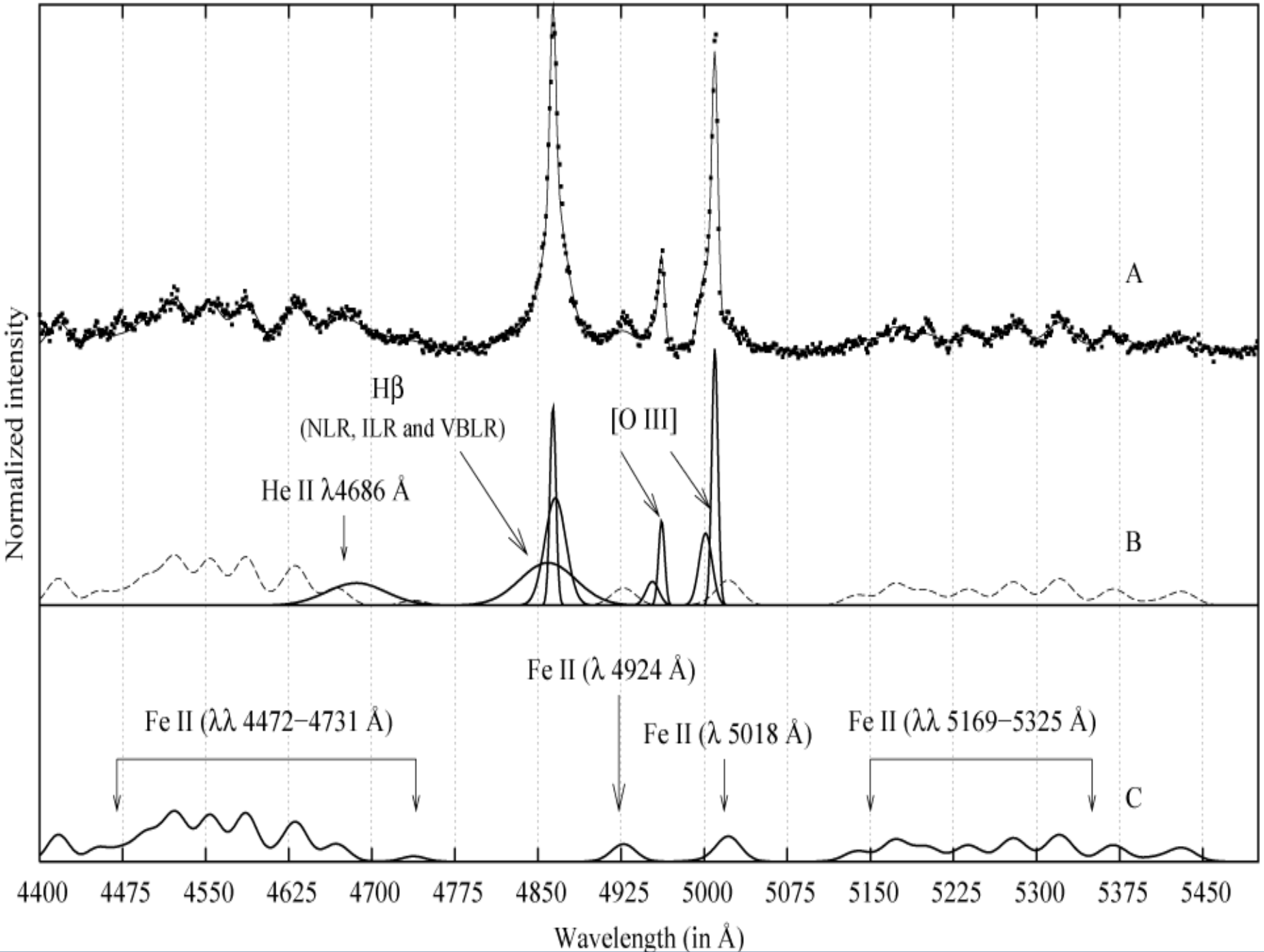
$3d^5\ 4s^2\ ^6S$

$3d^6\ (^3G)4s\ ^4G$

Their relatives intensities are calculated using the formula:

$$\frac{I_1}{I_2} = \left(\frac{\lambda_2}{\lambda_1}\right)^3 \frac{f_1}{f_2} \cdot \frac{g_1}{g_2} \cdot e^{-(E1-E2)/kT}$$

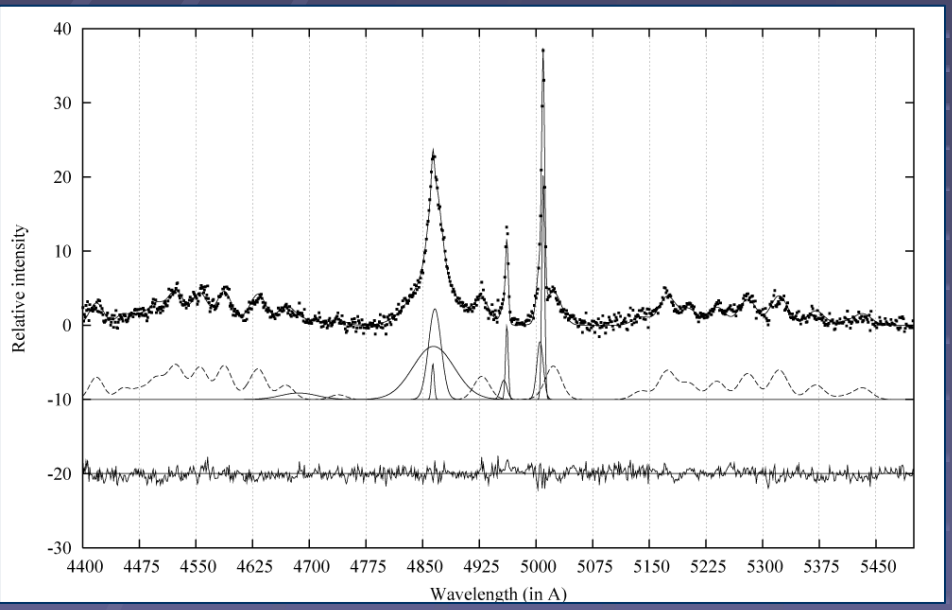
For the rest of 25 % of the Fe II emission we suppose that arise from fluorescence processes and we identify the15 lines from 1 Zw 1 object, which make iron template complete. Their relative intensities are taken from 1 Zw 1 object.

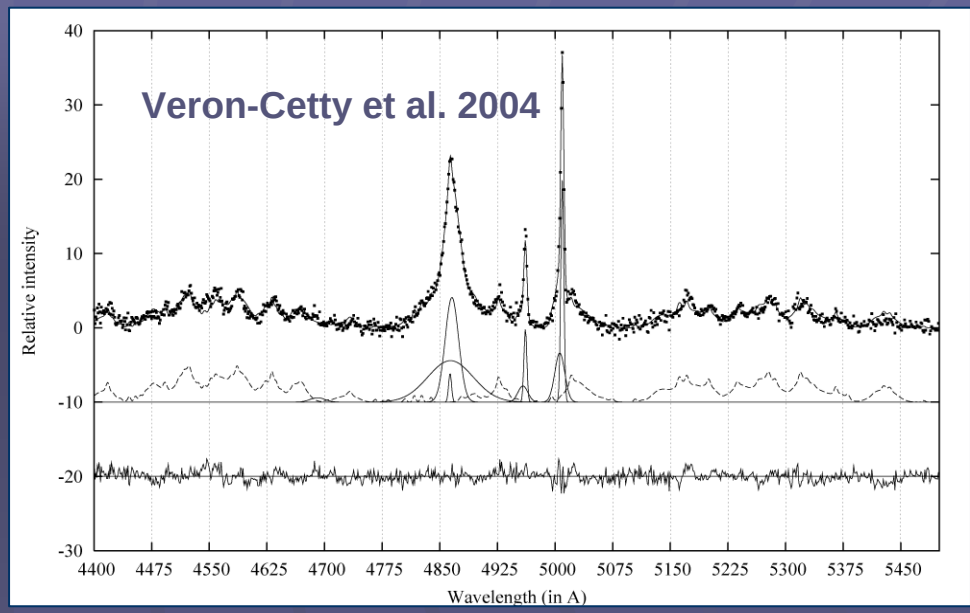

Normalized intensity
A
Hβ
(NLR, ILR and VBLR)
[O III]
He II λ4686 Å
B
Fe II (λ 4924 Å)
Fe II (λλ 4472−4731 Å)
Fe II (λ 5018 Å)
Fe II (λλ 5169−5325 Å)
C
4400
4475
4550
4625
4700
4775
4850
4925
5000
5075
5150
5225
5300
5375
5450
Wavelength (in Å)

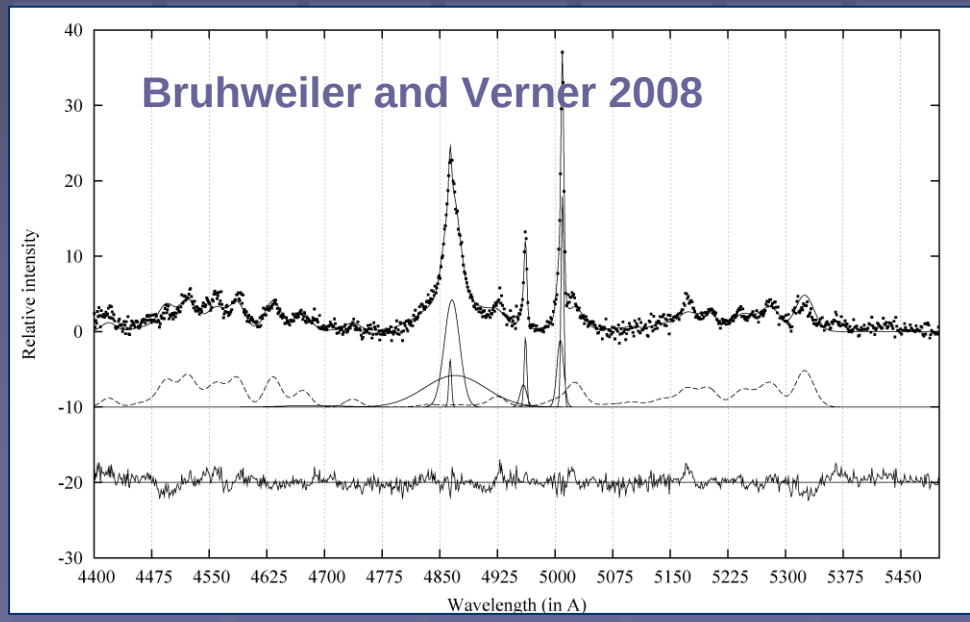
Comparison with other templates

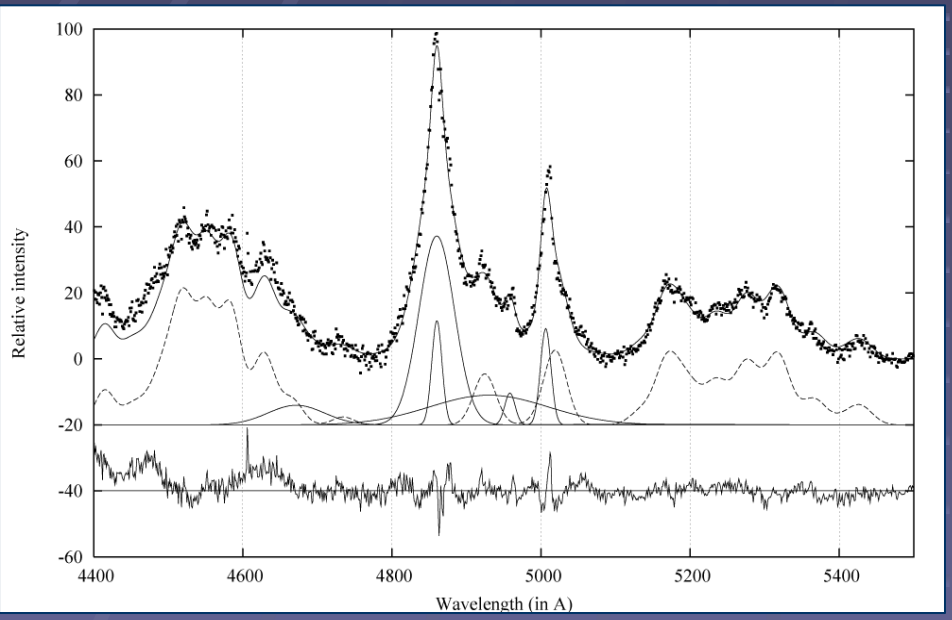
- Veron-Cetty et al. 2004 constructed Fe II template by identifying system of broad and system of narrow Fe II lines in 1 Zw 1 spectrum, and measuring their relative intensities in that object.

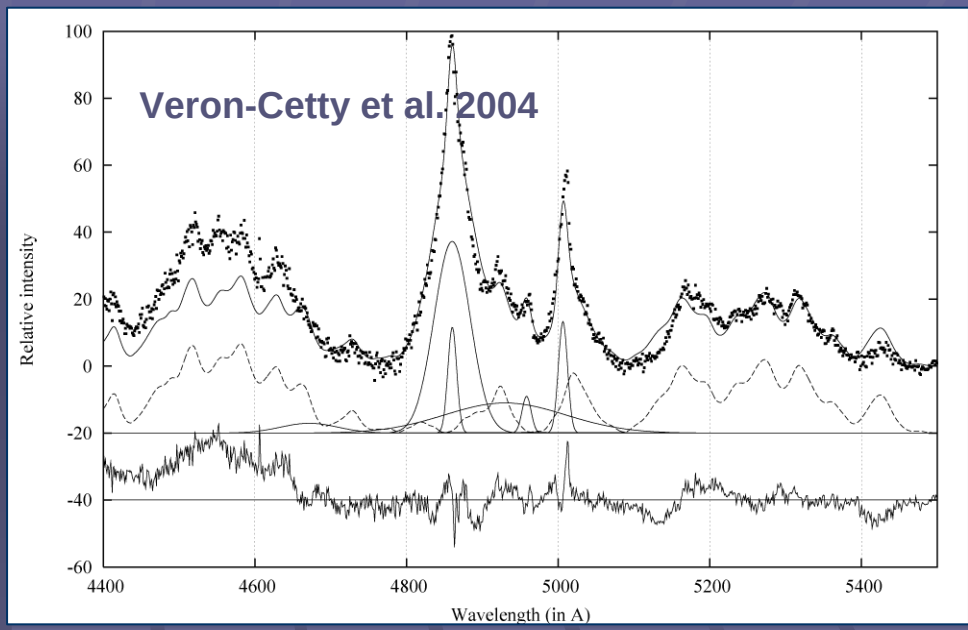
- Bruhweiler F. and Verner E. 2008 calculated Fe II template using Cloudy and an 830 level model atom

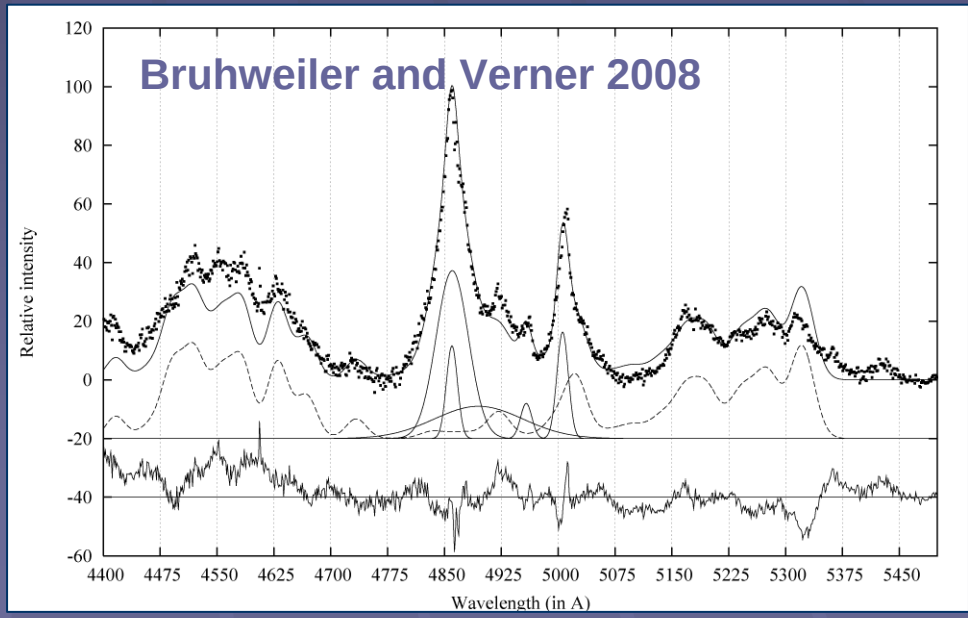

Relative intensity
Wavelength (in A)


Veron-Cetty et al. 2004
Relative intensity
Wavelength (in A)


Bruhweiler and Verner 2008
Relative intensity
Wavelength (in A)







Thank you for your attention !