The Broad Line Region Geometry of AGN

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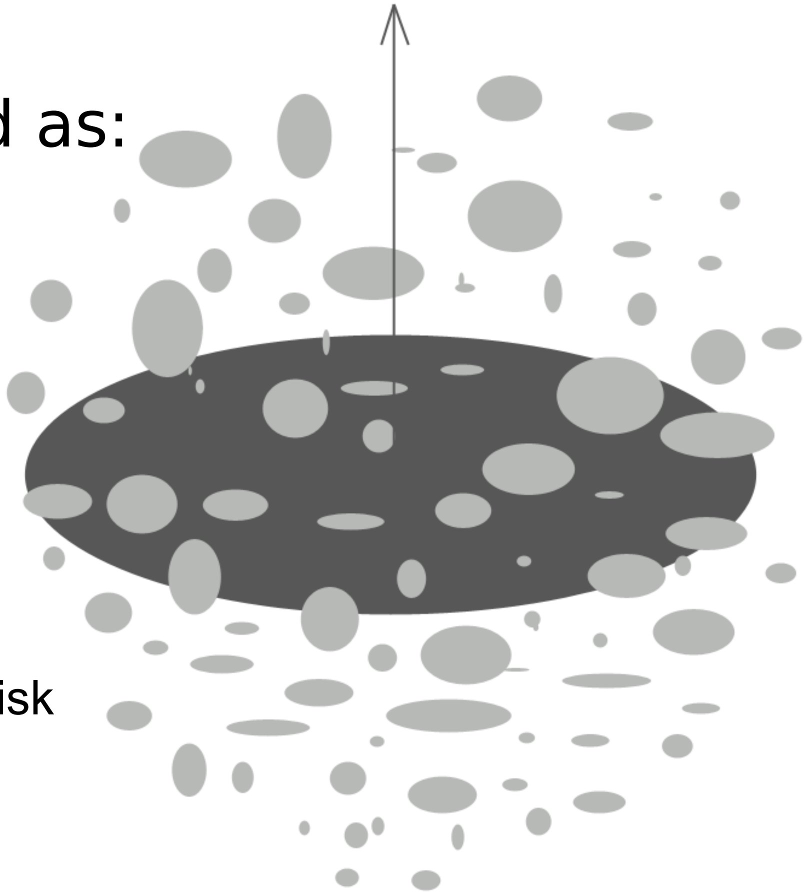
Two-component model

- The disk (Chen & Halpern 1989) is contributing to the wings of the lines,
- a surrounding medium around the disk to the core of the lines.

The whole line profile can be described as:



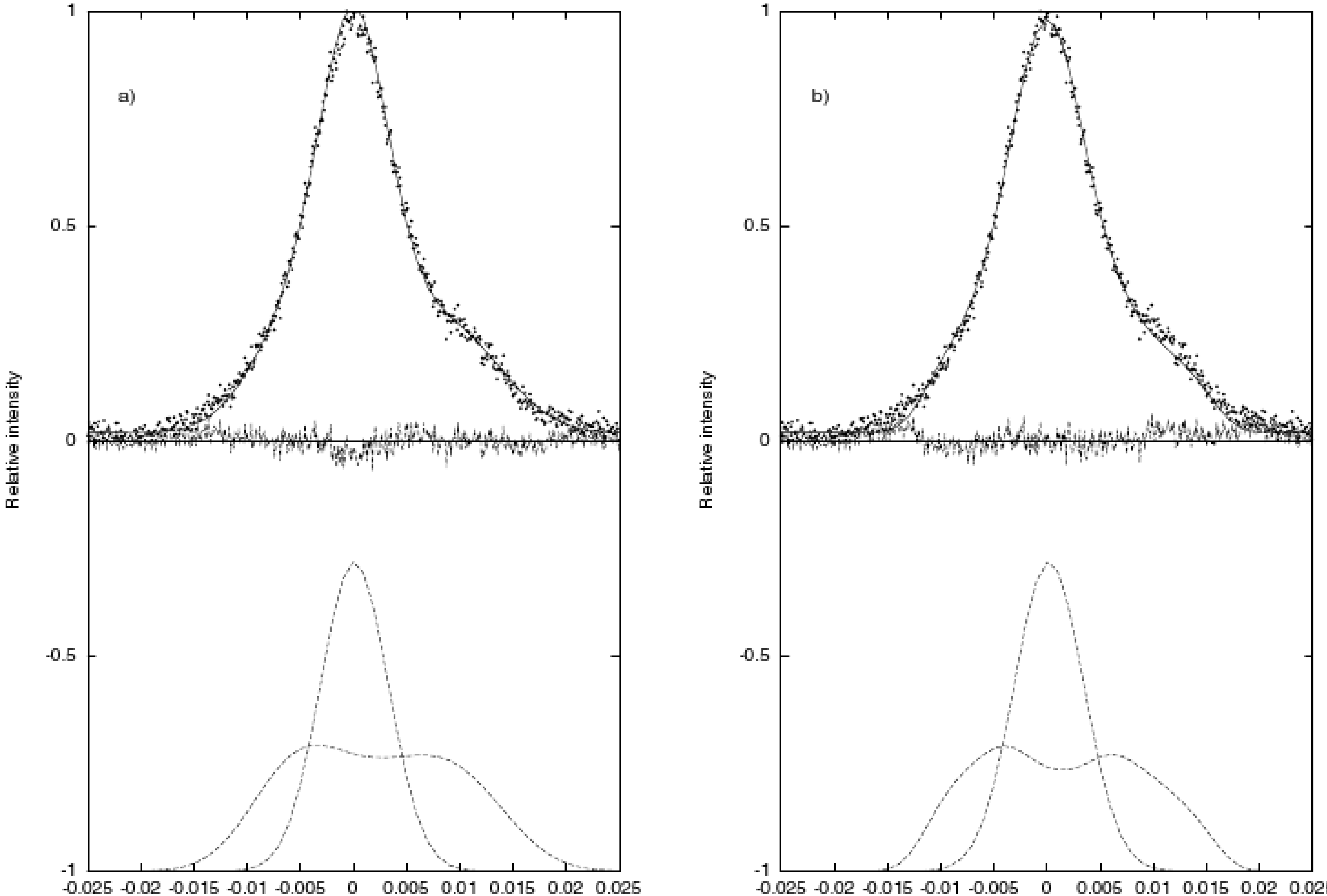
$$I(\lambda) = I_{AD}(\lambda) + I_G(\lambda)$$

Where:

$I_{AD}(\lambda)$ the emissions of the relativistic accretion disk

$I_G(\lambda)$ the emissions of the spherical region around the disk

Popović et al, 2003, 2004, Bon et al 2006



Two fits of 3C 273 with the two-component model. The disk parameters are:
a) i=14◦, R_{inn}=400 R_g, R_{out}=1420 Rg, W_d = 1620 km/s,p = 3 (W_G=1350km/s);
b) i=29◦, R_{inn} = 1250 R_g ,R_{out}=15 000 R_g, W_d=700 km/s, p=2.8 (W_G=1380 km/s).
(Popovic et al 2004 A&A)

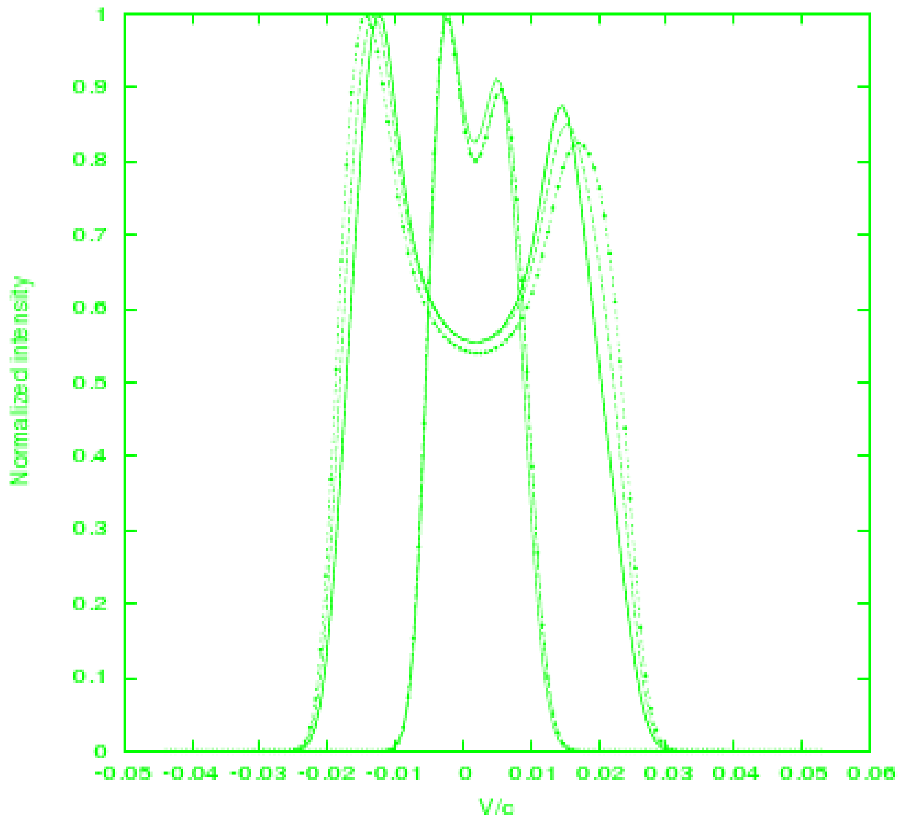
Approximations:

• the emissivity of the disk was fixed to p=3,

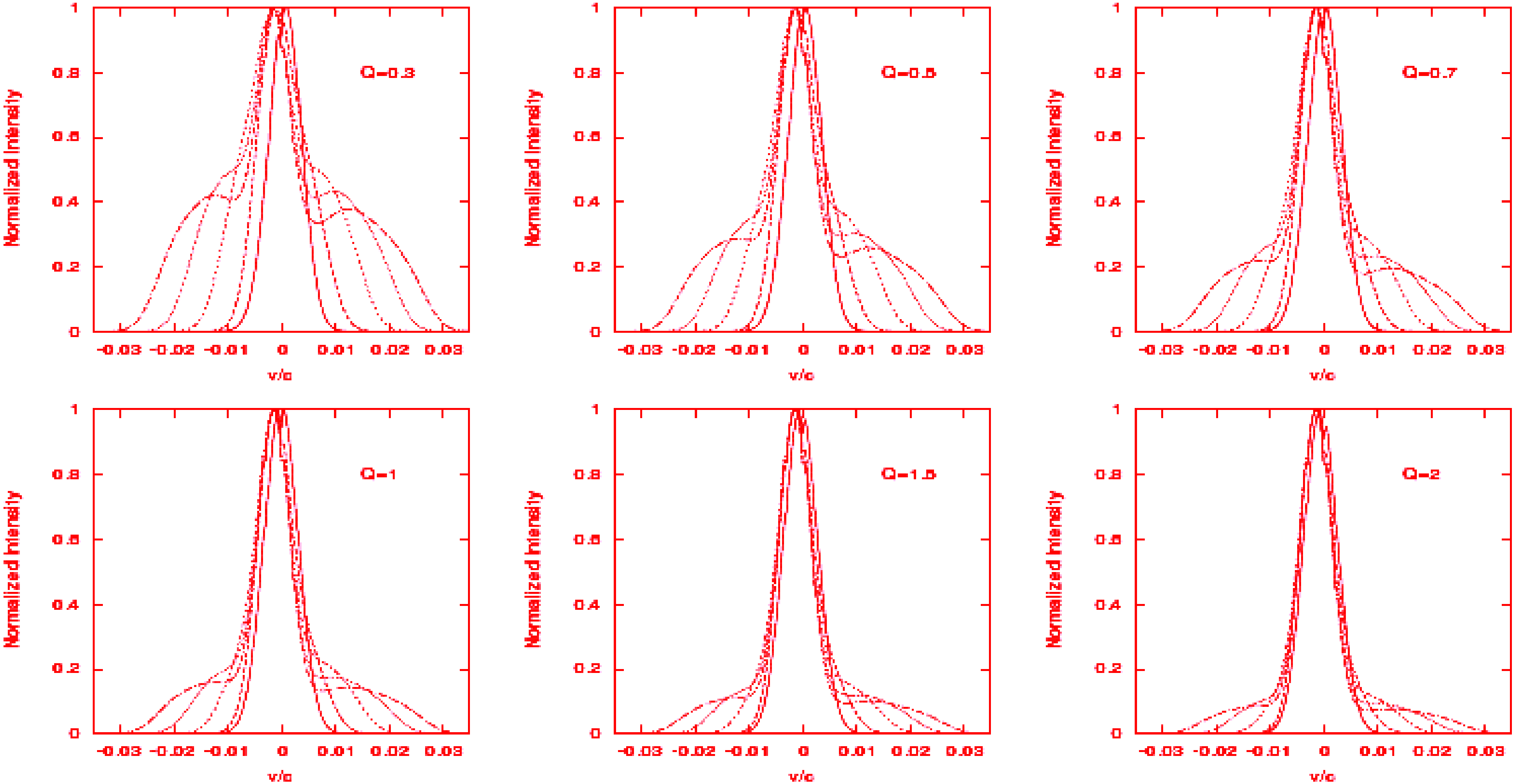
• the Gaussian broadening in the disk was fixed to 1000 km/s, and the random velocities of the isotropic component was also fixed to 1000 km/s, according to results from Popović at al. 2004 and Bon et al. 2006,

•the inner and outer radius were fixed by averaging the disk size obtained from the fitting of the double-peaked lines in the work of Eracleous & Halpern (2003),

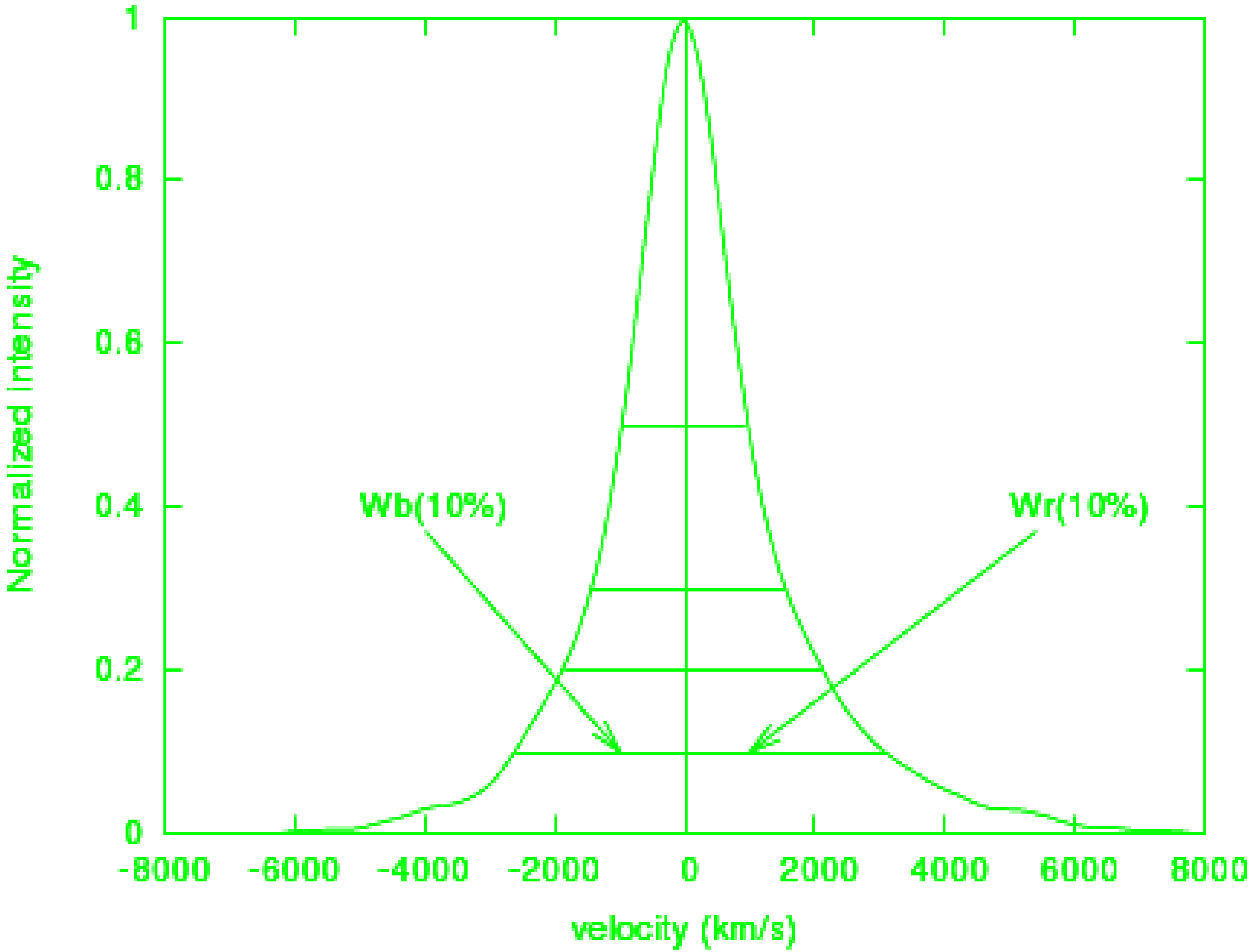
so R_{inn} =600 R_g, R_{out} =4000 R_g.



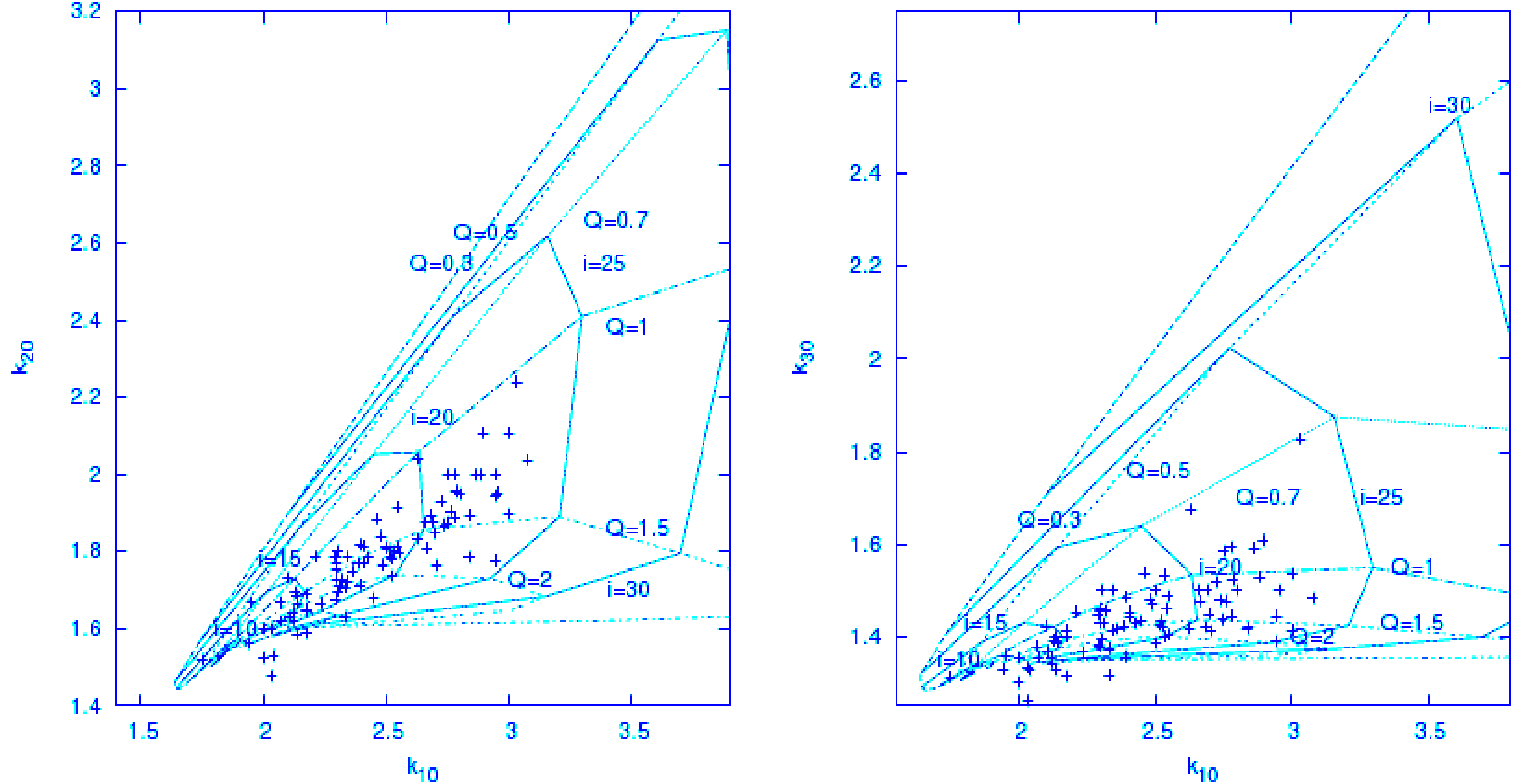
Simulated disk profiles for different values of the emissivity: p=2 (solid line) p=3 (dashed line) and p=4 (doted-dashed line), for two inclinations i =10 (narrower lines) and 30 degrees (broader line profiles). The inner and outer radius are taken as: R_{inn} =500 R_g and R_{out} =1500 R_g. The maximum intensity is scaled to one.



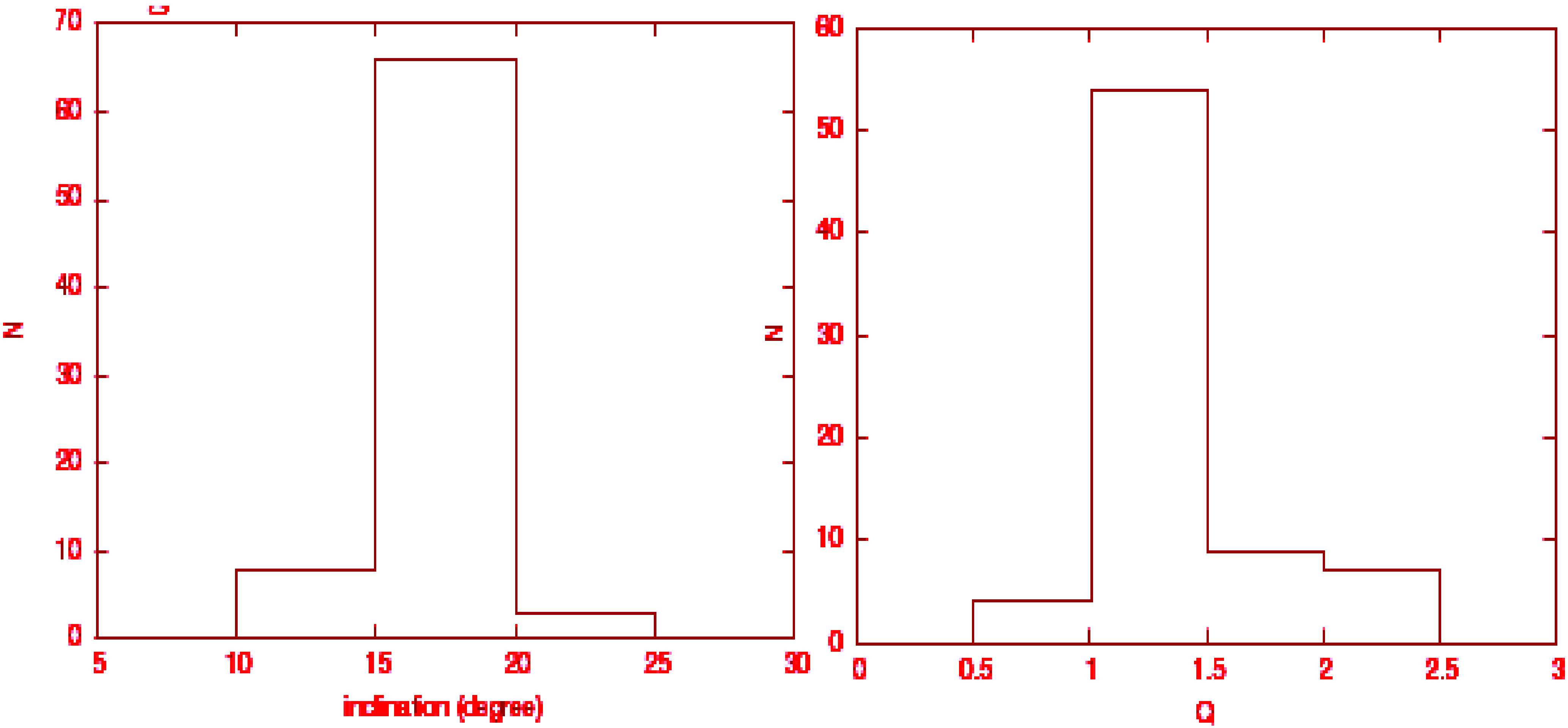
Simulated line profiles emitted by the two-component model for five different inclinations (i=1°, 10°, 20°, 40° and 60°, from the narrowest to the broadest line profile, respectively) for different contributions of the disk to the composite line profiles (as it is written in figures). The inner radius of the disk is taken to be 400 R_g, while the outer radius is 1200 R_g.



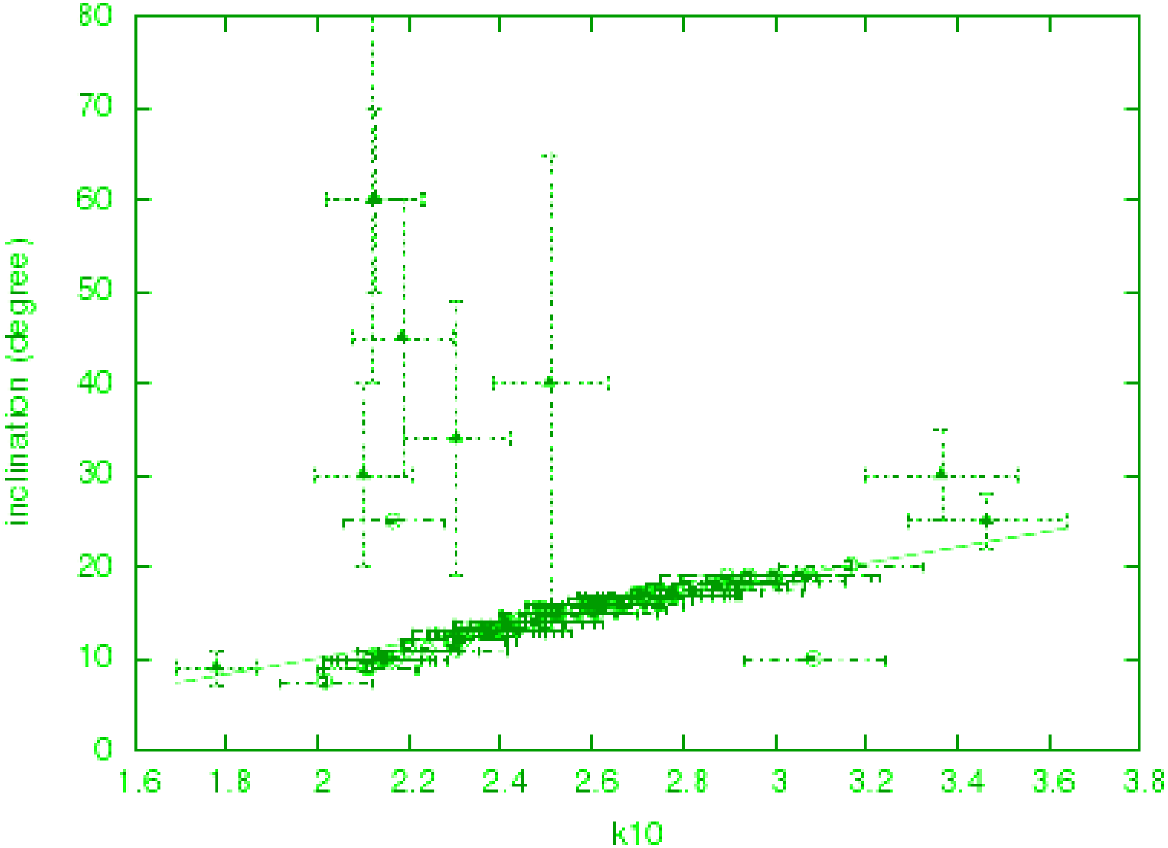
The broad Hα line of SDSSJ1025+5140. The horizontal lines presented the measured widths at 10%, 20%, 30% and 50% of the maximum intensity. The blue and red half widths have been measured.



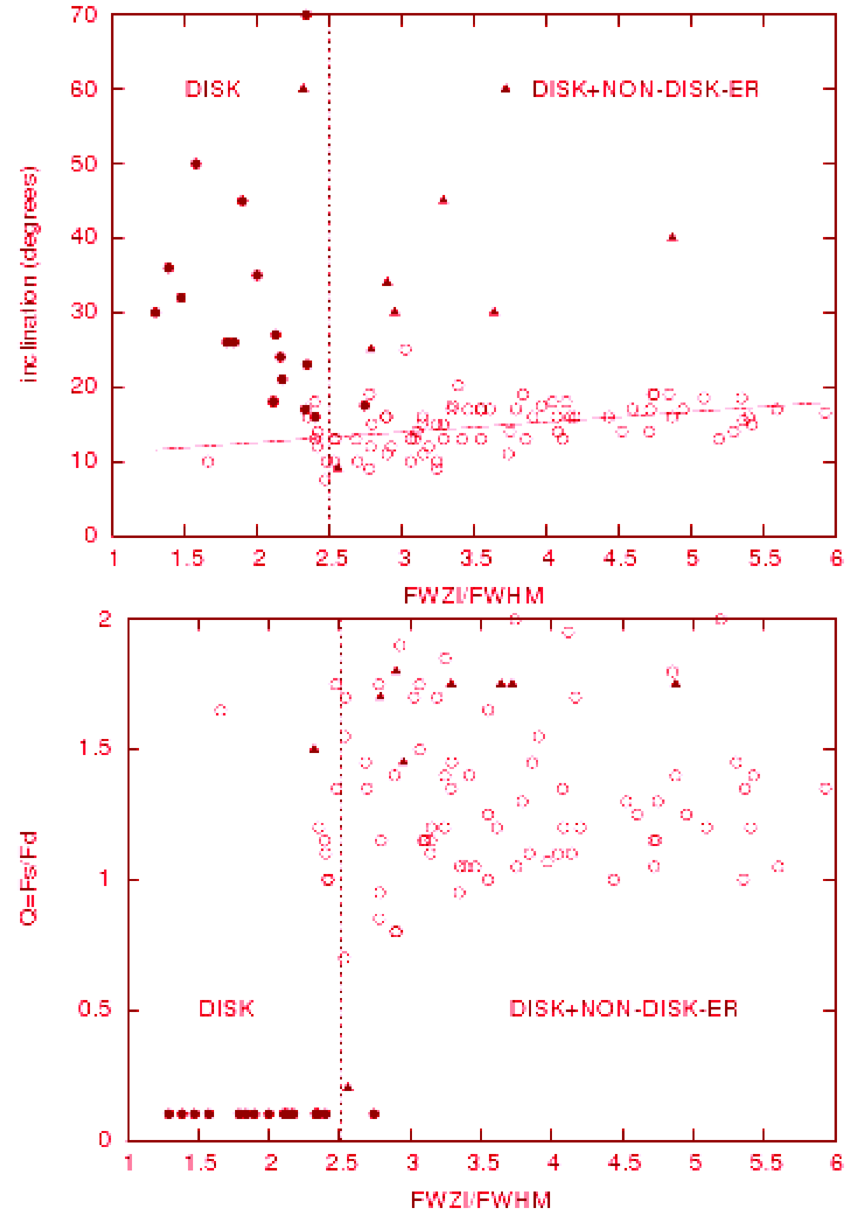
The measured width ratios (crosses) and simulated values (dashed lines) from the two-component model for the different contribution of the disk emission to the total line flux (Q=0.3, 0.5, 0.7, 1, 1.5 and 2). The inner disk radius is taken to be 600 R_g, outer 4000 R_g, and different inclinations are considered (solid isolines for i = 10°, 15°, 20°, 25° and 30°, respectively). The sample contained 90 SDSS AGN (La Mura et al. 2007 ApJ).



Histograms of the inclination (left) and $Q = F_s / F_{disk}$ (right) for the sample. The cases where discrepancy in the inclination were more than one degree, were not taken into account.



Inclination vs. k10. The points where description were more than one degree (mainly above the other points) are denoted with full triangles.



Q vs. inclination for the sample, and the position of the well known AGN with double-peaked lines (Eraclous & Halpern 1994), where is assumed that in these objects Q < 0.1.

CONCLUSIONS:

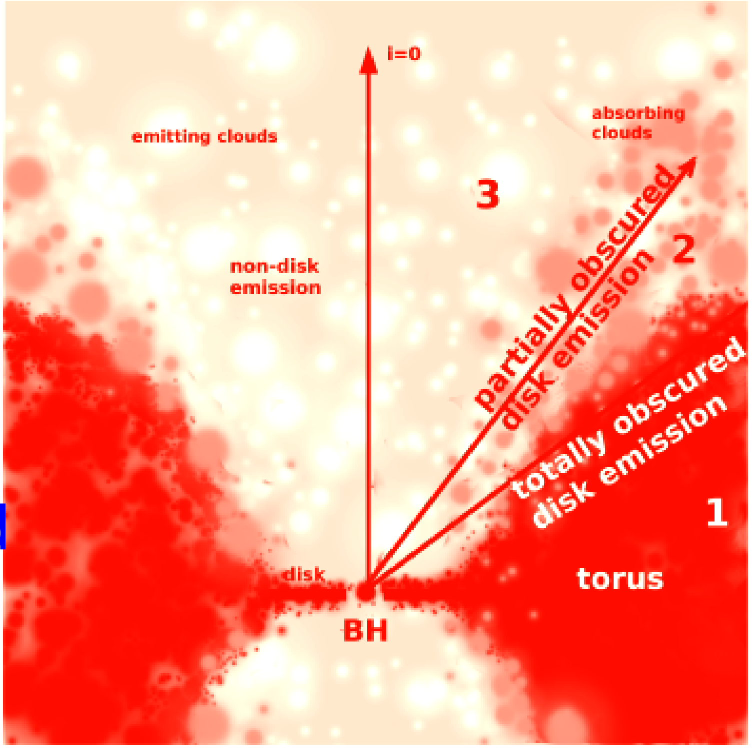
Here we investigated the hidden disk emission in single peaked line profiles of type 1 AGN.   We outline the following conclusions:

1) The two component model (disk + non-disk region) can well describe the majority of the observed single peaked line profiles.

2) After comparing simulated and observed line profiles, there is an indication that the disk emission may be present also in single peaked broad line profiles, but it is mainly smaller than 50% of the total line flux.

3) The estimated inclination of the disk indicates a low inclined disk, with inclinations $i < 25^{\circ}$ that might be caused by the torus and/or absorbing material around the torus.

4) Some lines that showed larger errors and corresponded to higher inclinations what indicate possible obscuration of the torus



Obscuration of the disk emission: (1)torus, (2)absorbing material around the torus and (3) the region without absorption.

(Bon et al. 2009 MNRAS accepted)