Two Component model of BLR emission

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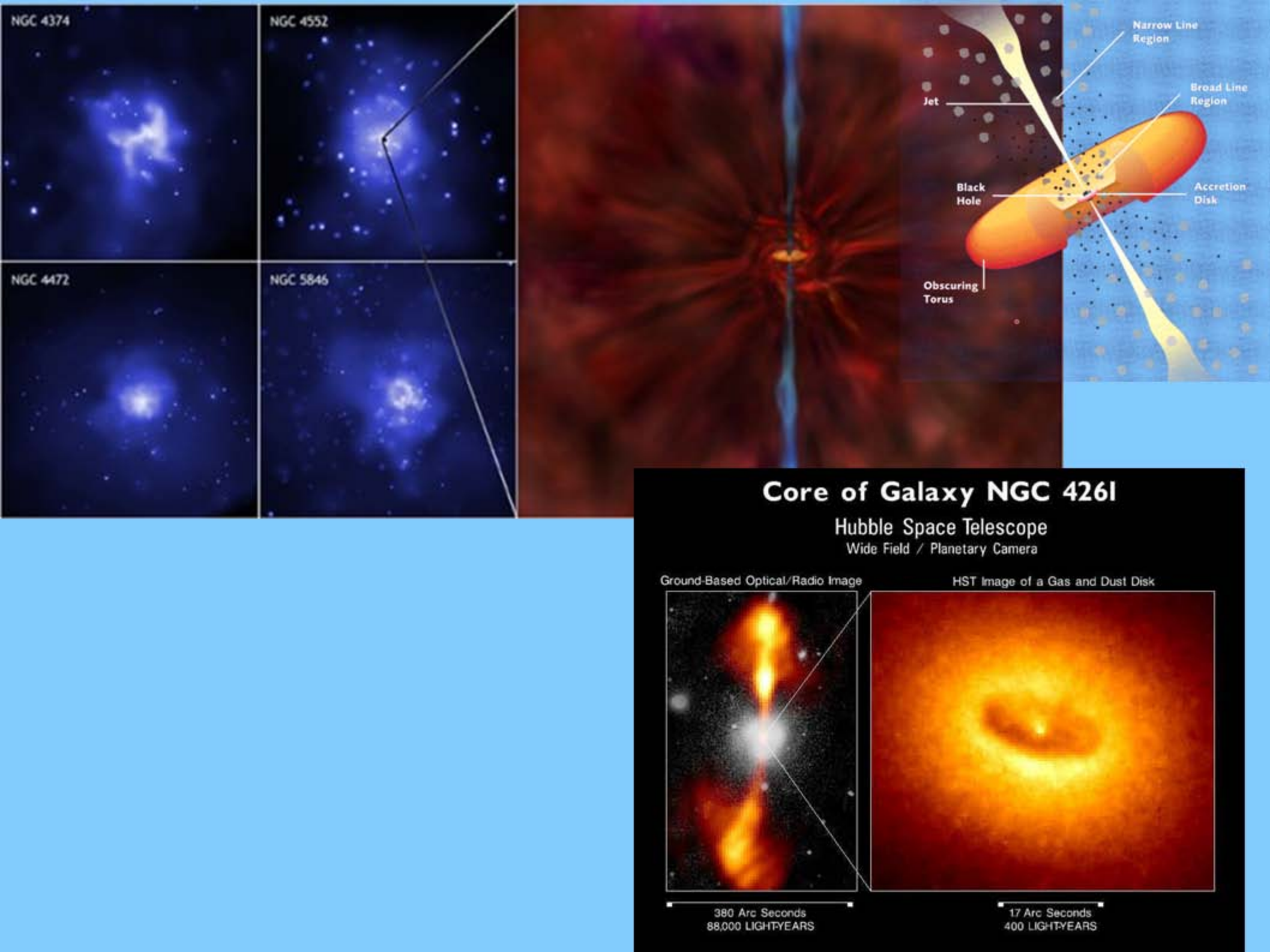
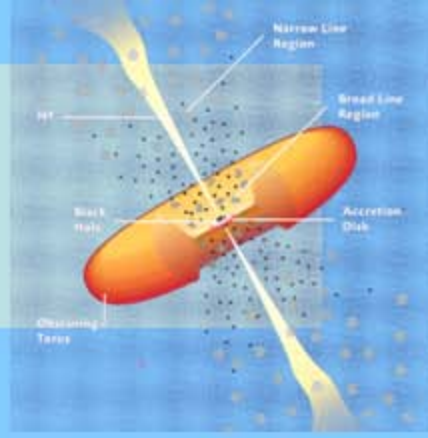

NGC 4374
NGC 4552
NGC 4472
NGC 5846
Narrow Line Region
Broad Line Region
Jet
Black Hole
Accretion Disk
Obscuring Torus
Core of Galaxy NGC 4261
Hubble Space Telescope
Wide Field / Planetary Camera
Ground-Based Optical/Radio Image
HST Image of a Gas and Dust Disk
380 Arc Seconds
88,000 LIGHT-YEARS
17 Arc Seconds
400 LIGHT-YEARS

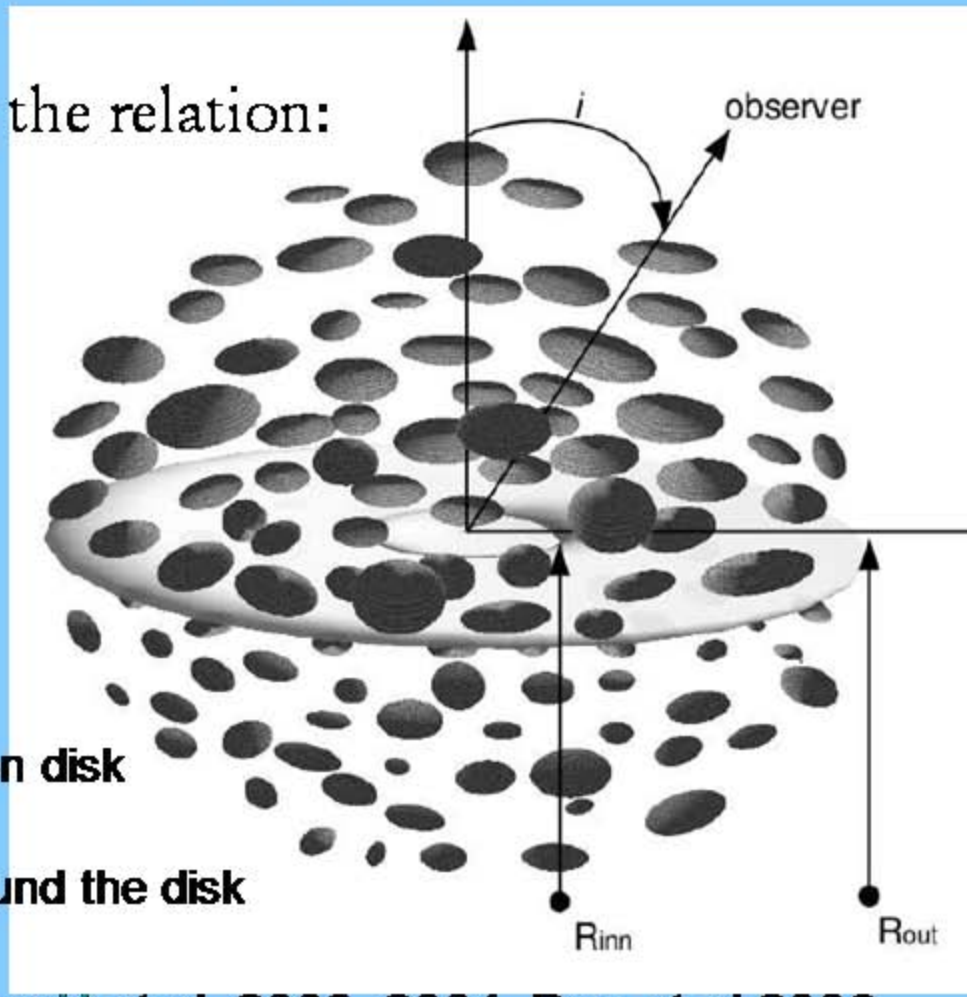
Two-component model



- The disk is contributing to the wings of the lines,
- a spherical medium arround the disk to the core of the lines.

The whole line profile can be described by the relation:

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



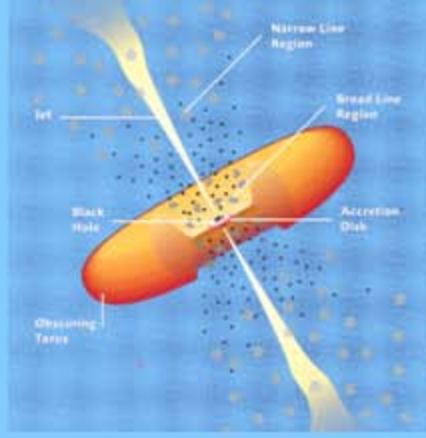
Where:

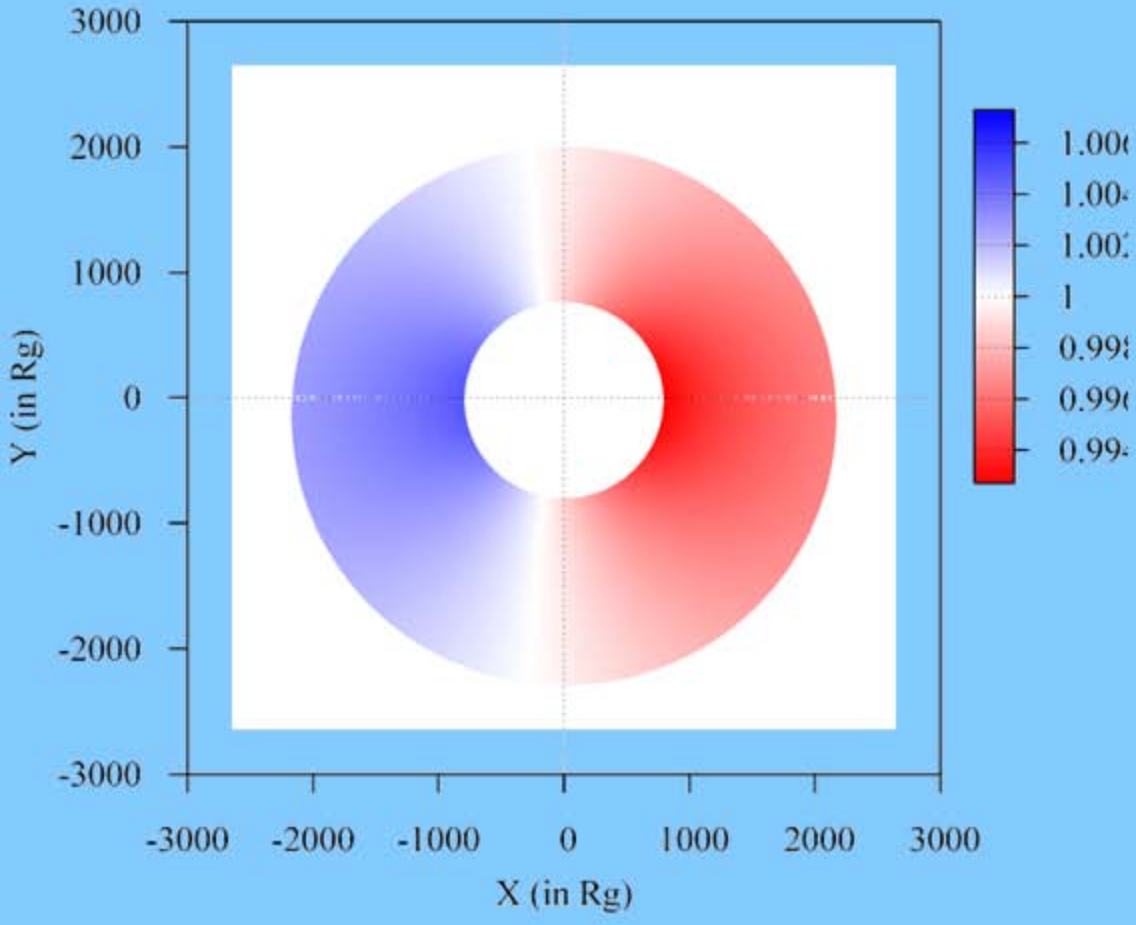
$I_{AD}(\lambda)$ **the emissions of the relativistic accretion disk**

$I_{G}(\lambda)$ **the emissions of the spherical region around the disk**

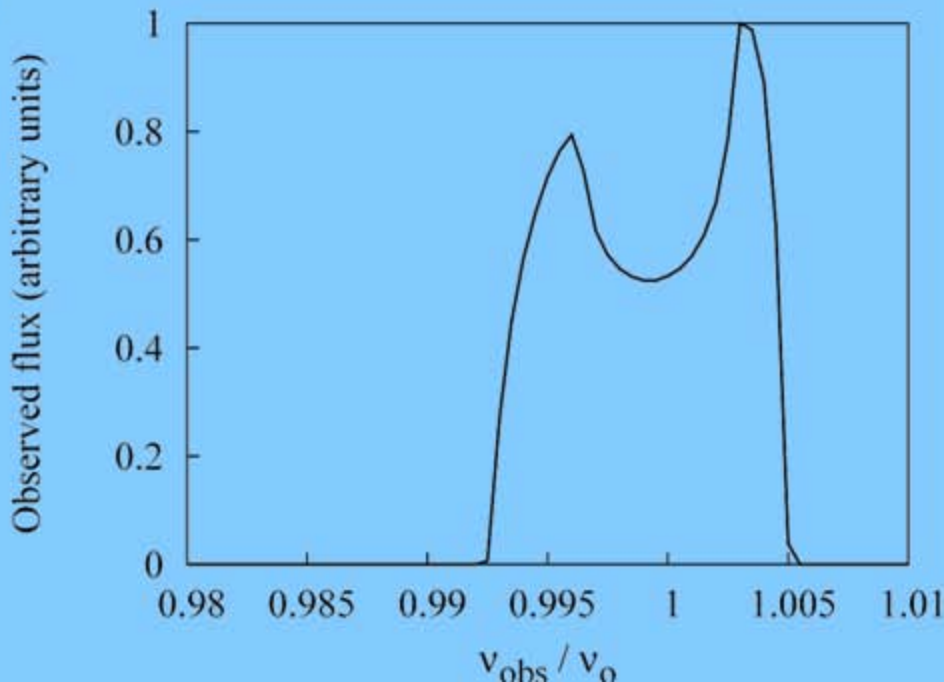
Popović et al, 2003, 2004, Bon et al 2006

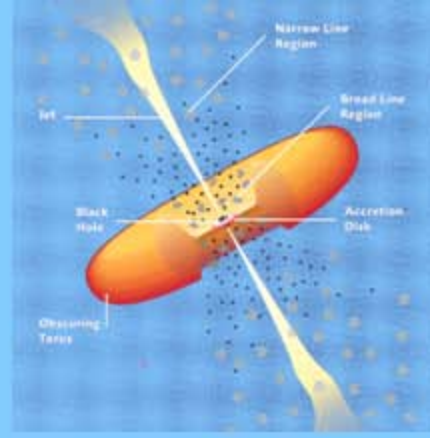
Disk model

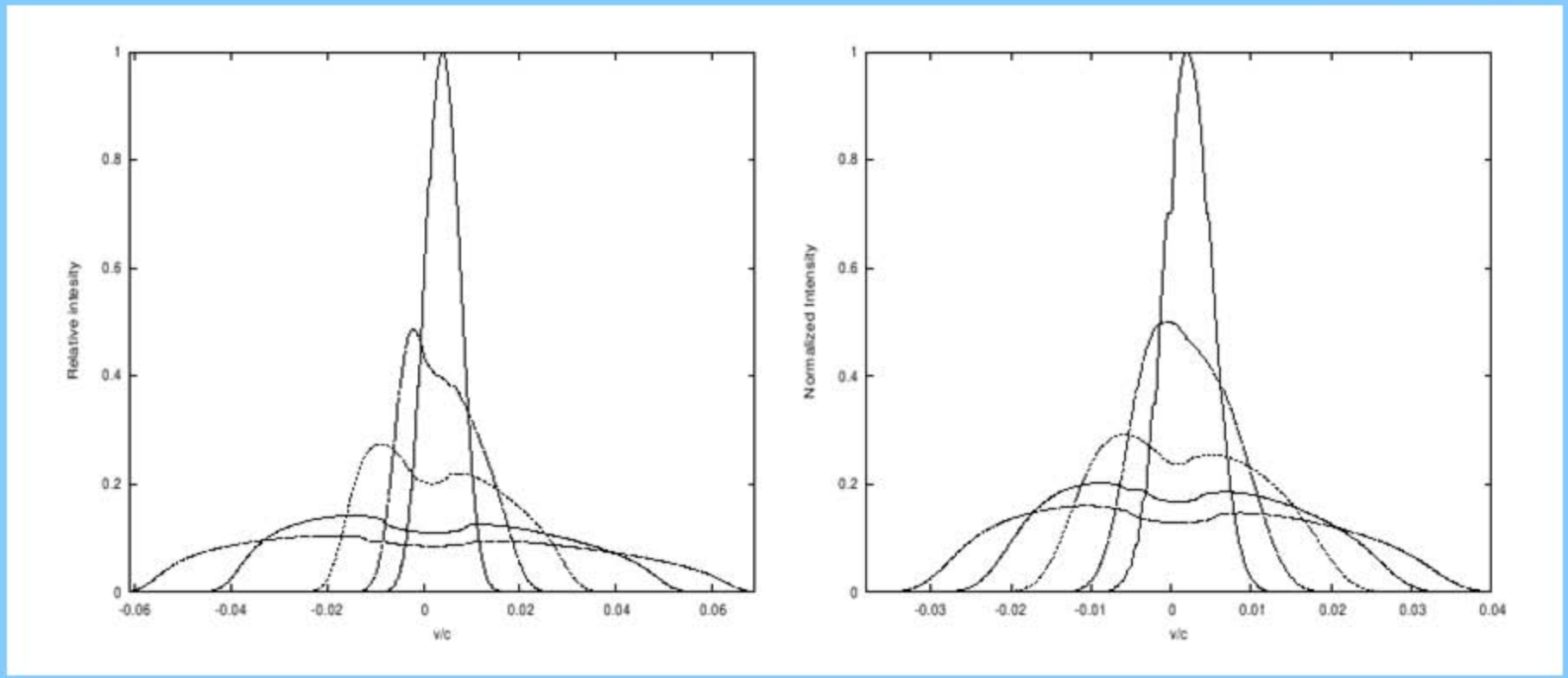




Chen & Halpern (1989).

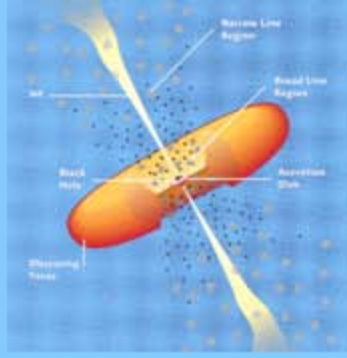






Simulated disk line profiles for 5 different disk inclinations (i=1, 10, 20, 40 and 60 degrees, from the most to the lowest intensive line, respectively) for the disk with fixed inner radius Rinn =400 Rg and with outer Rout =1200 Rg (left) and Rout =10400 Rg.

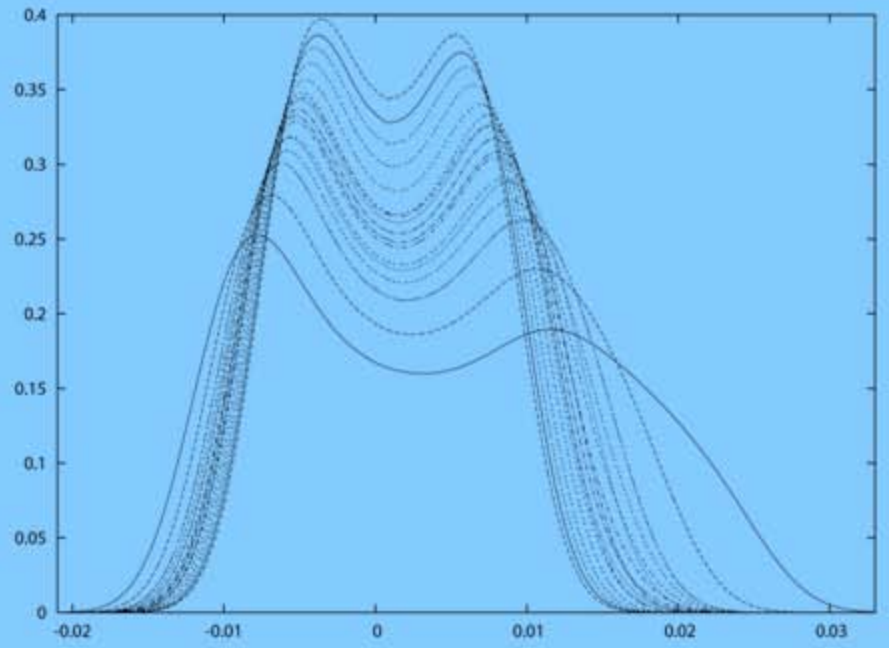
$$F_{tot} = F_d + F_s,$$

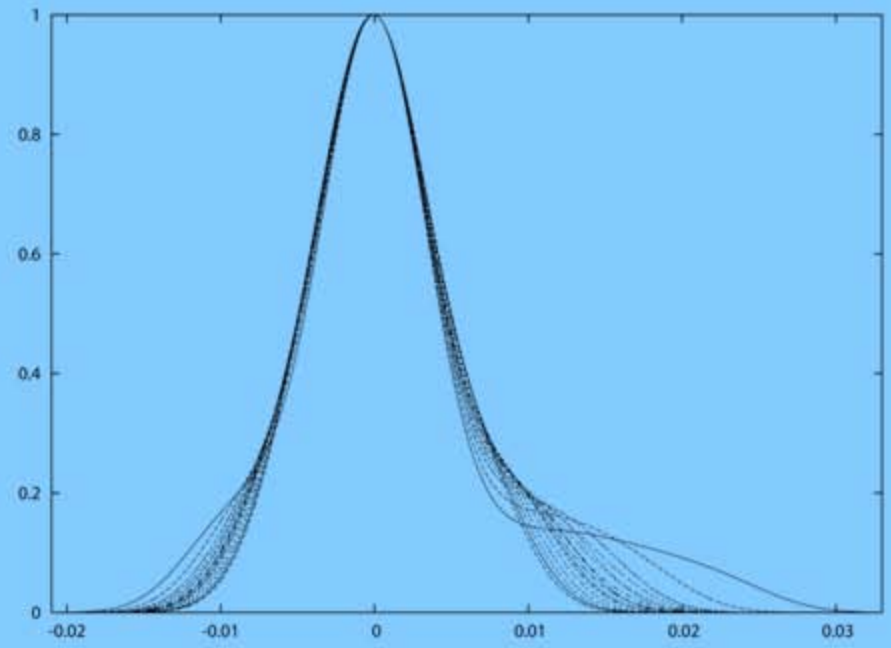


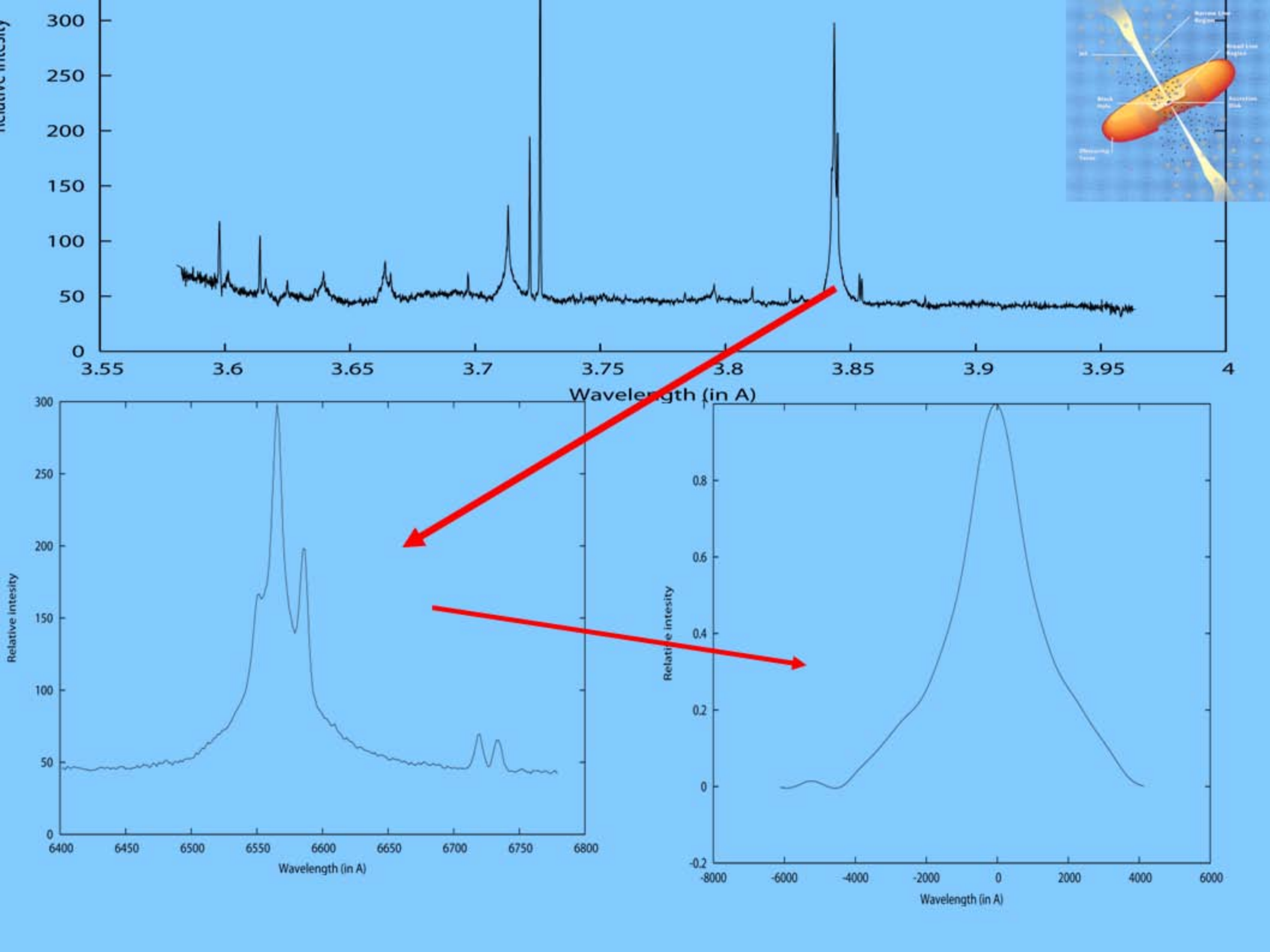
Disk profile for i=16°,
fixed ring Rinn-Rout =800 Rg
and emissivity p=3

Disk + Spherical region

For flux ratio $F_d/F_g=1$






Relative intesity
300
250
200
150
100
50
0
3.55
3.6
3.65
3.7
3.75
3.8
3.85
3.9
3.95
4
Wavelength (in A)
Relative intesity
300
250
200
150
100
50
0
6400
6450
6500
6550
6600
6650
6700
6750
6800
Wavelength (in A)
Relative intesity
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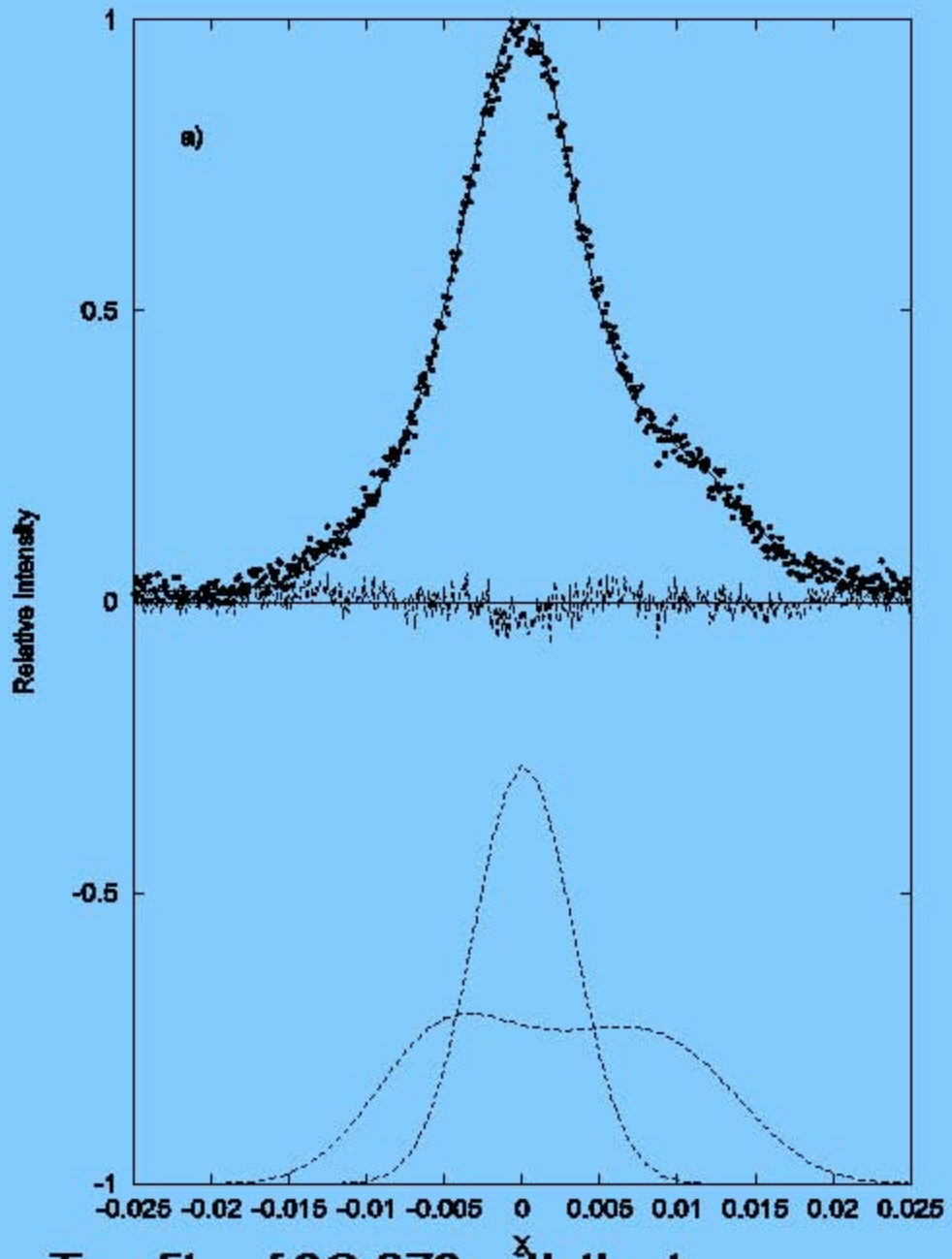
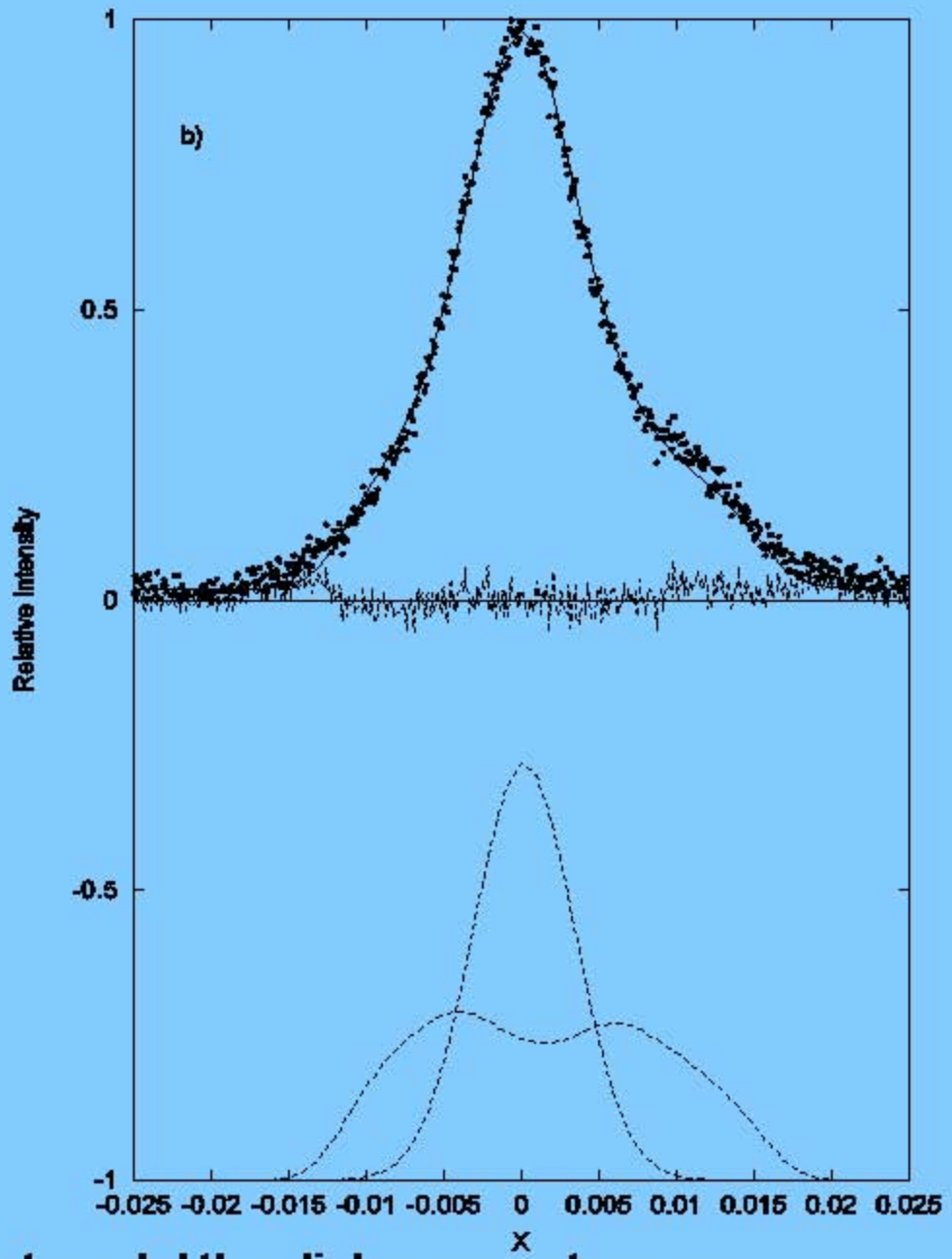
Wavelength (in A)





Two fits of 3C 273 with the two-component model the disk parameters are:

a) i=14°, Rinn=400 Rg, Rout=1420 Rg, Wd=1620 km/s, p=3.0 (WG=1350 km/s);

b) i=29°, Rinn=1250 Rg, Rout=15000 Rg, Wd=700 km/s, p=2.8 (WG=1380 km/s)

Popović, L. Č., Mediavlilla, E.G., Bon, E., Ilić, D., 2004, ***ApJ***

Previously showen to have an indication of a disk emission in the X domain of spectra

Object	i	$z_1^{min,max}$	$W_1^{min,max}$ (km/s)	$R_{inn,min}$ (Rg)	$R_{out,max}$ (Rg)	$z_g^{min,max}$	W_g (km/s)	p^{min}
3C 120	8–30	–300, +300	1050, 1500	350	20 000	+30, +300	900 ±150	2.0
3C 273	12–30<	–30, +300	690, 1760	400	15 400	+30, +60	1380 ±150	2.3
MRK 1040	5–27<	–250, +300	800, 1400	100	18 000	0 ±30	500 ±200	1.3
MRK 110	7–50	–320, +300	450, 1250	400	49 000	+150 ±30	960 ±50	1.7
MRK 141	12–33	–630, –450	700, 1500	300	10 000	+200, +300	1620 ±100	2.1
MRK 493	5–30<	–480, +60	360, 560	600	124 000	+60 ±30	360 ±50	1.8
MRK 817	12–35	–450, +300	850, 1200	140	14 000	0, +130	1550 ±100	1.8
MRK 841	15–50	–750, –150	1070, 1800	450	27 400	–300 ±30	1500 ±100	2.1
NGC 3227	12–34	–780, –300	900, 1550	350	12 000	–300, 300	1500 ±100	2.1
NGC 4253	5–25<	–630, –90	280, 850	500	69 500	–90, –30	550 ±50	2.0
PG 1116	8–30<	–450, 0	1100, 1800	500	15 800	0, +90	1400 ±250	2.2
PG 1211	8–30	–660, 0	540, 1100	600	67 400	+90 ±30	600 ±300	1.9
III Zw2	7-17	-600	1400,1550	400	1300	120 ±10	1200±100	3
NGC 3516	6-16	-760 ±120	600,840	400	1550	150±200	1500±200	3
⟨…⟩	9–31	–515, –5	770, 1330	390	32700	110	1110	2.1

Popović, L. C., Mediavlilla, E.G., Bon, E., Ilić, D., 2004, ***A&A***, 423, 909.

HOW TO SIMPLIFY THE MODEL?

HOW TO REDUCE THE NUMBER OF PARAMETERS ?

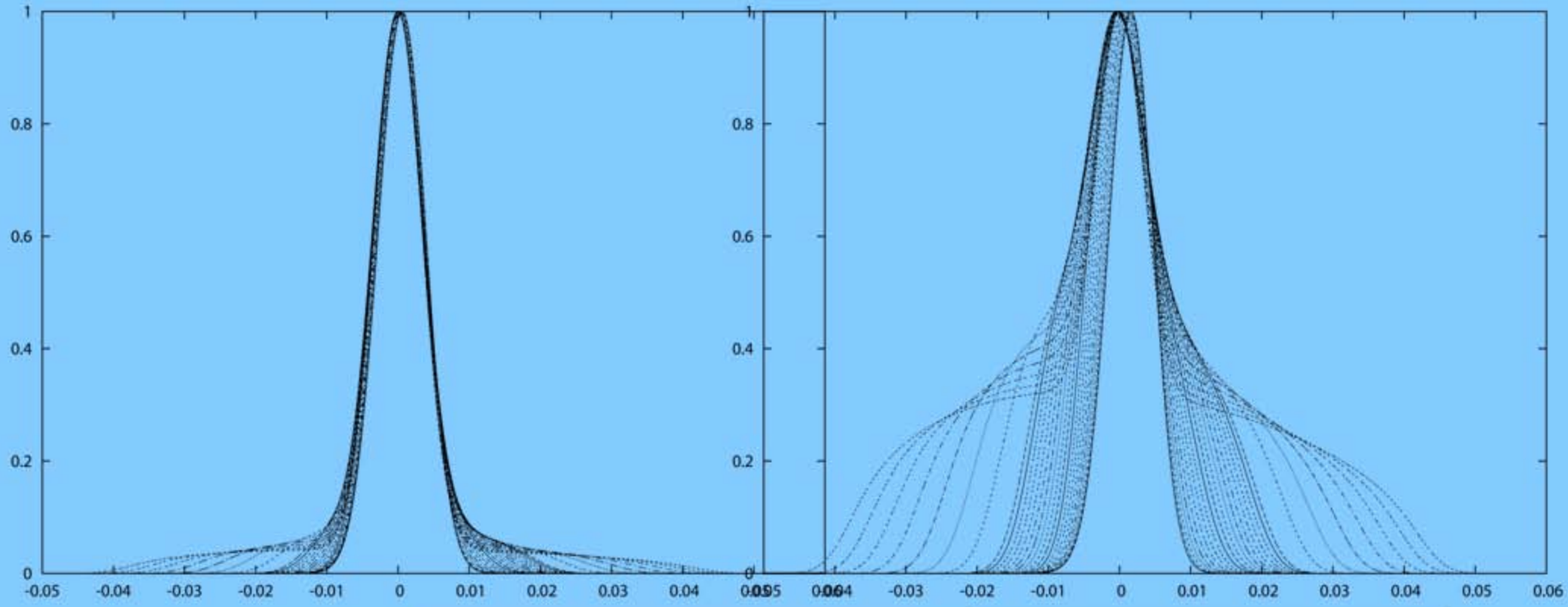
HOW TO DETERMINE THE DOMAINS OF THE PARAMETERS?

Disk + spherical region

profiles for the inclinations from 1° to 60°
and flux ratios of these regions corresponding to:

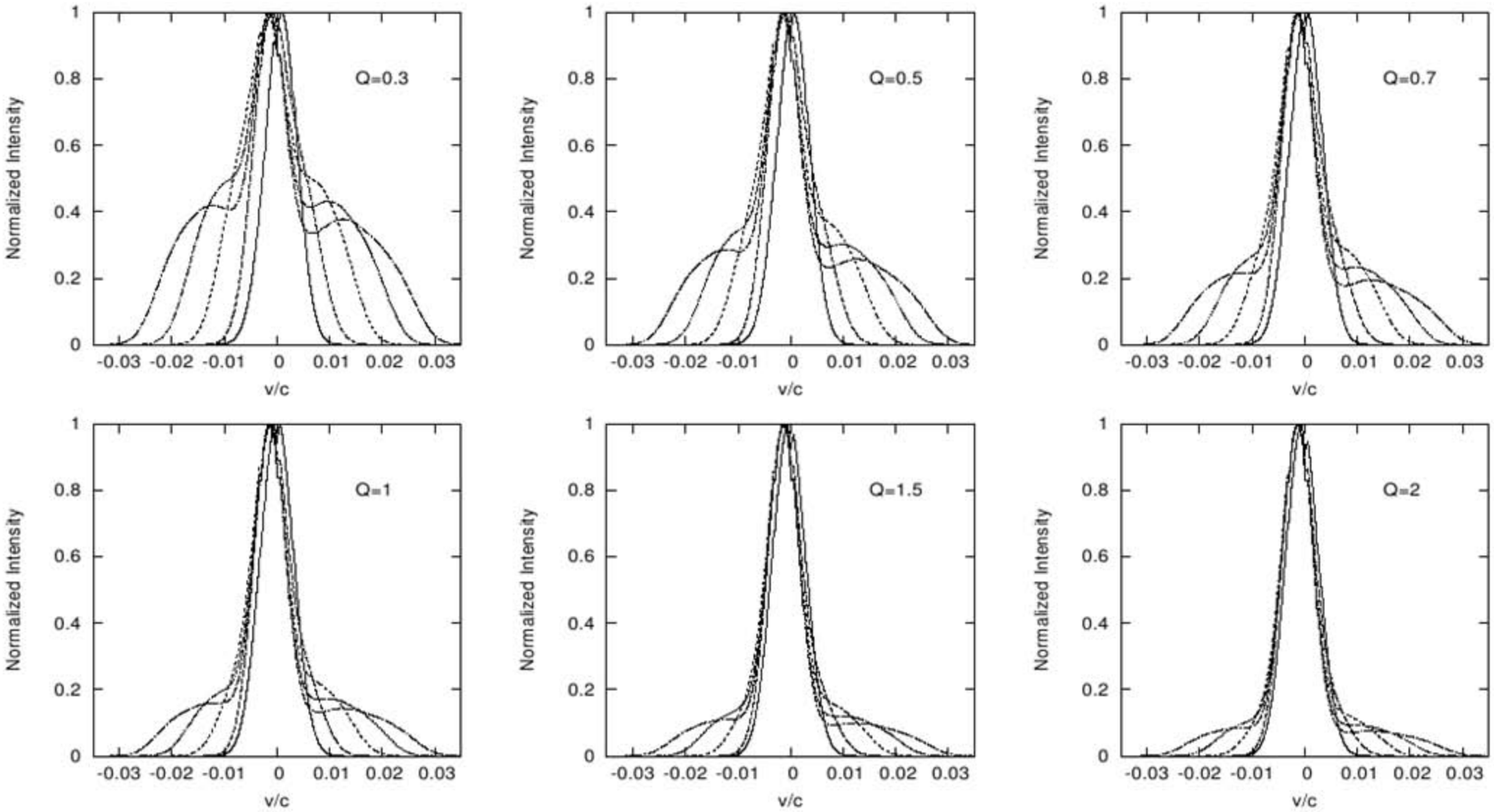
Q=3

Q=0.3

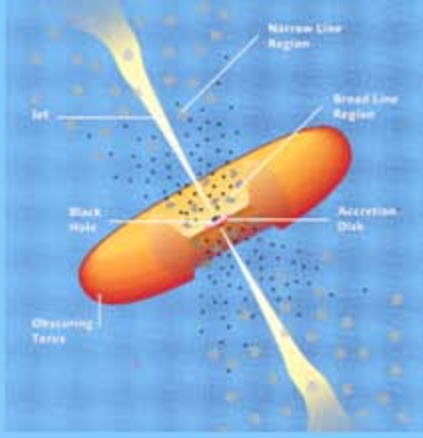


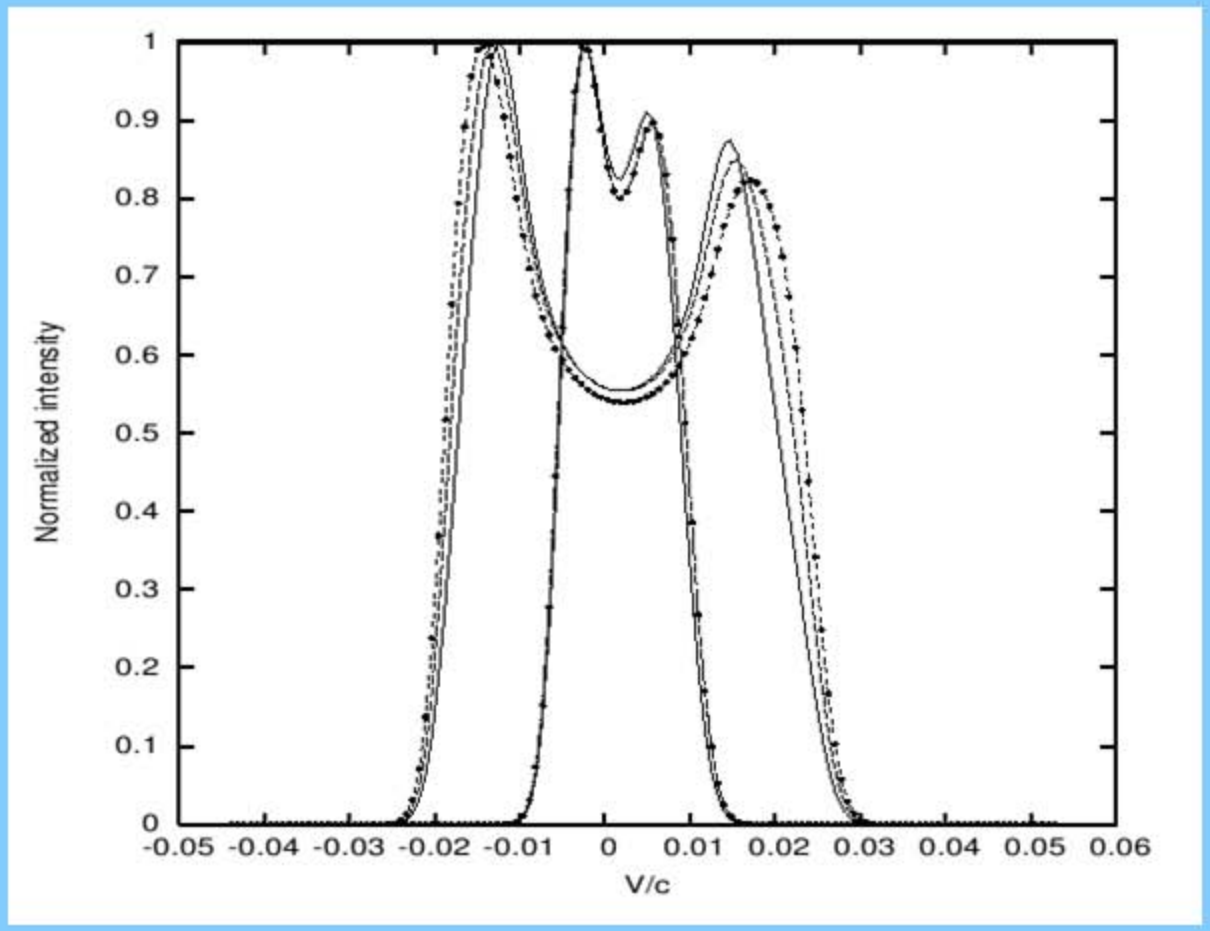
$$F_{tot} = F_d + F_s,$$

$$Q = \frac{F_s}{F_d}$$



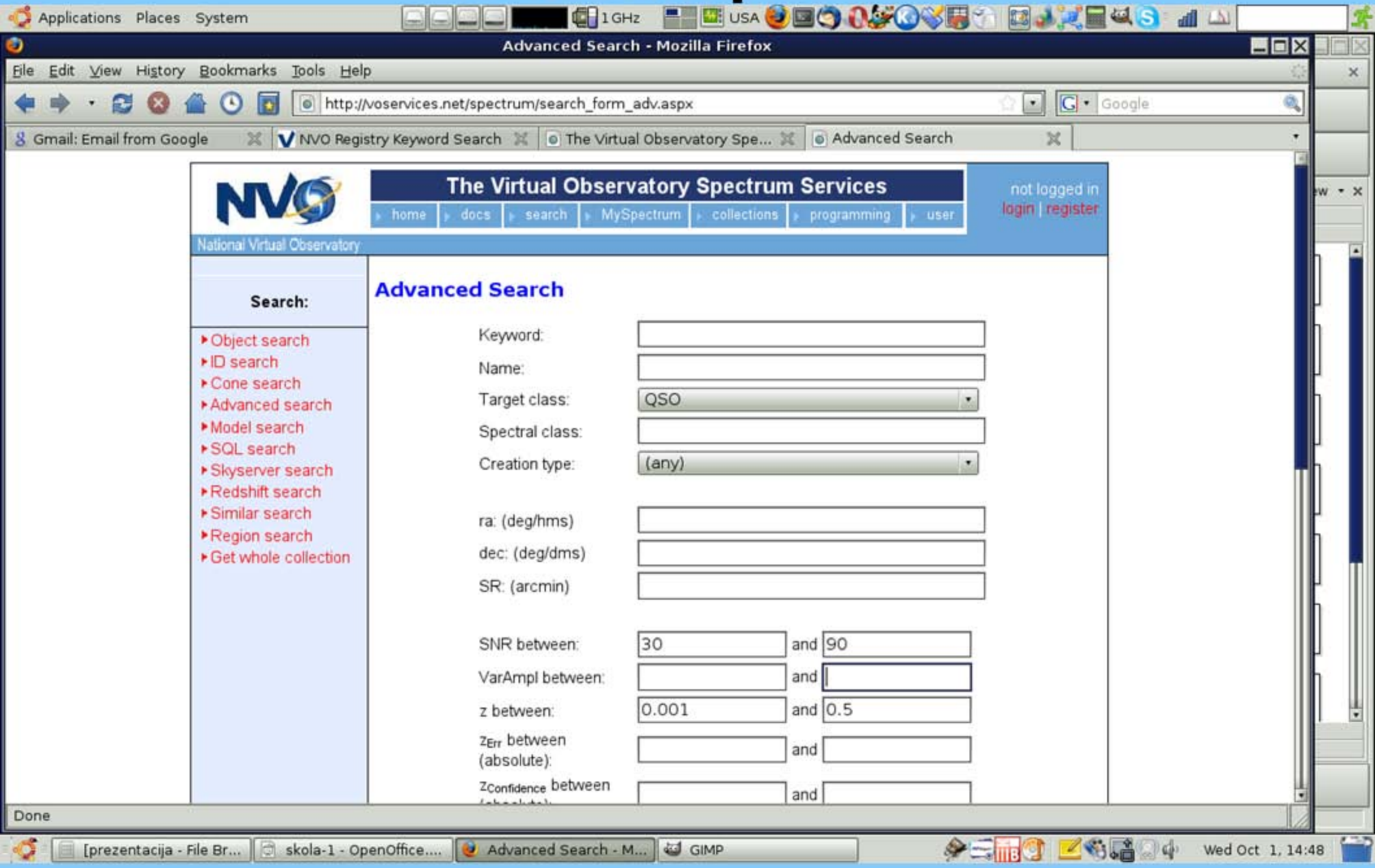
Simulated line profiles emitted by the two-component model for five different inclinations (i=1, 10, 20, 40 and 60 degrees, from the most narrow to the most broad line, respectively) for different contribution of the disk in the composite line profiles (as it is written in figures). For the inner radius of the disk is taken 400 Rg, while the outer radius is 1200 Rg.





Simulated disk profiles for different value of the emissivity: p=2 (solid line) p=3 (dashed line) and p=4 (doted-dashed line), for two inclination i =10 (narrower lines) and 30 degrees. The inner and outer radius are taken as: Rinn =500 Rg and Rout =1500 Rg. The maximal intensity is scaled to one.

The sample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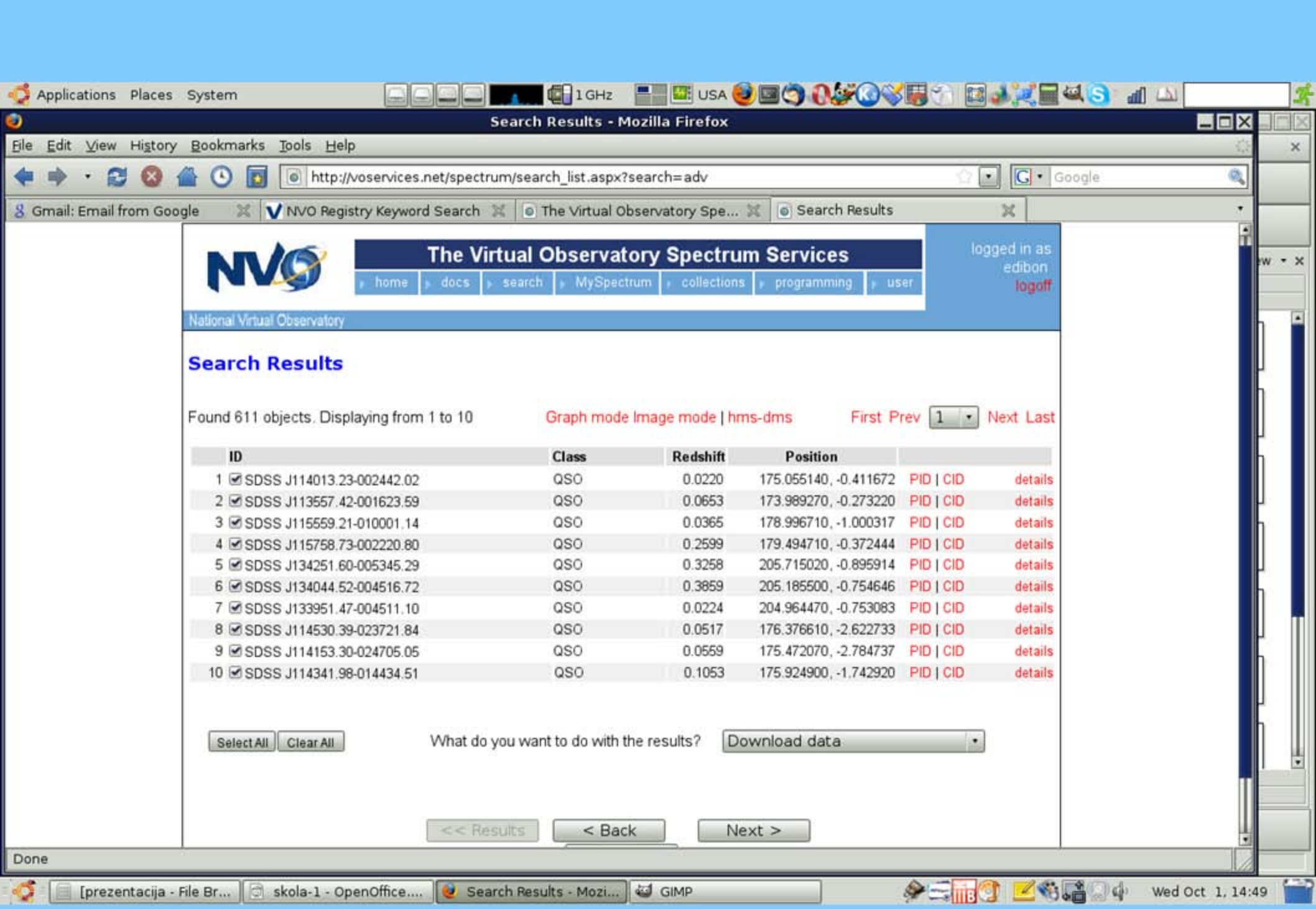
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First Prev 1 Next Last
ID Class Redshift Position
1 SDSS J114013.23-002442.02 QSO 0.0220 175.055140, -0.411672 PID | CID details
2 SDSS J113557.42-001623.59 QSO 0.0653 173.989270, -0.273220 PID | CID details
3 SDSS J115559.21-010001.14 QSO 0.0365 178.996710, -1.000317 PID | CID details
4 SDSS J115758.73-002220.80 QSO 0.2599 179.494710, -0.372444 PID | CID details
5 SDSS J134251.60-005345.29 QSO 0.3258 205.715020, -0.895914 PID | CID details
6 SDSS J134044.52-004516.72 QSO 0.3859 205.185500, -0.754646 PID | CID details
7 SDSS J133951.47-004511.10 QSO 0.0224 204.964470, -0.753083 PID | CID details
8 SDSS J114530.39-023721.84 QSO 0.0517 176.376610, -2.622733 PID | CID details
9 SDSS J114153.30-024705.05 QSO 0.0559 175.472070, -2.784737 PID | CID details
10 SDSS J114341.98-014434.51 QSO 0.1053 175.924900, -1.742920 PID | CID details
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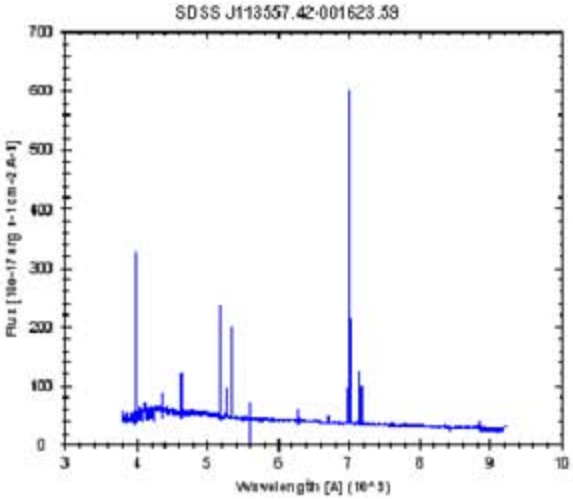

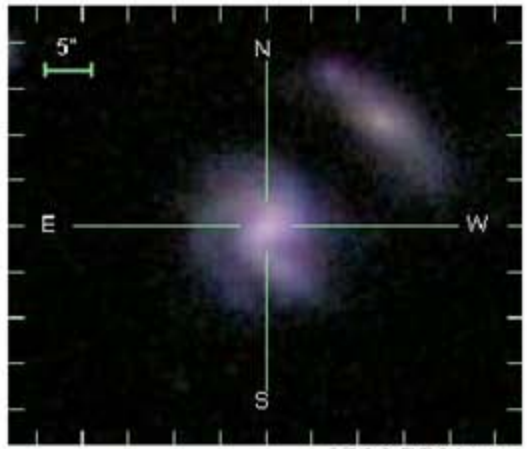

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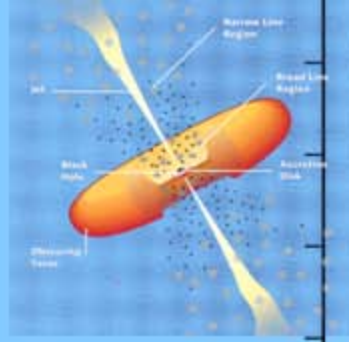
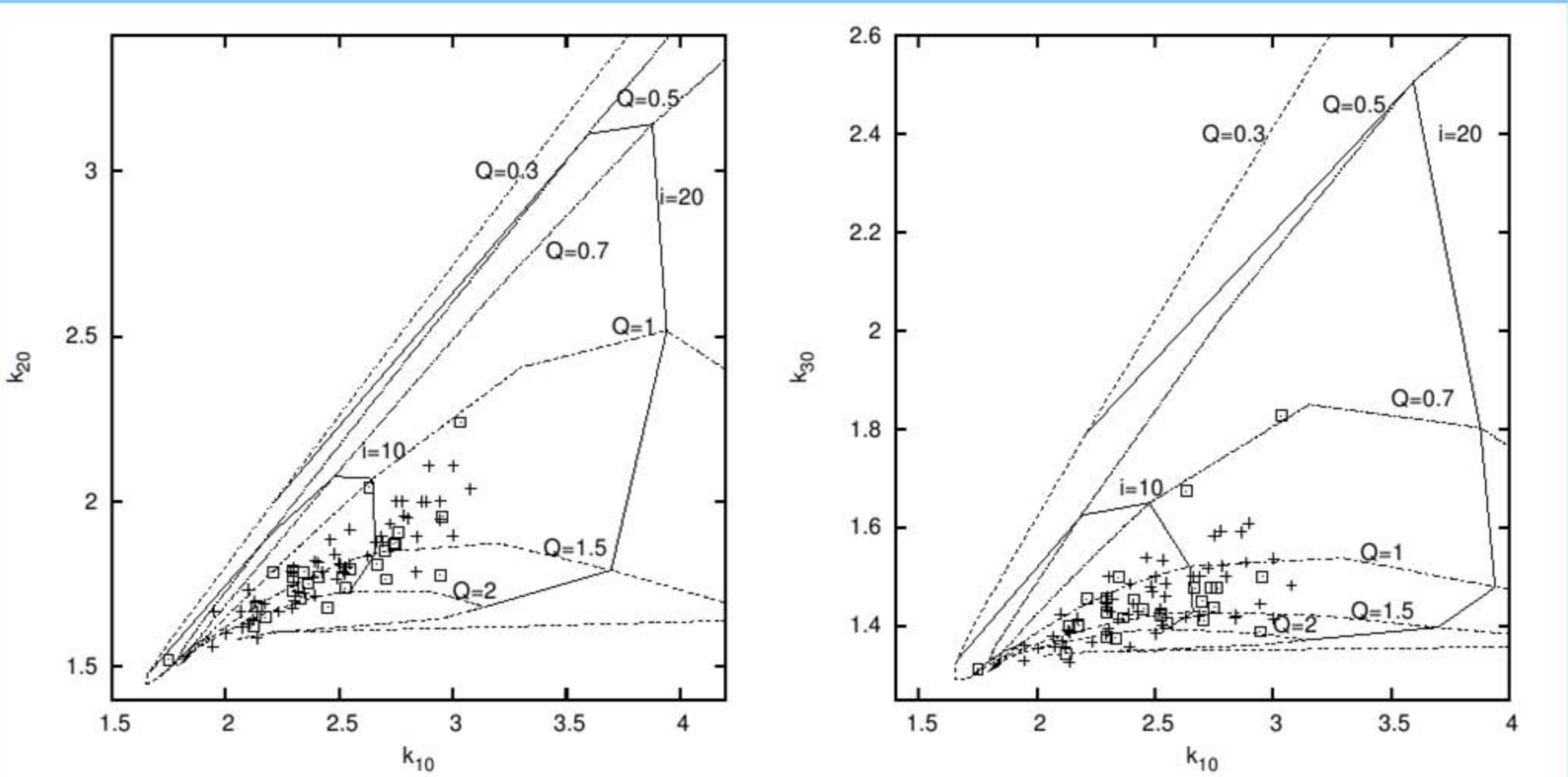
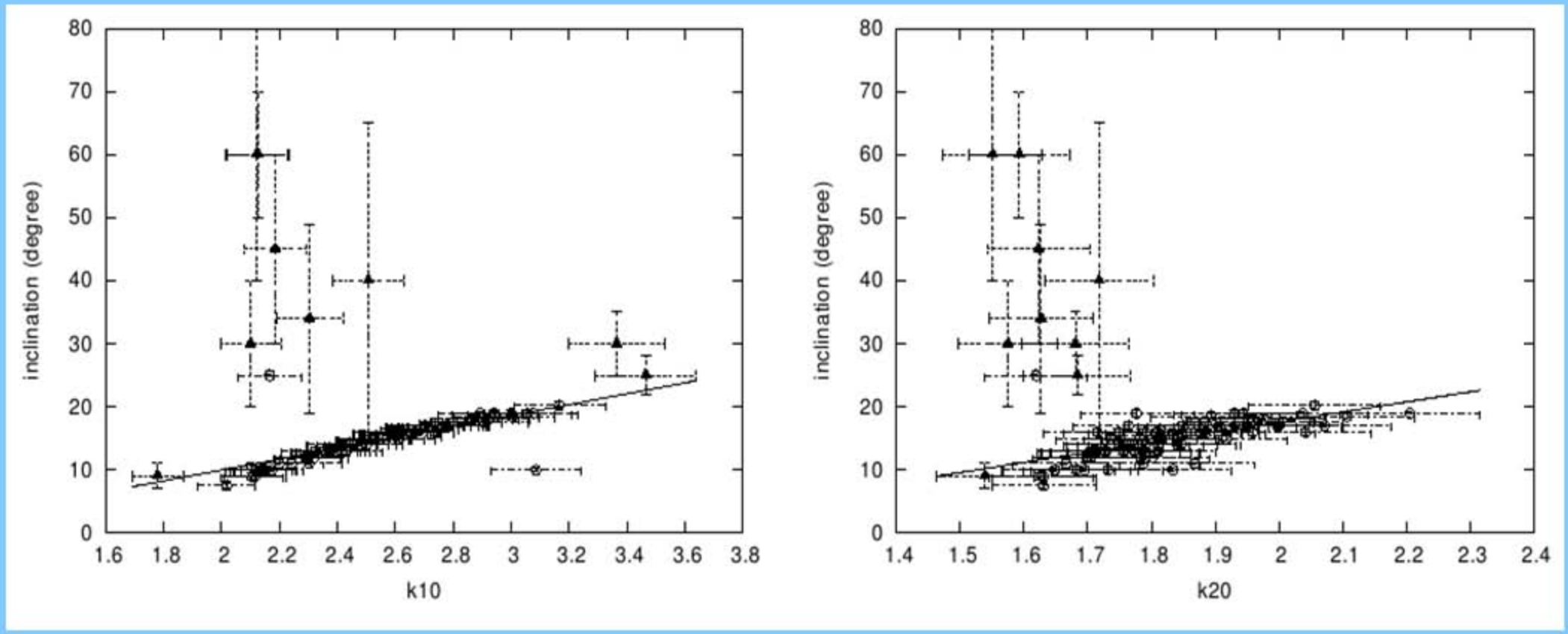


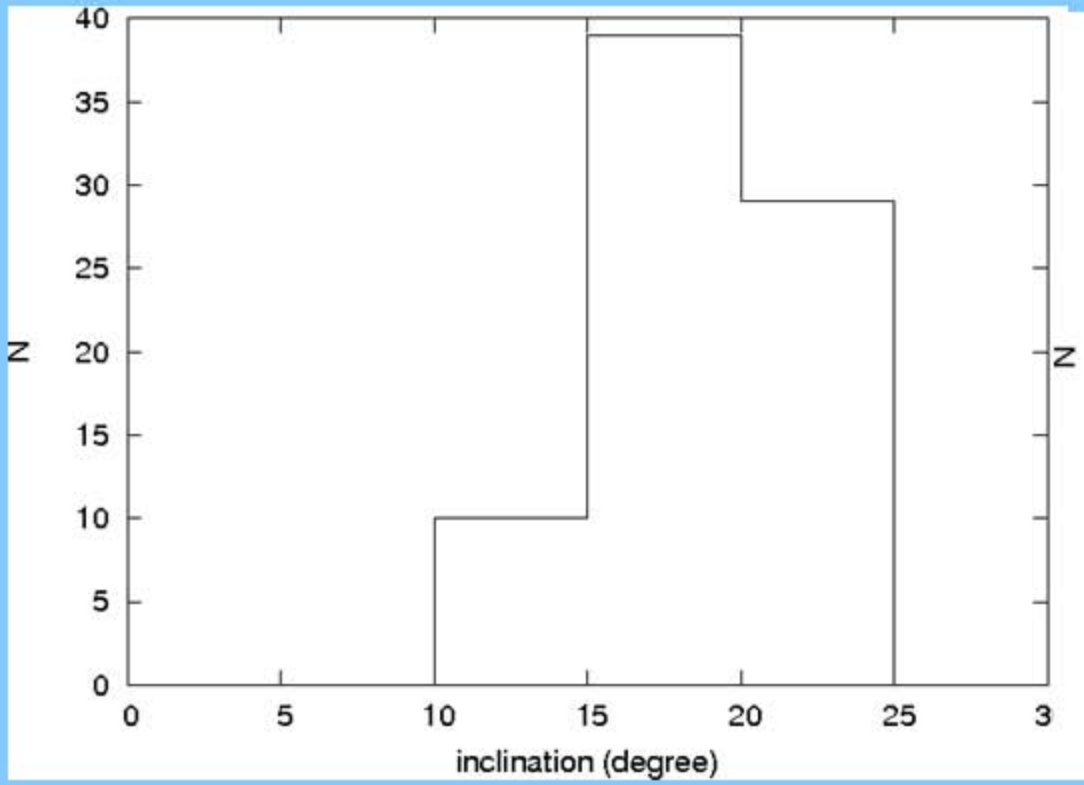
$$k_{10} = w_{10\%}/w_{50\%},\ k_{20} = w_{20\%}/w_{50\%} \text{ and } k_{30} = w_{30\%}/w_{50\%}.$$

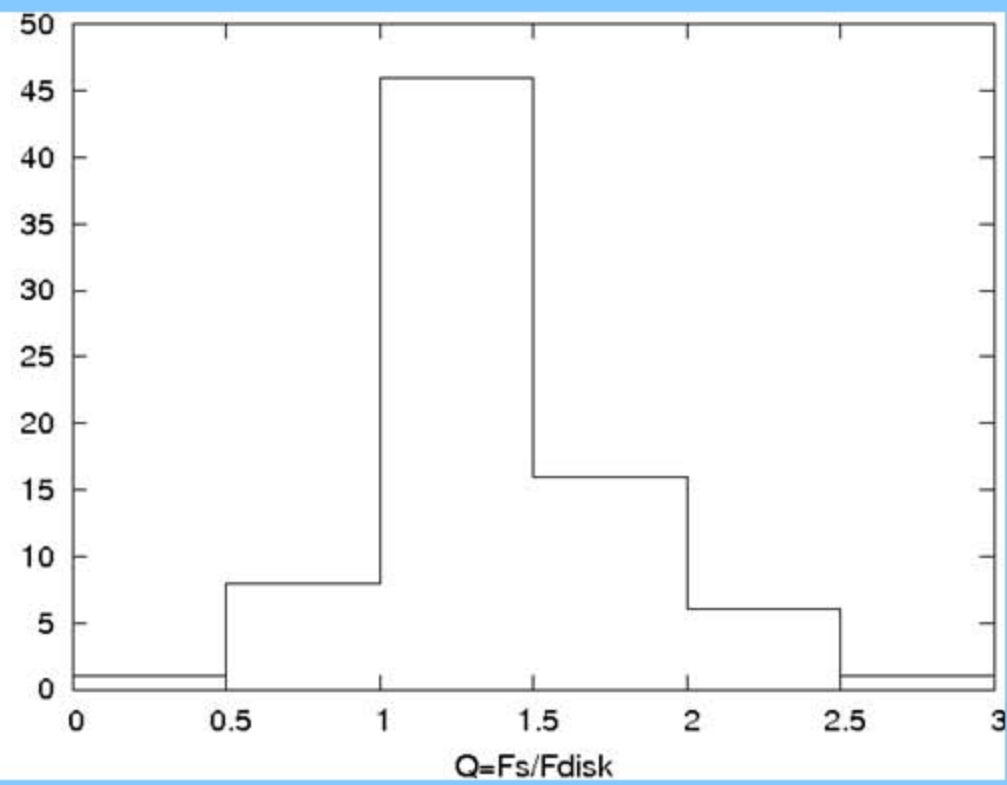


The measured width ratios (crosses) and simulated values (dashed lines) from the two-component model for different contribution of the disk emission to the total line flux (R=0.3, 0.5, 0.7, 1 and 1.5). The inner disk radius is taken to be 400 Rg, outer 4000 Rg,and different inclinations are considered (solid isolines presented i= 10, 20 and 30 degrees, respectively).

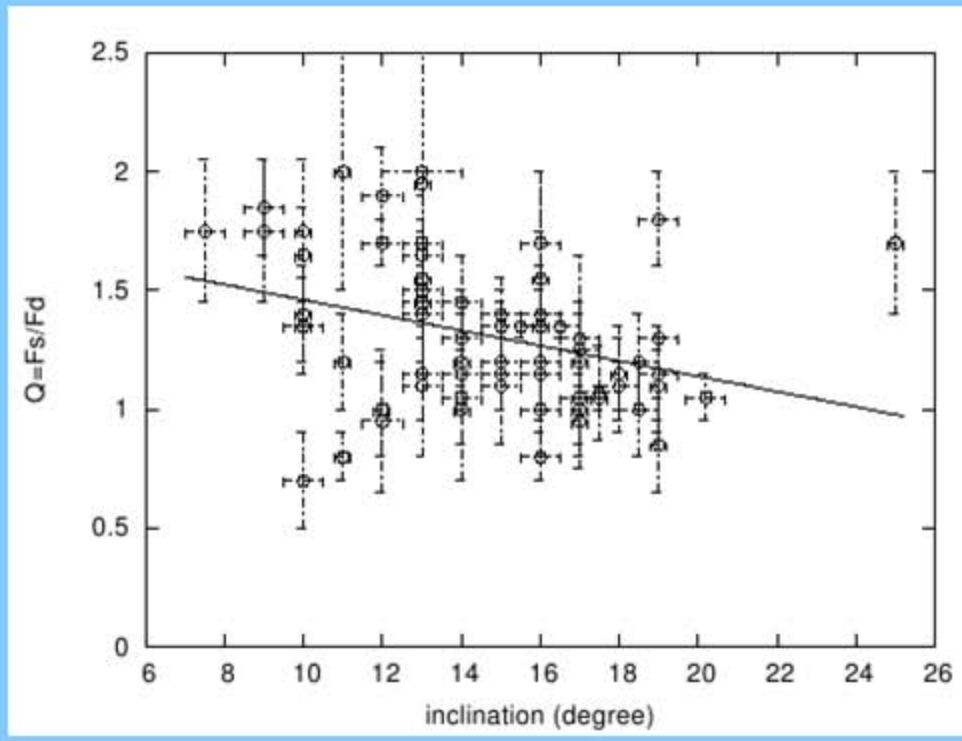


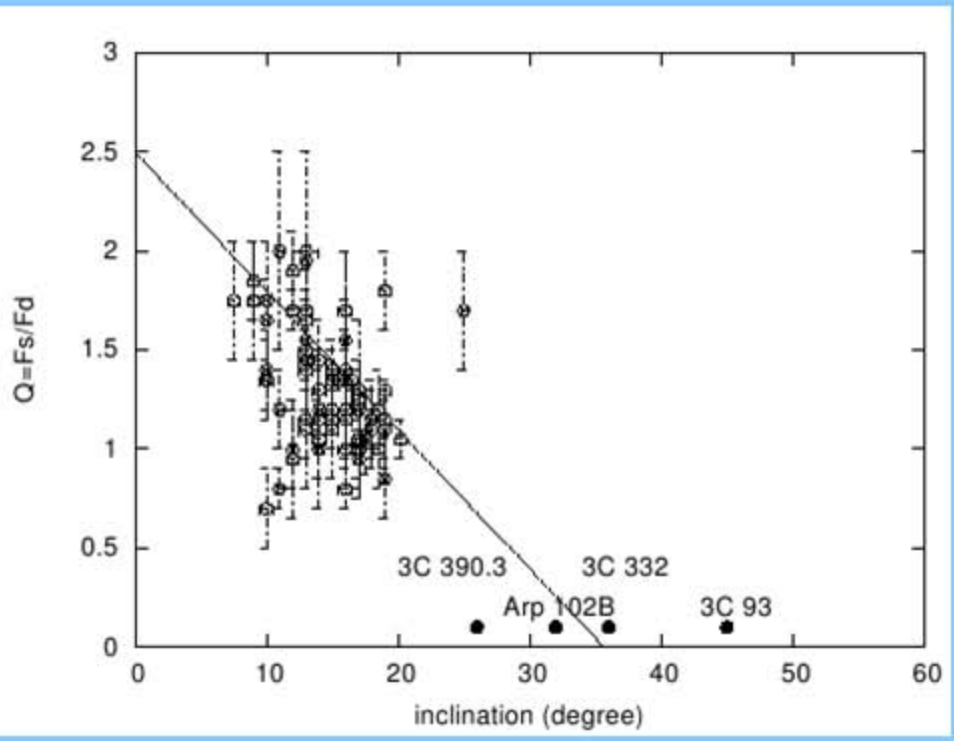
Inclination vs. k10 (left), k20 (right).



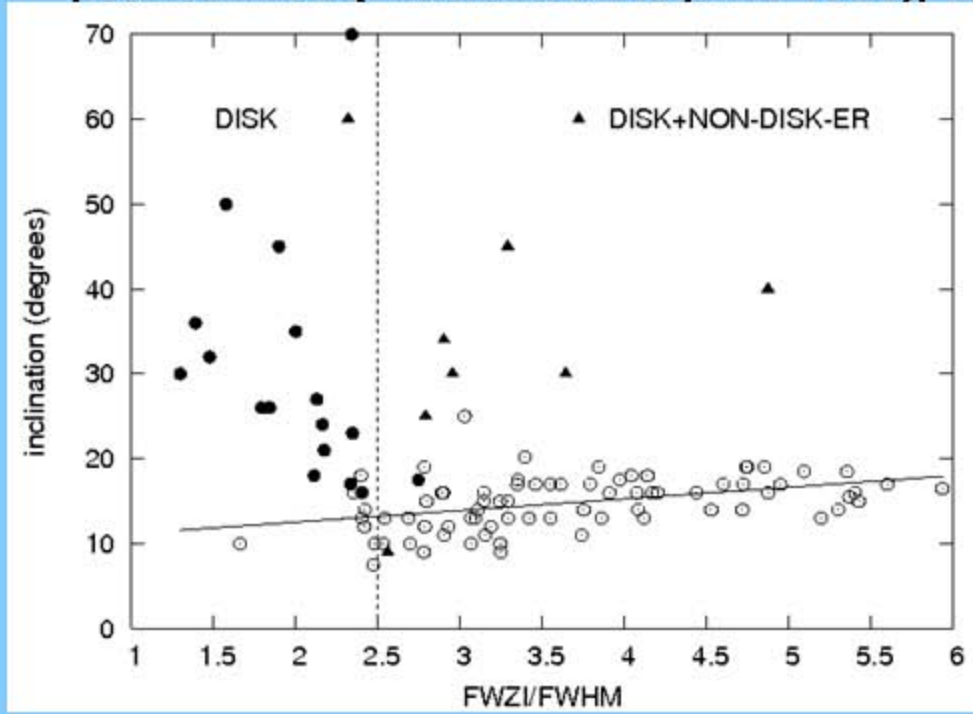


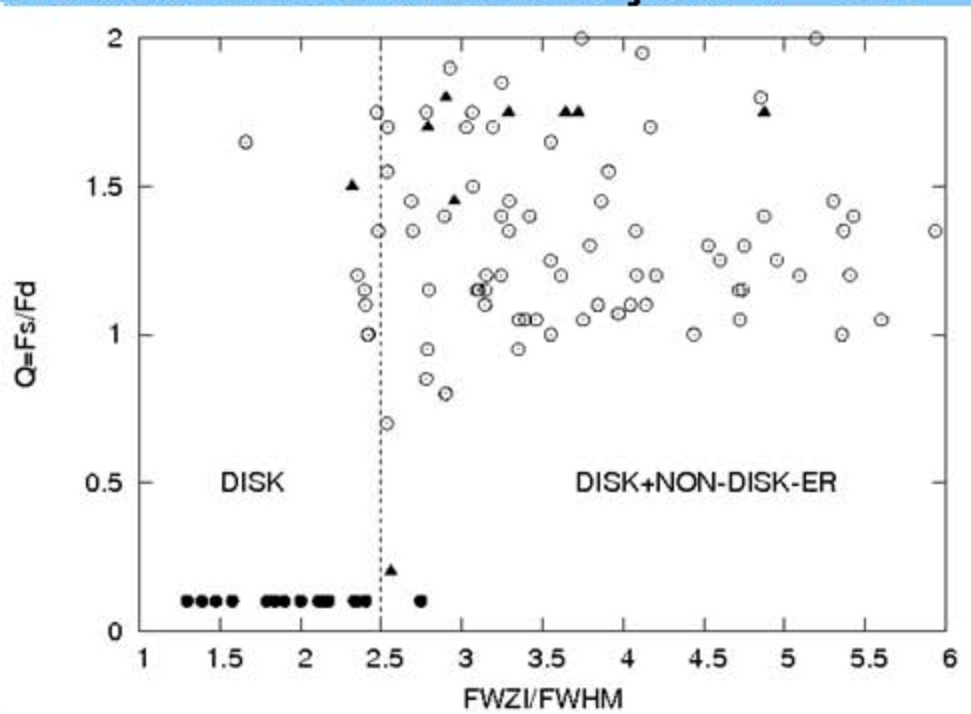
Histograms of the number of objects to the inclination *i* and Q = Fs /Fdisk for the sample.



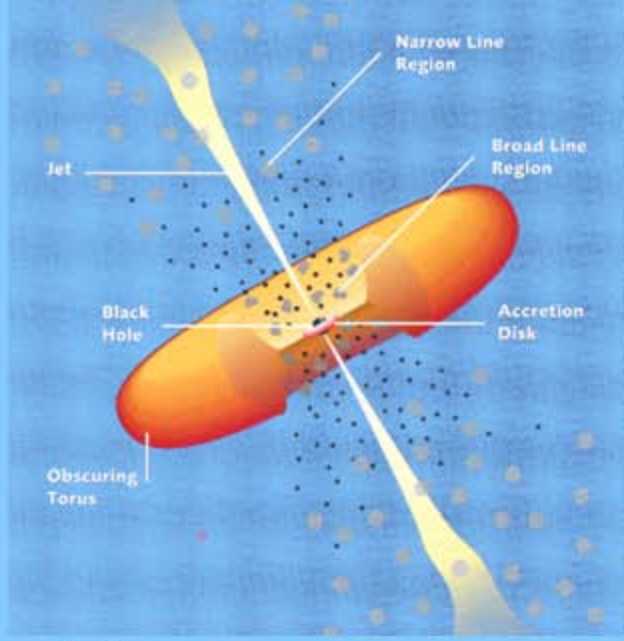


Q vs. inclination (left), and the comparison to the set of AGN with double-peaked lines (Eraclous & Halpern 1994), where is assumed that in this objects Q < 0.1.





Conclusions



- Contribution to the line wings
- **Fd/Fs>1/3**, but if **Fd/Fs>3**, two peak should appear

Width ratios =>

- inclination should be small mainly: **10 < I < 25°**,
- flux ratios: **0.5 < Q < 2.5**
- It is likely that **Fd/Fs~1** in the most of the considered AGN