The relativistic RM for NLS1 soft X-ray broad lines

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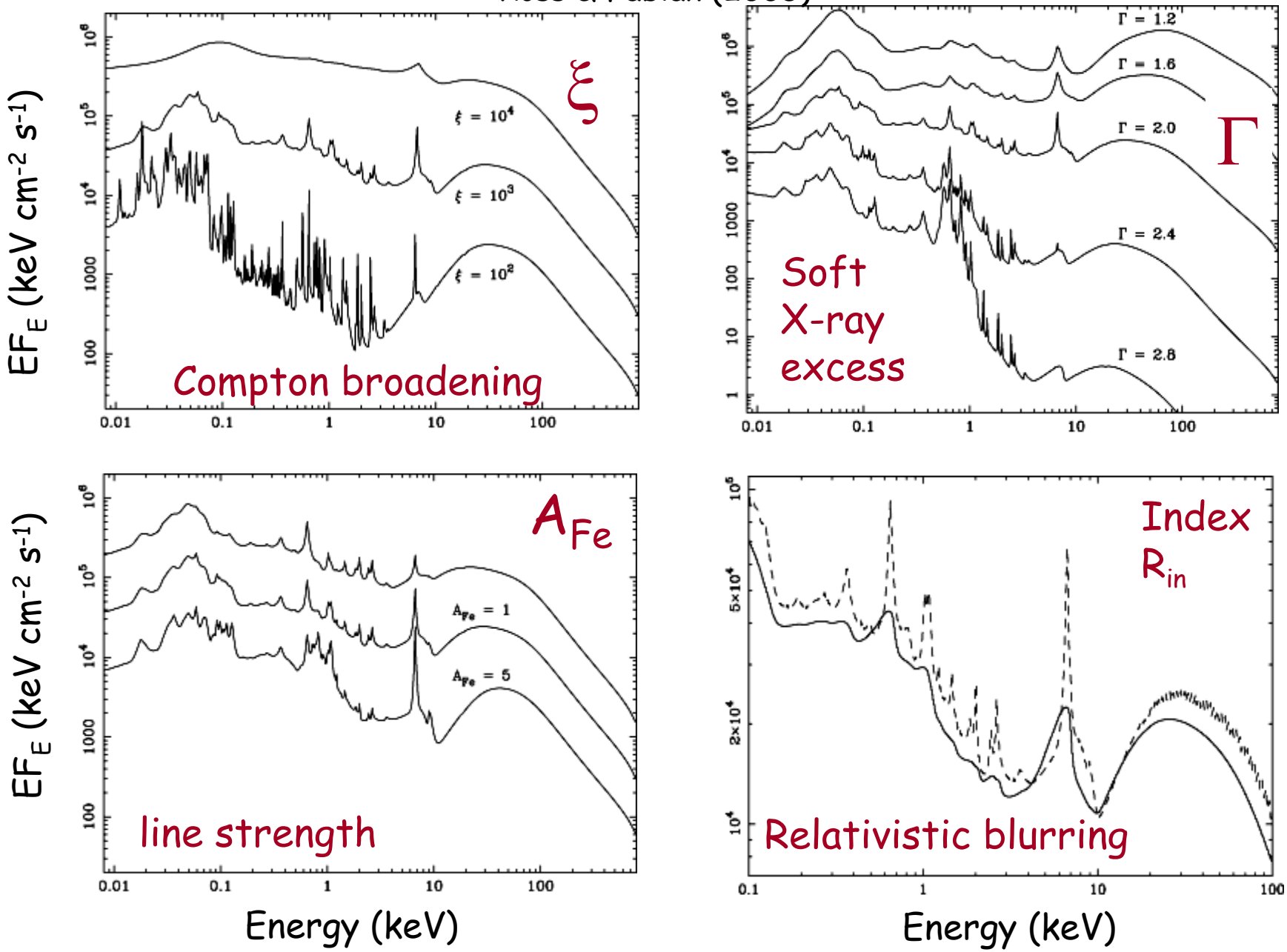
1. The relativistic reflection model (RM)
2. The NLS1 sample and RGS RM fitting reliability
3. RGS RM fitting results in the strong and weak GR field limit
4. Predictions for IXO

The relativistic RM: Compton- and GR line broadening

Ross & Fabian (2005)



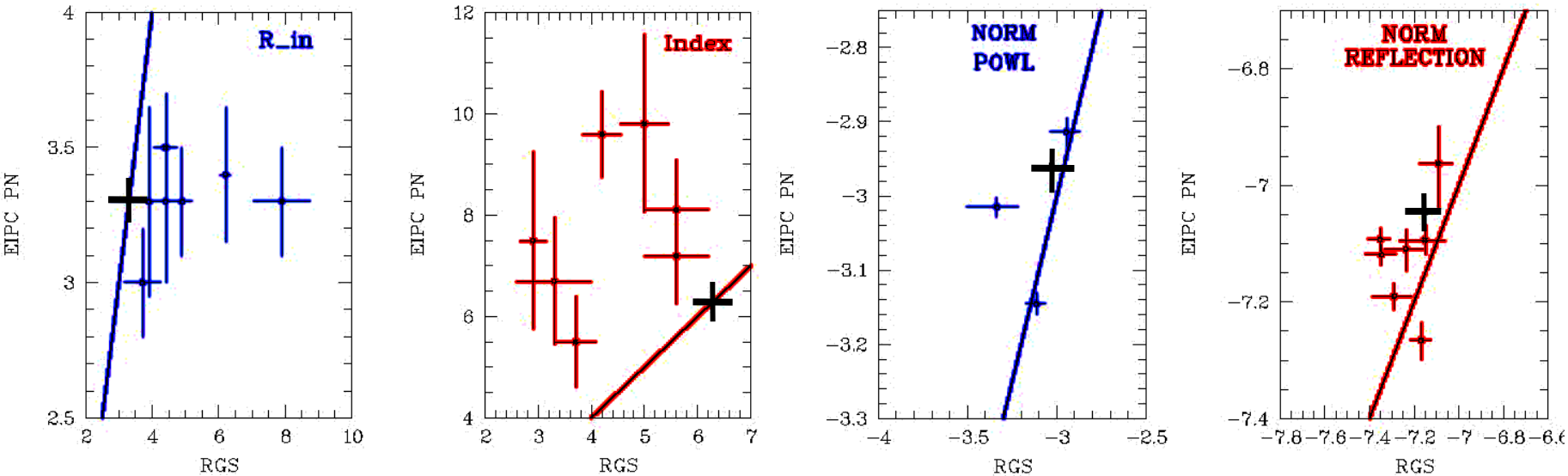
2. The NLS1 sample

Object	#OBS ID's	total RGS exp.	RGS counts	EPIC counts
1H0707	10	790 ks	120000	~ factor of 10
Ark 564	5	180 ks	310000	
Mrk 110	1	47 ks	40000	
Ton S180	2	50 ks	23000	
I Zw1	2	80 ks	14000	
IRAS 13224	1	64 ks	4200	
PG 1244	1	13 ks	3200	
PHL 1092	3	223 ks	0	

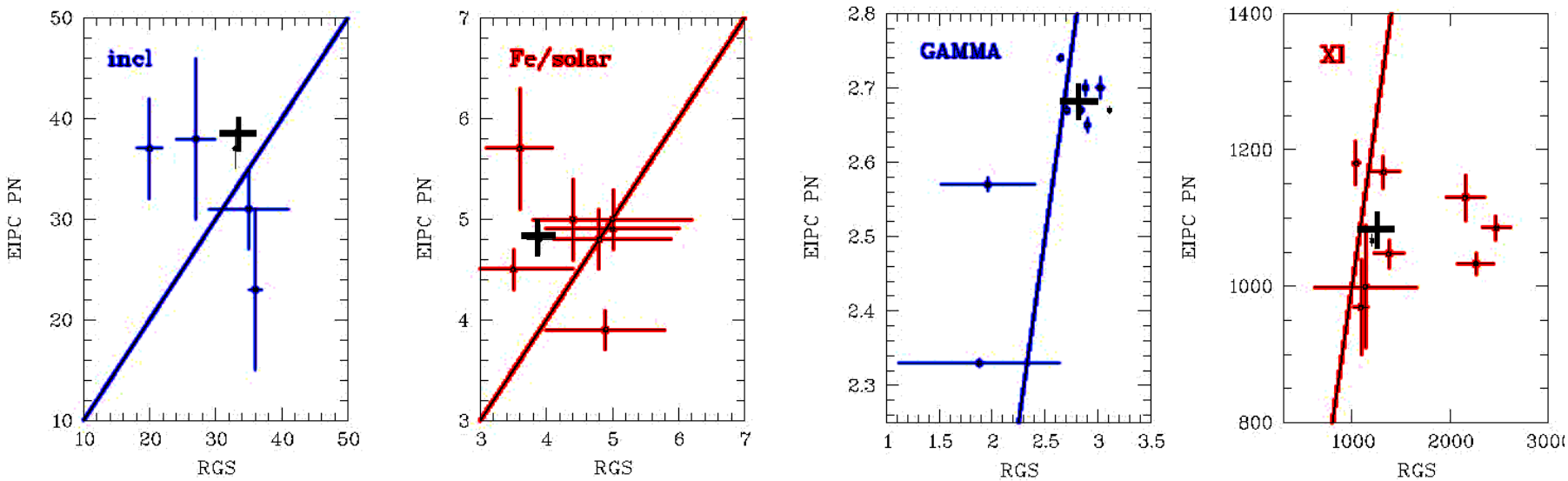
RM fits to merged RGS1/RGS2 first order and EPIC pn spectra
for individual and the merged data sets

extension to the work by Blustin & Fabian 2009 on 1H0707

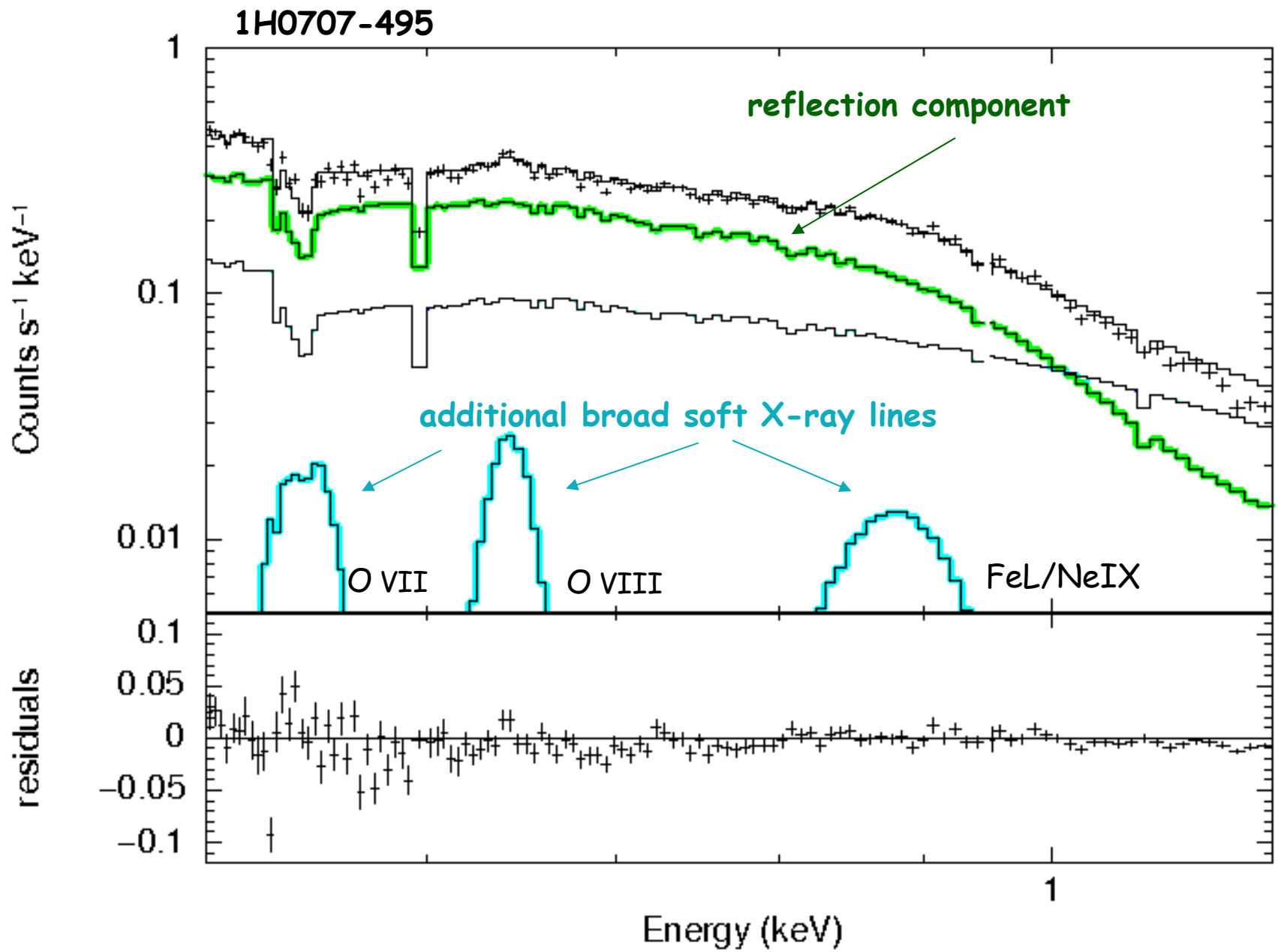
How reliable are the RM fits in the limited RGS band ?

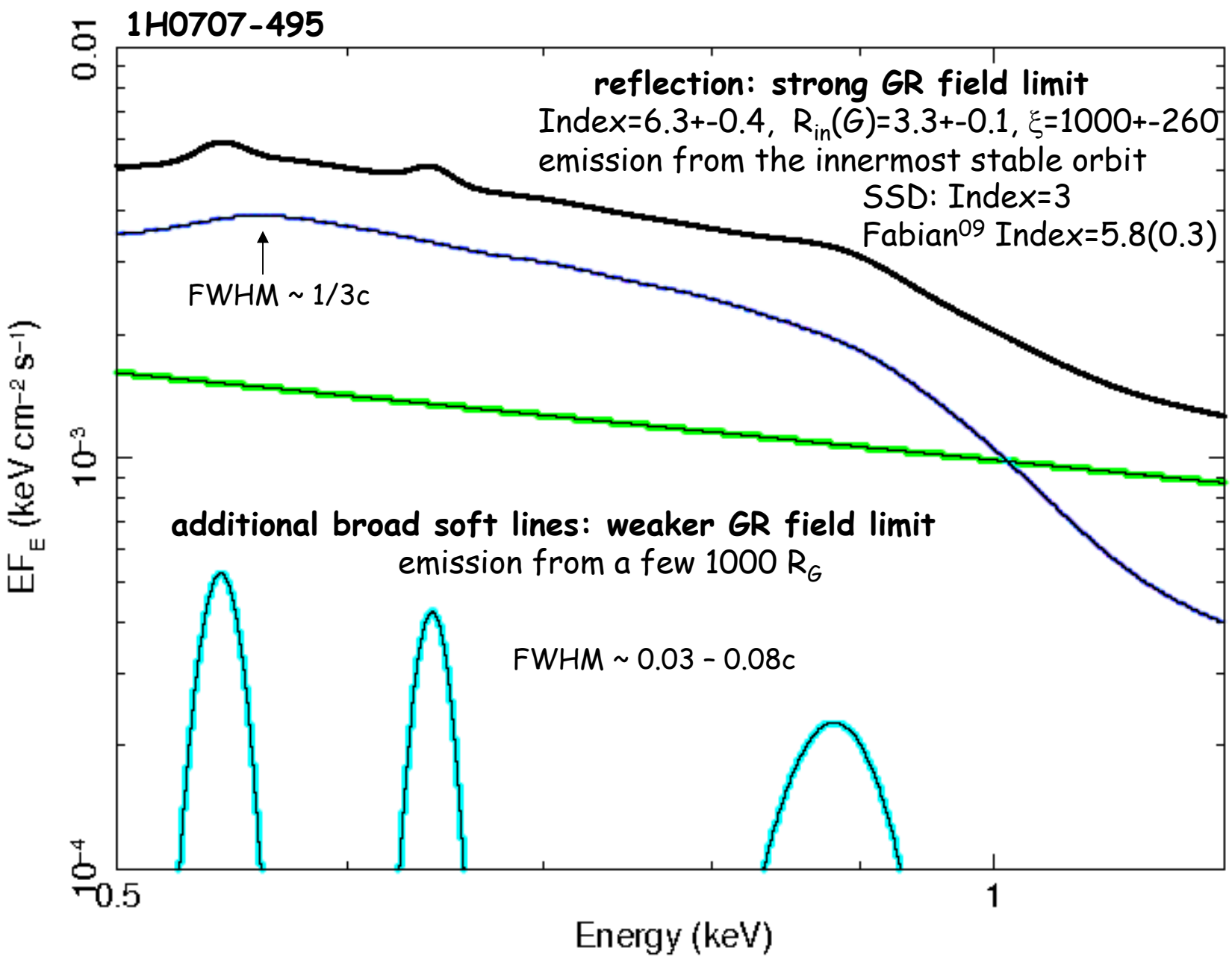


Result: RGS RM fit reliable when some EPIC RM parameters are fixed

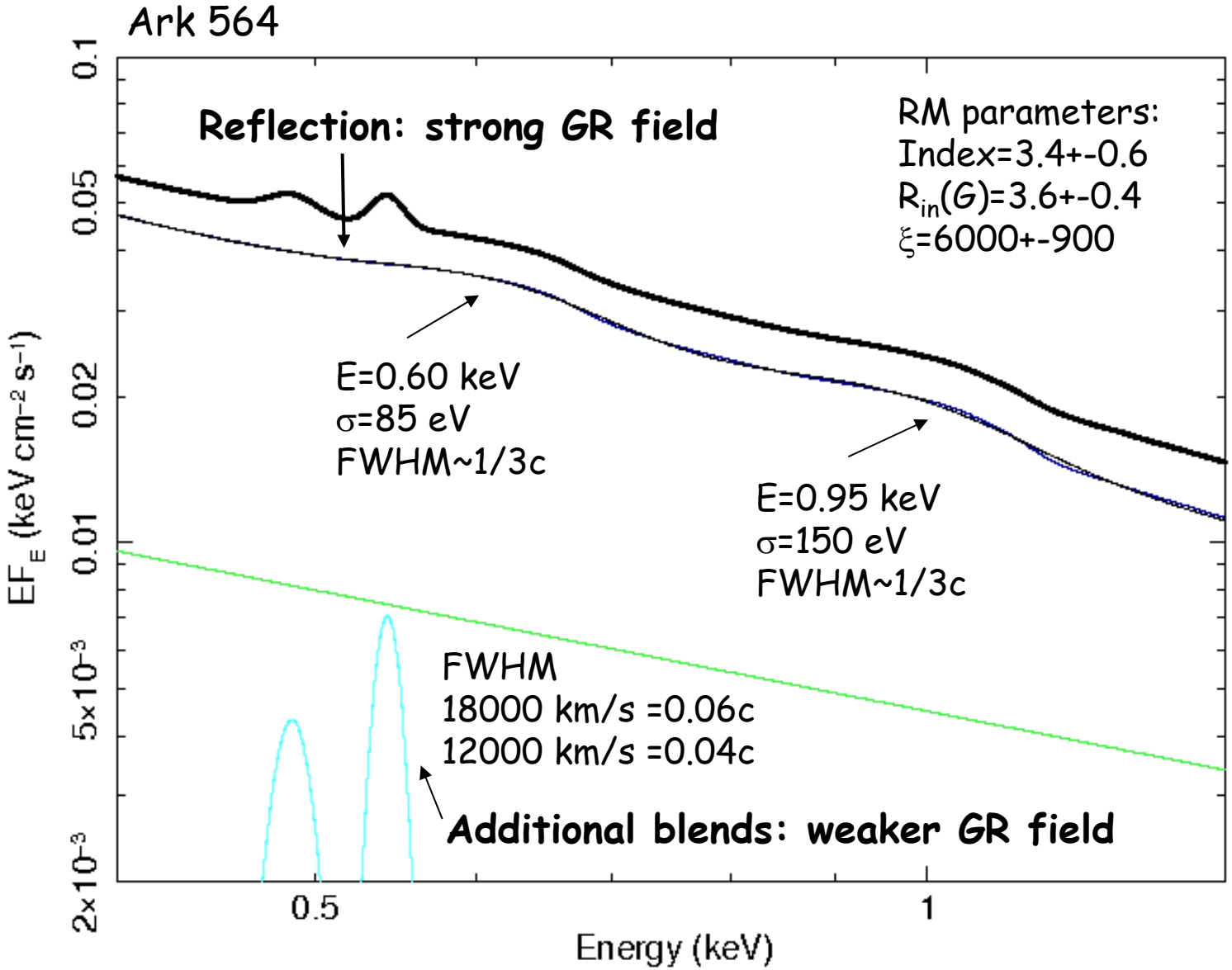


3. RGS RM fitting results in the strong and weak GR field limit

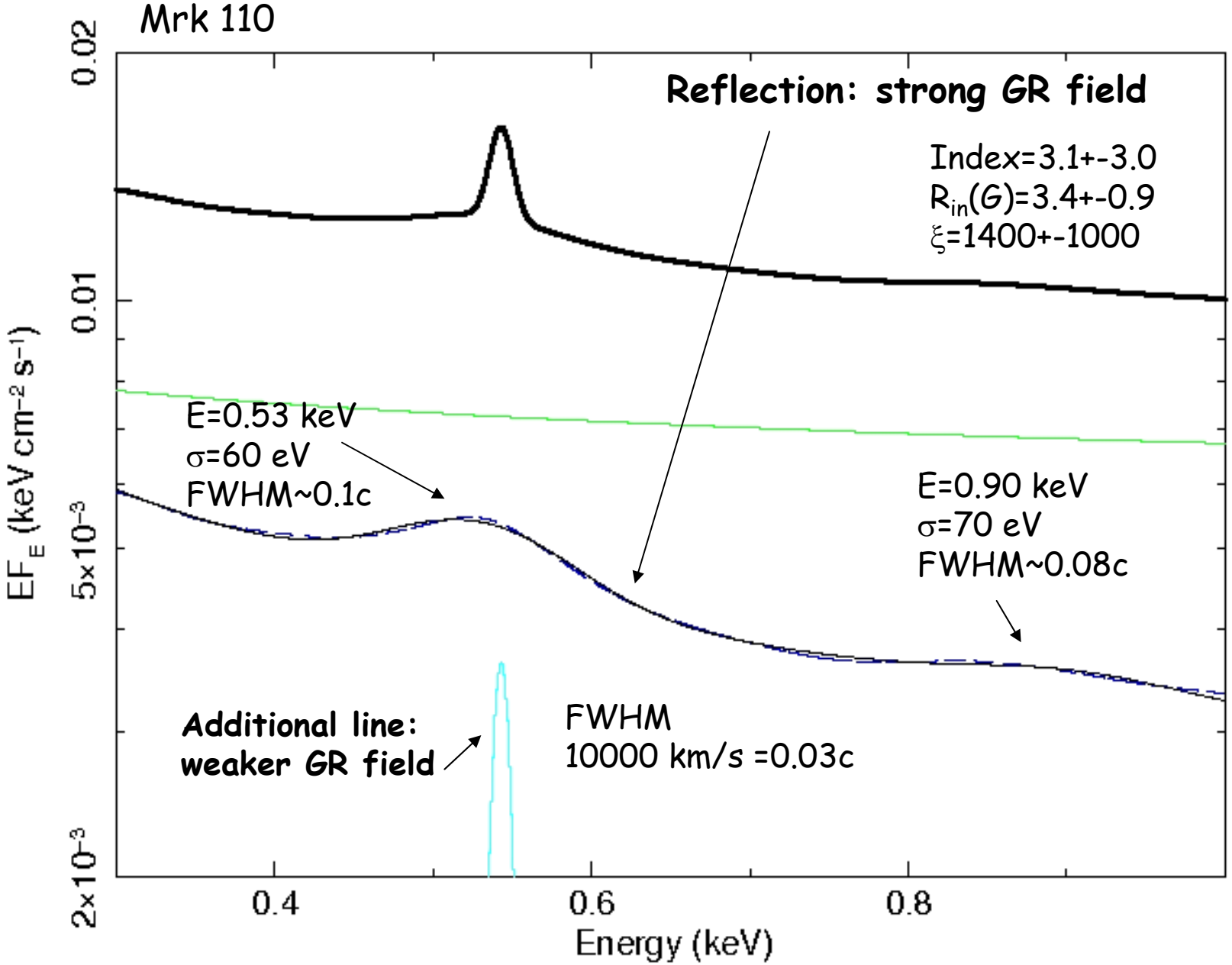



1H0707-495
reflection: strong GR field limit
Index=6.3+-0.4, $R_{in}(G)$=3.3+-0.1, ξ=1000+-260
emission from the innermost stable orbit
SSD: Index=3
Fabian09 Index=5.8(0.3)
FWHM ~ 1/3c
additional broad soft lines: weaker GR field limit
emission from a few 1000 R_G
FWHM ~ 0.03 - 0.08c
0.01
10^{-3}
10^{-4}
0.5
1
EF_E (keV cm^{-2} s^{-1})
Energy (keV)

RGS RM fitting results in the strong and weak GR field limit

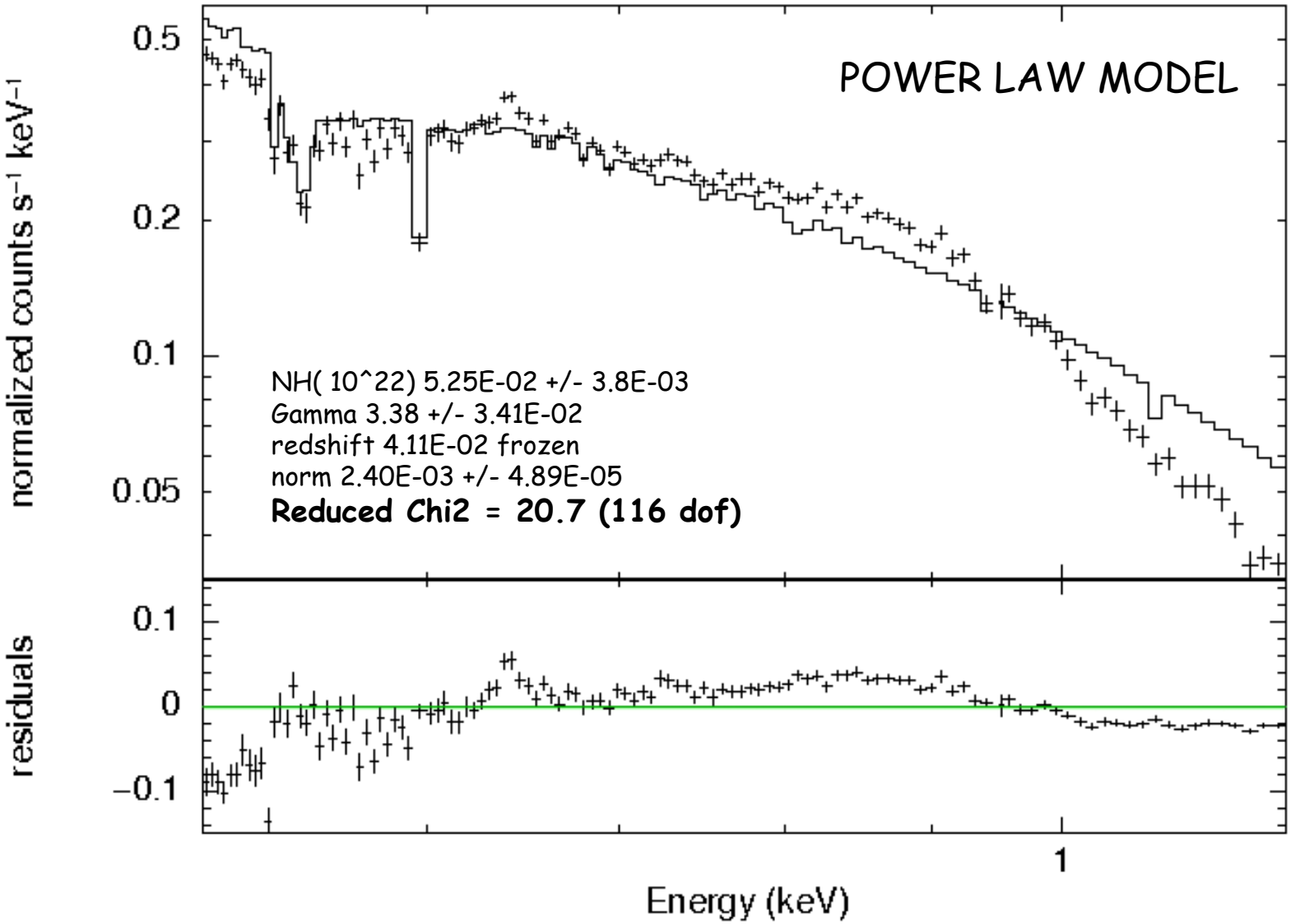


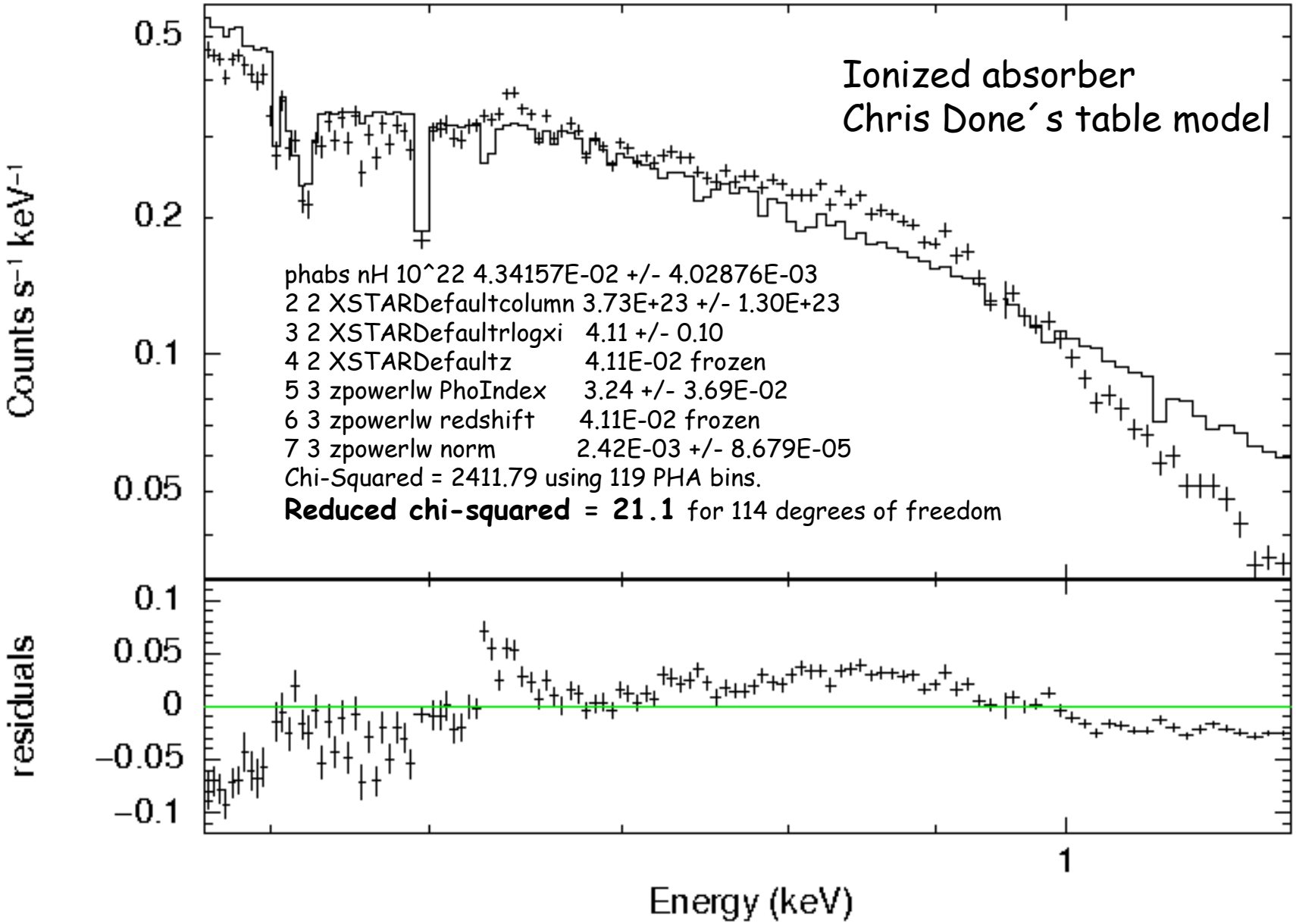
RGS RM fitting results in the strong and weak GR field limit



Test of other models

1H 0707




Ionized absorber
Chris Done´s table model
phabs nH 10^22 4.34157E-02 +/- 4.02876E-03
2 2 XSTARDefaultcolumn 3.73E+23 +/- 1.30E+23
3 2 XSTARDefaultrlogxi 4.11 +/- 0.10
4 2 XSTARDefaultz 4.11E-02 frozen
5 3 zpowerlw PhoIndex 3.24 +/- 3.69E-02
6 3 zpowerlw redshift 4.11E-02 frozen
7 3 zpowerlw norm 2.42E-03 +/- 8.679E-05
Chi-Squared = 2411.79 using 119 PHA bins.
Reduced chi-squared = 21.1 for 114 degrees of freedom
Counts s⁻¹ keV⁻¹
0.5
0.2
0.1
0.05
residuals
0.1
0.05
0
−0.05
−0.1
1
Energy (keV)

Basic results

1. RGS RM spectral fitting

the line emission from the RM is arising at the innermost stable orbit at ~ 3 R_G and is strongly comptonized

the FWHM values are about 1/3 c

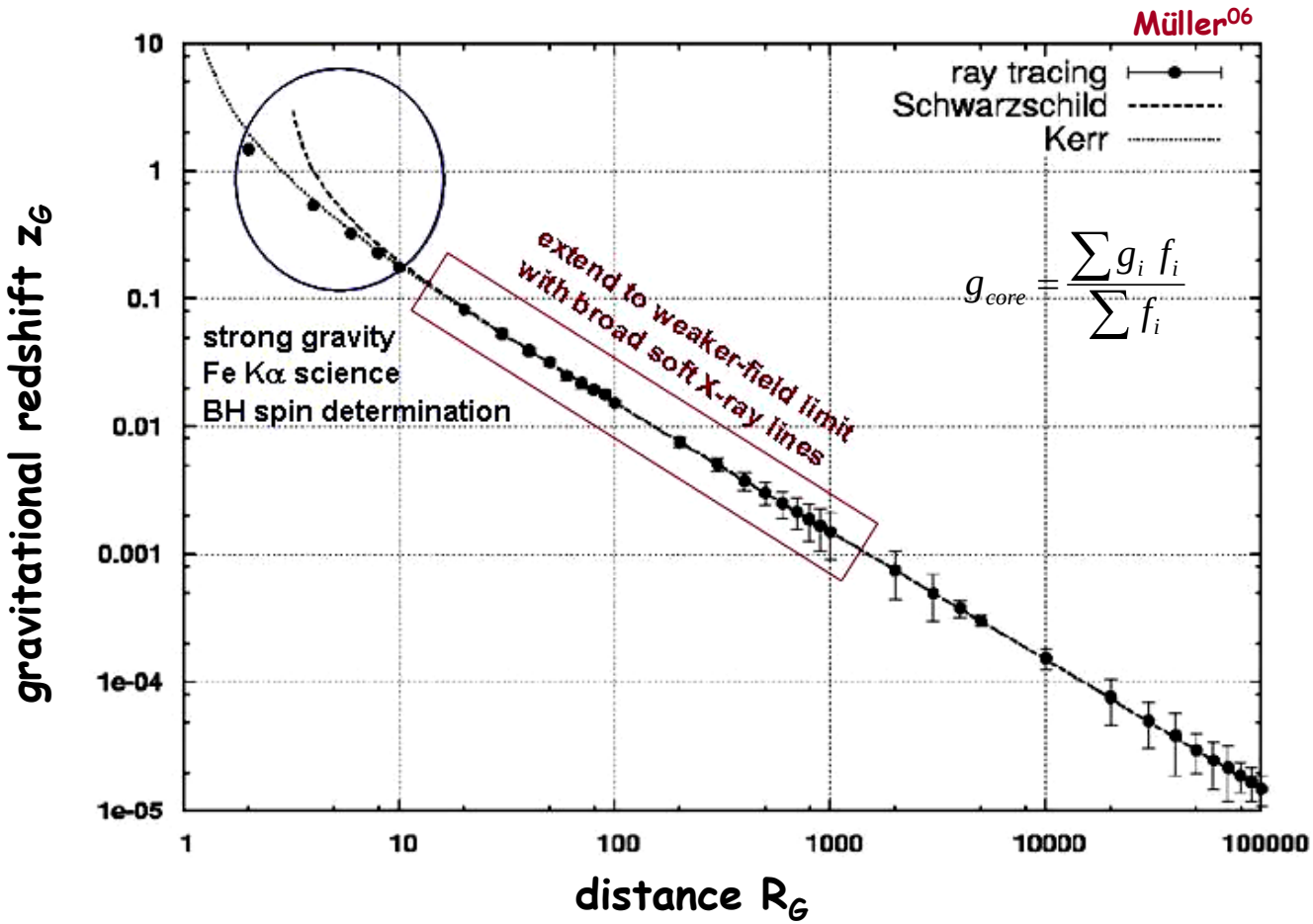
RM RGS fitting probes General Relativity in the strong gravity field limit

2. additional soft X-ray lines

emission arising from larger distances ~1000 R_G

soft X-ray lines are extending GR to the to weaker gravity field limit

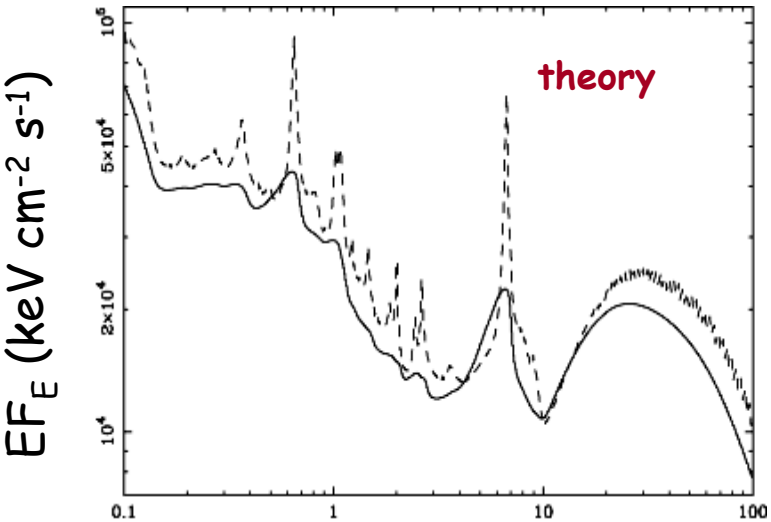
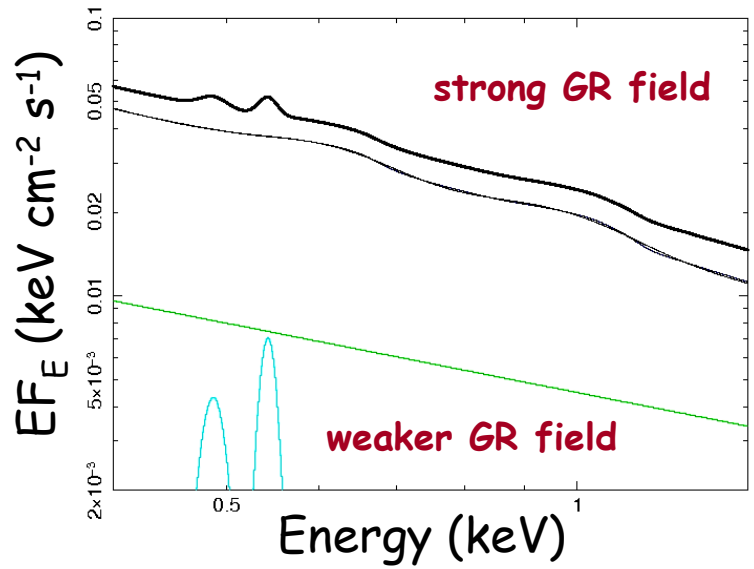
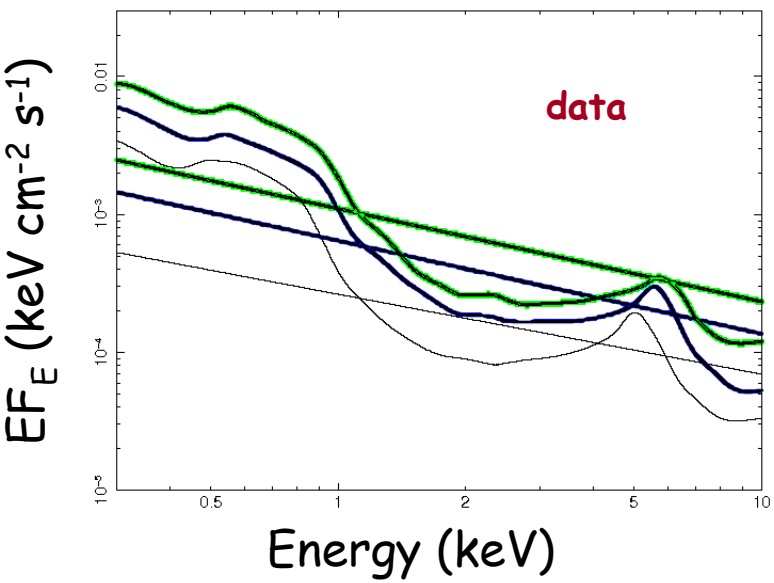
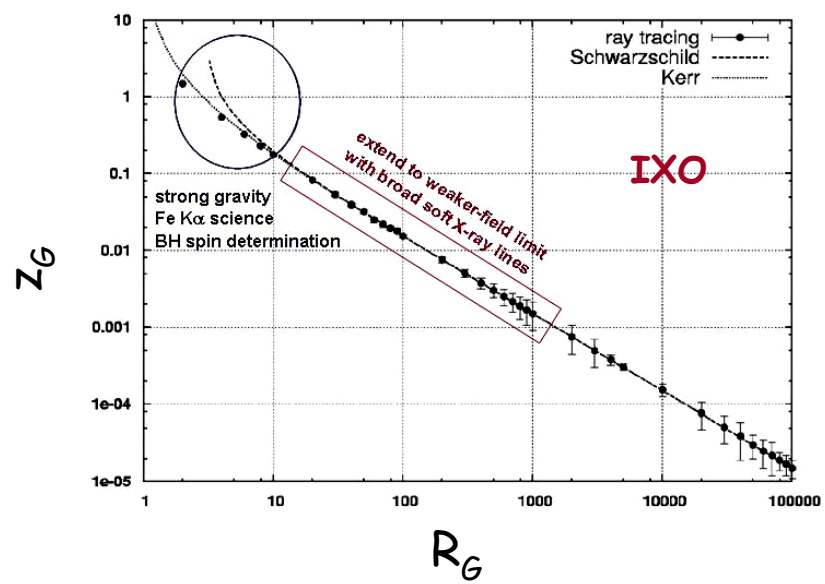
4. Predictions for IXO



line profile measurements provide values for g_{core} which deliver the z_G and R_G

1. this allows to test GR prediction via IXO measurements

2. the Fe Kα measurements in the strong field regime can be extended to the weaker field limit by studying relativistic soft X-ray lines

The End

RGS reflection model fitting results in the strong and weak GR field limit