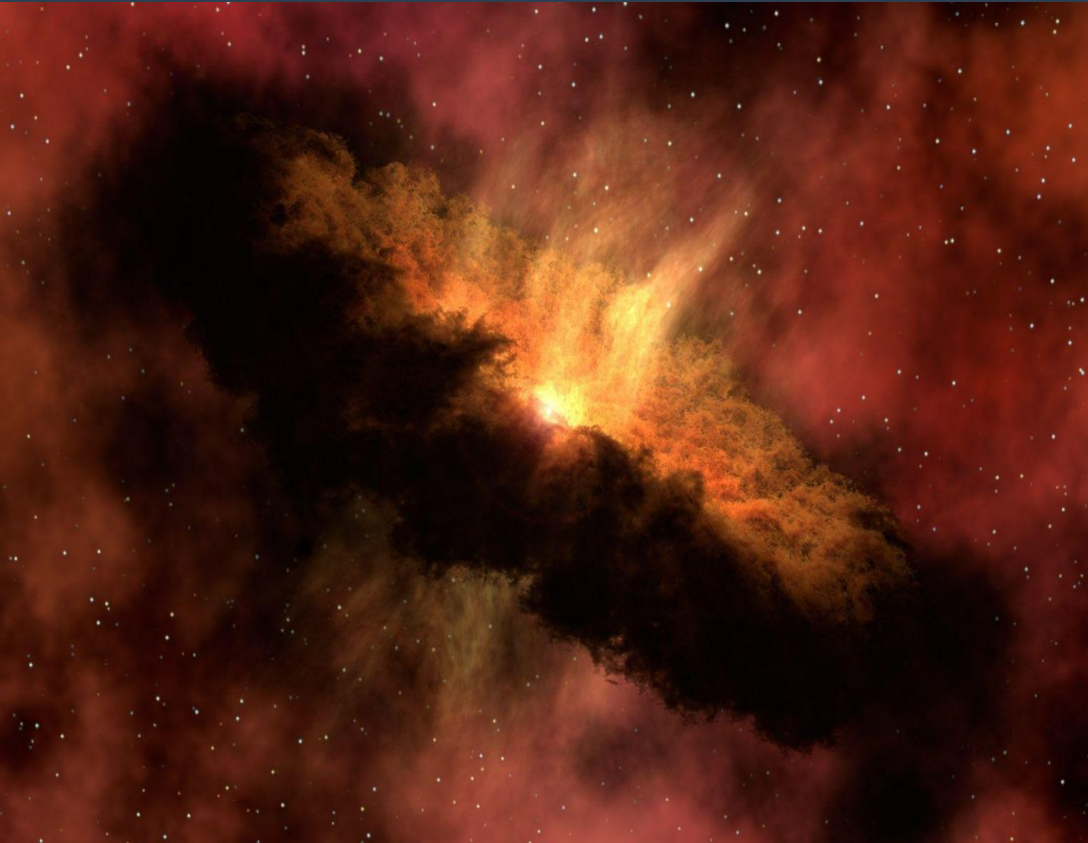


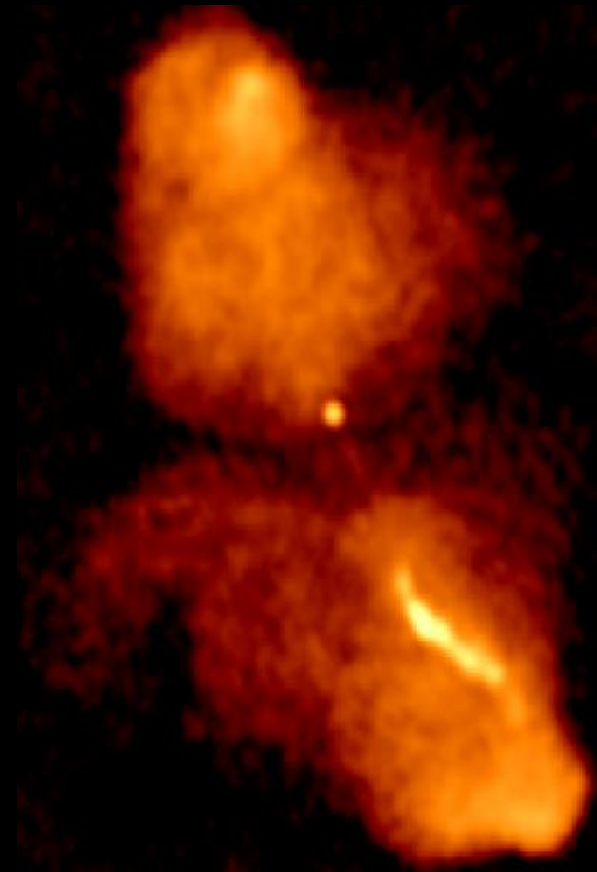
Radio morphology-accretion mode link in FR II low-excitation radio galaxies



Duccio Macconi

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INAF - OAS Bologna

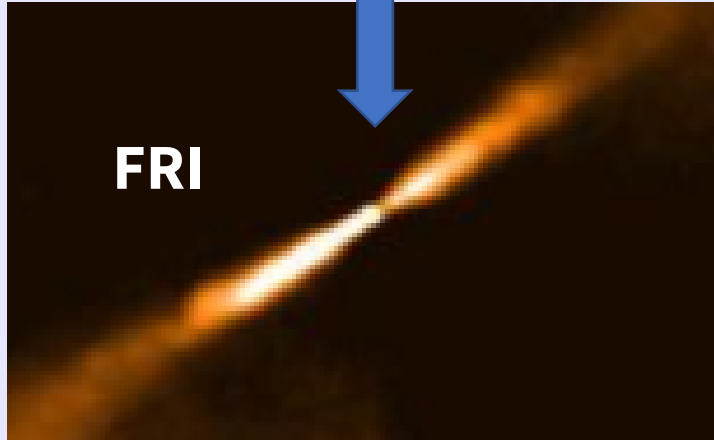


In collaboration with: Cristian Vignali (UNIBO)
Paola Grandi (OAS)
Eleonora Torresi (UNIBO-OAS)
Bia Boccardi (MPIFR Bonn)

Radio and Optical classification

RADIO:

$$L(178\text{MHz}) < 10^{26} \left[\frac{W}{\text{Hz}} \right] < L(178\text{MHz})$$

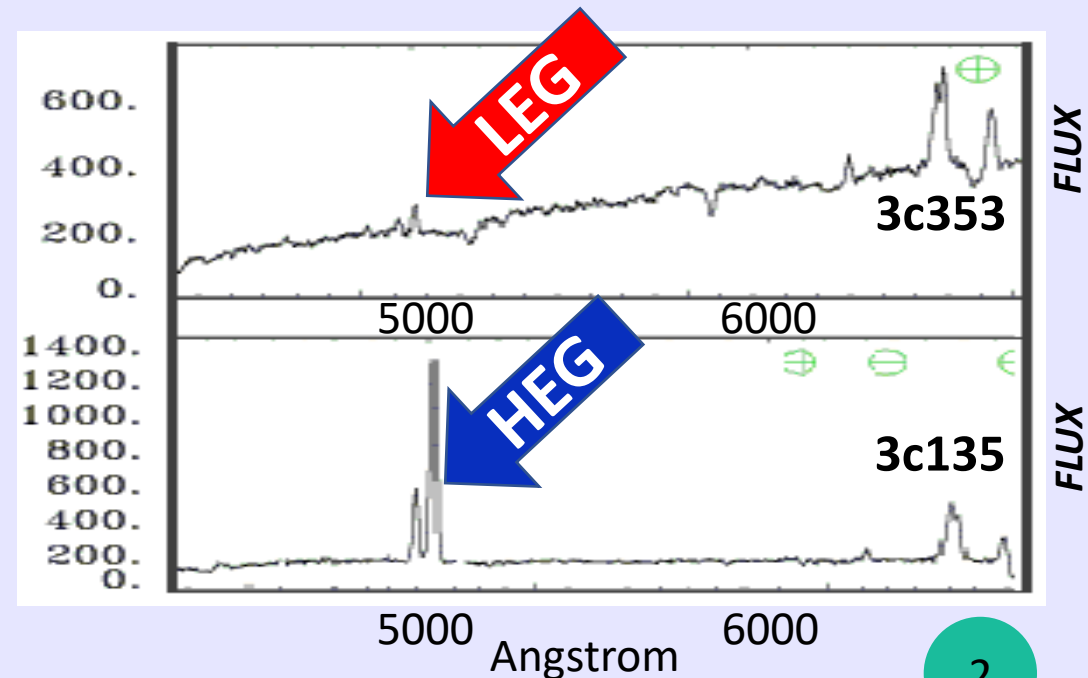


OPTICAL:

$EI < 0.95$ LEG

$EI > 0.95$ HEG

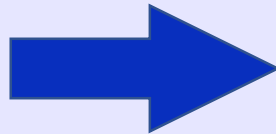
$$EI = \log \left(\frac{[OIII]}{H\beta} \right) - \frac{1}{3} * \left[\log \left(\frac{[NII]}{H\alpha} \right) + \log \left(\frac{[SII]}{H\alpha} \right) + \log \left(\frac{[OI]}{H\alpha} \right) \right]$$



Scientific context

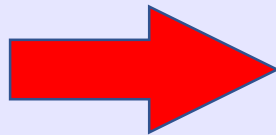
Cross-correlation between Radio and Optical classifications

FRII-HEG: efficient (COLD) accretion



powerful radio emission on large scales and high optical excitation

FRI-LEG: inefficient (HOT) accretion



low radio emission and low optical excitation

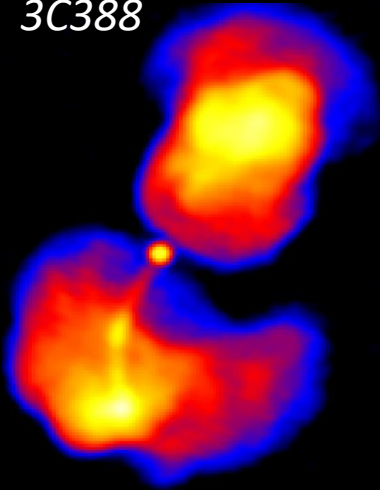
FRII-LEG:

???

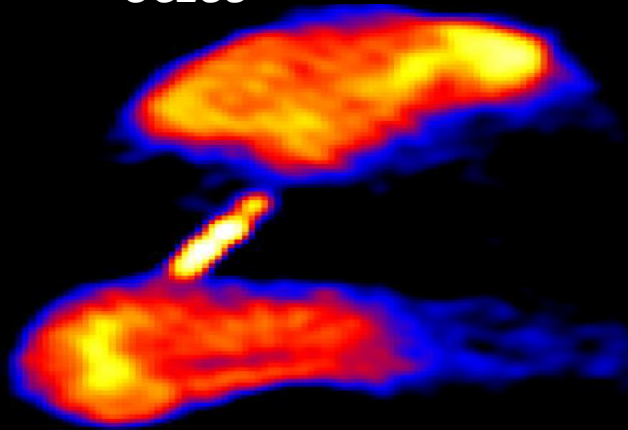
FRII-LEGs

VLA images of FRII-LEERs (1.4 GHz)

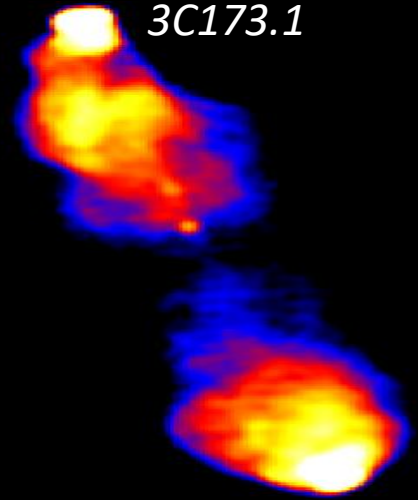
3C388



3C288

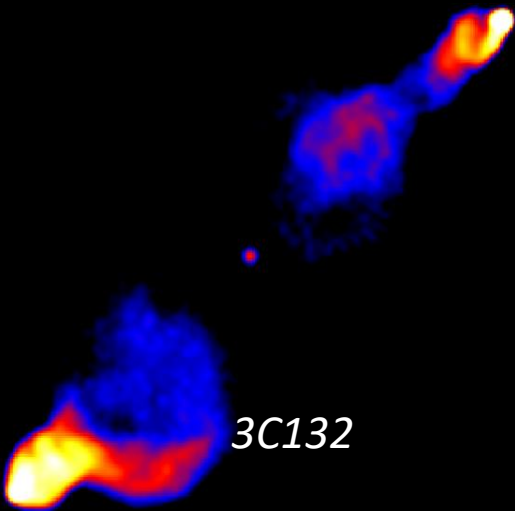


3C173.1

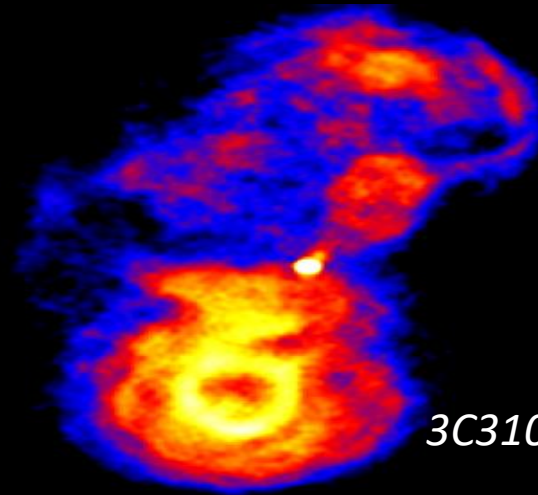


- FRII for radio morphology
- LEG for optical classification

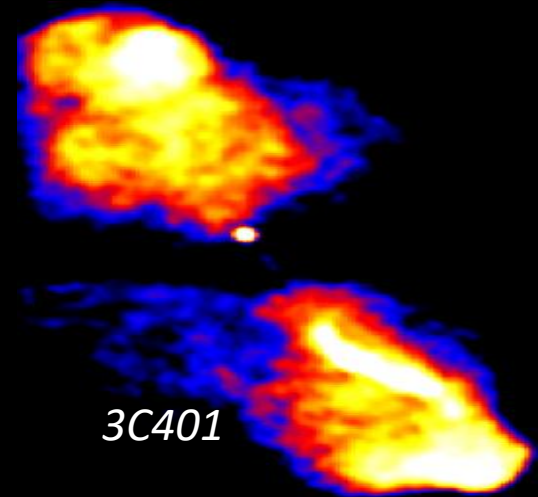
3C132



3C310



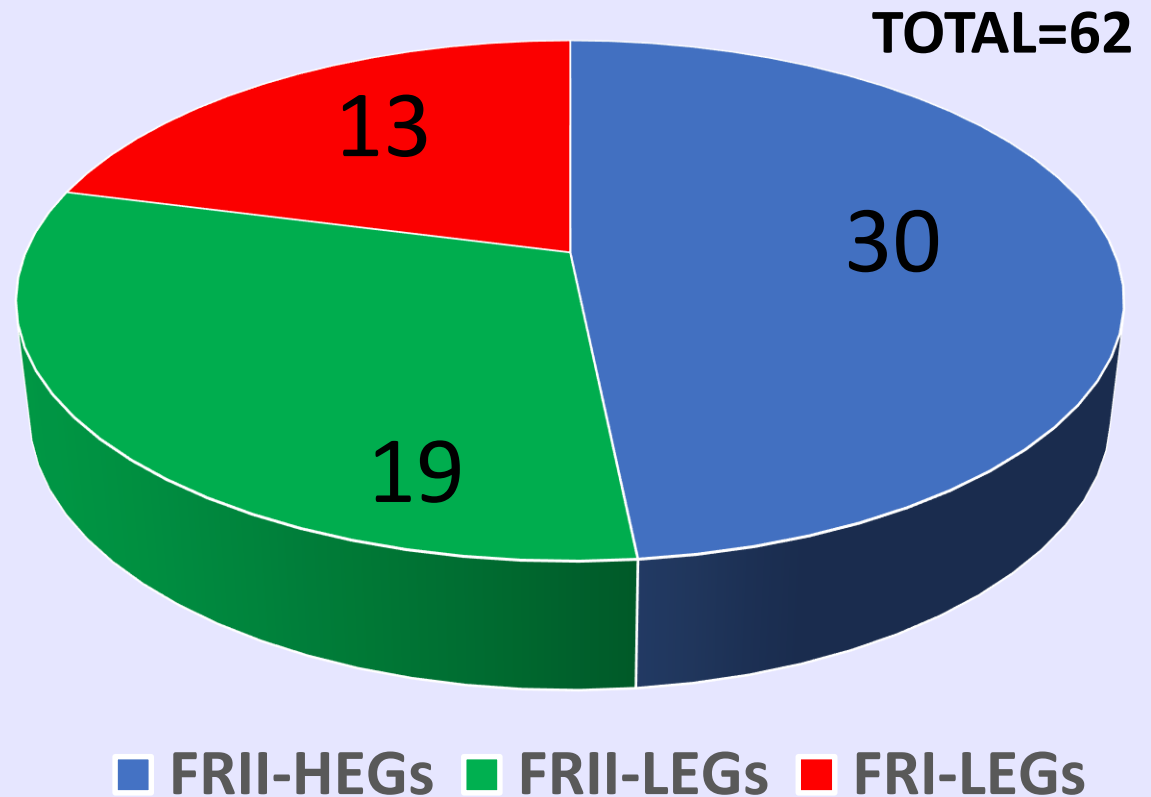
3C401



The Sample

Available data:

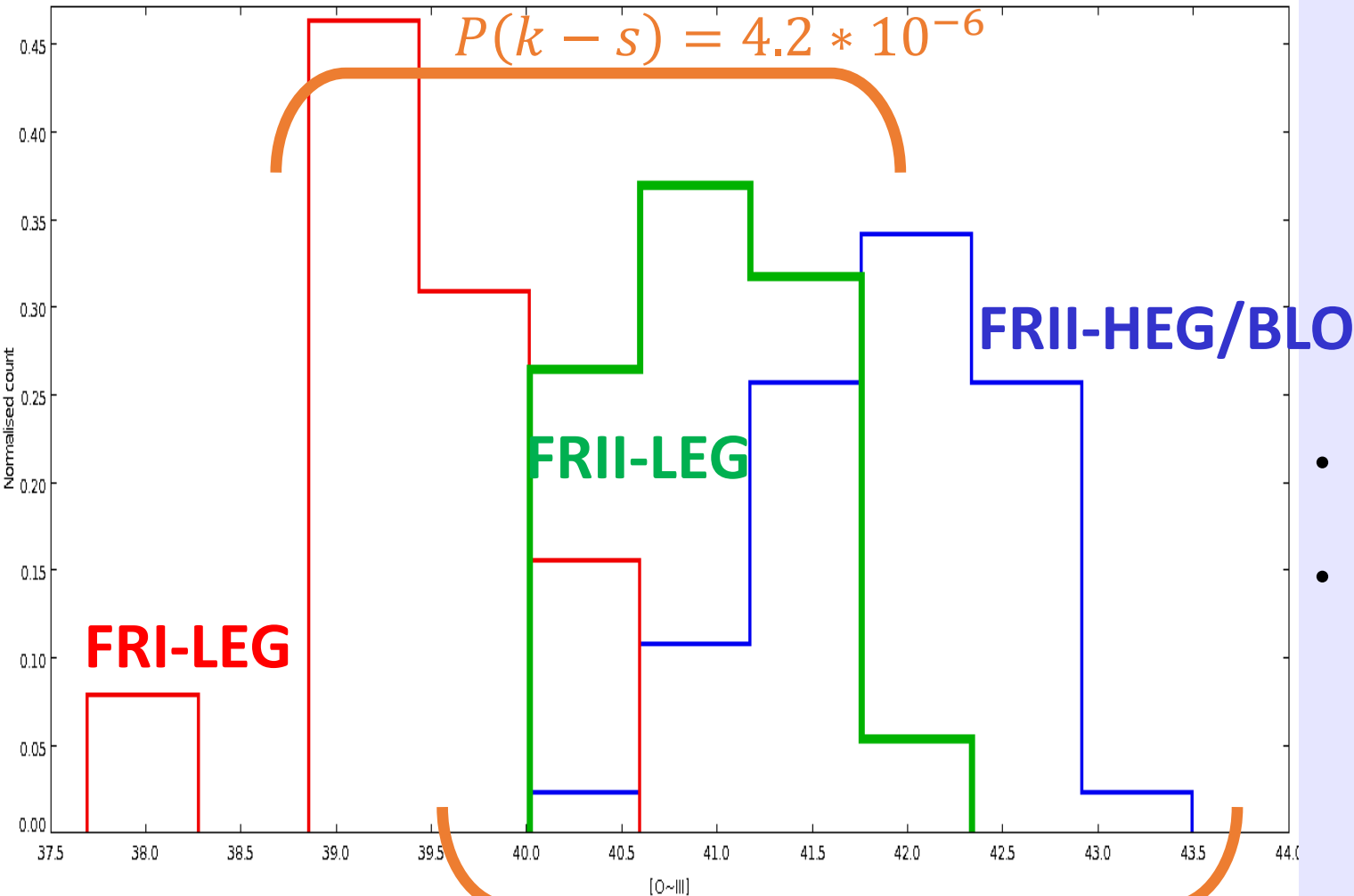
- 3CR catalogue
- 113 sources (northern sky)
- $z < 0.3$
- Radio data: 178MHz and 5GHz luminosity
- Optical spectra: high and low excitation lines
- H-band magnitude



Comparison of the populations on the basis of:

- [OIII] luminosity
- X-ray luminosity
- Intrinsic absorption

[OIII] Luminosity



- $L(\text{FRII-LEG}) \neq L(\text{FRII-HEG/BLO})$
- $L(\text{FRI-LEG}) \neq L(\text{FRII-LEG})$

MEDIAN:

FRII-LEG=40.95

FRII-BLO/HEG=41.81

FRI-LEG=39.41

X-ray analysis

Chandra archival data for:

- 16 FRII-LEGs
- 15 FRII-HEGs

Spectral results:

About half **FRII-LEGs** (8/16) and **FRII-HEGs** (9/15) are intrinsically absorbed

BUT...

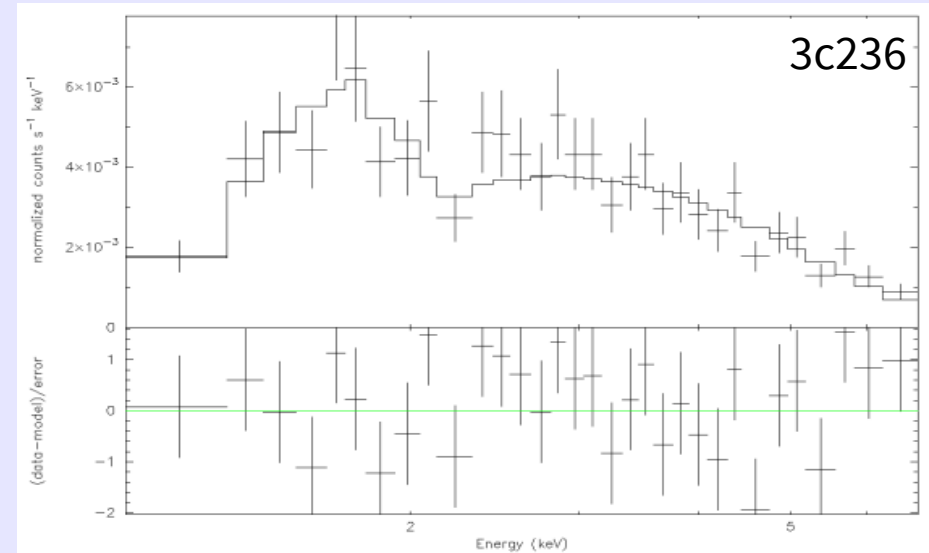
Intrinsic absorption is, on average, **10** times larger for **FRII-HEGs** than for **FRII-LEGs**

Median luminosity (2-10KeV)

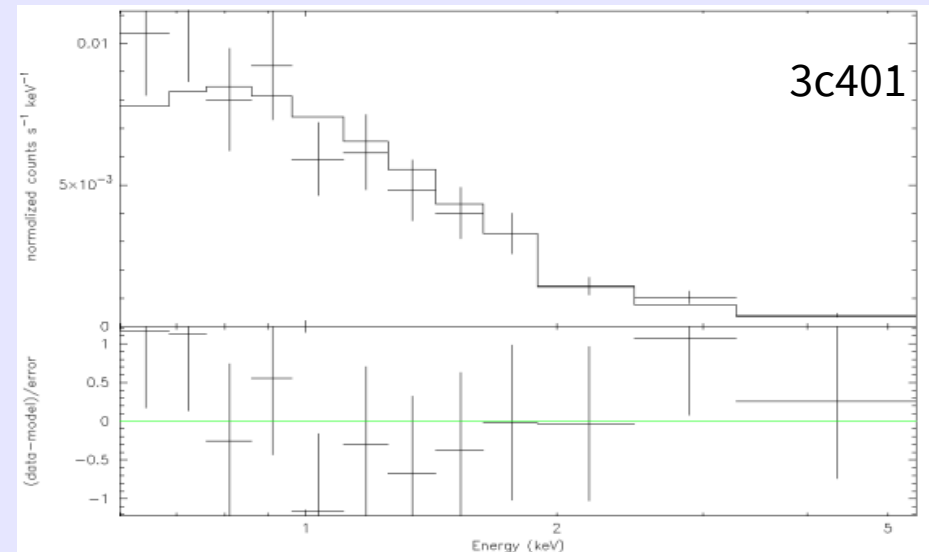
FRII-HEGs = $4.0 * 10^{43}$ erg/s

FRII-LEGs = $1.0 * 10^{43}$ erg/s

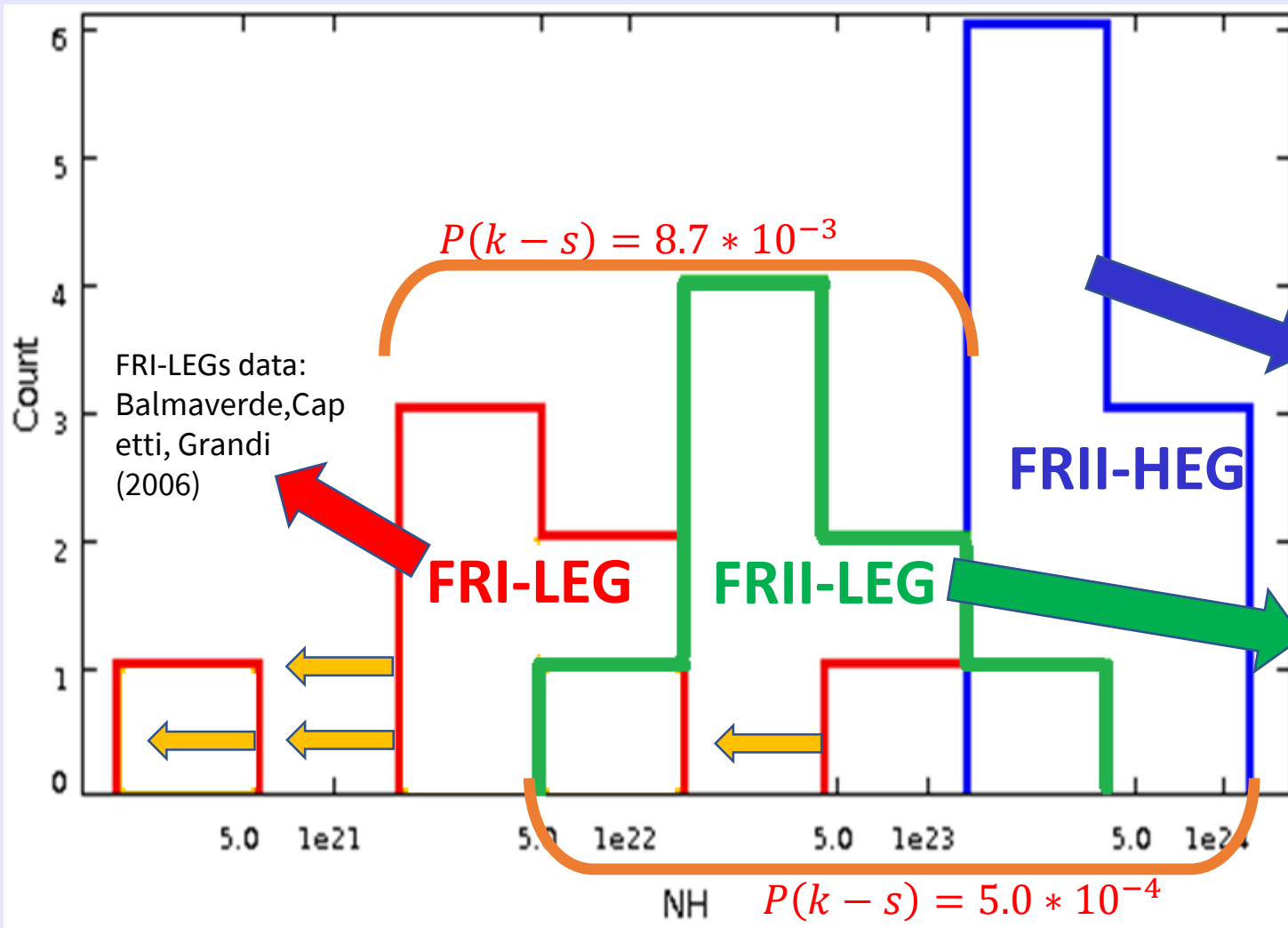
MODEL: phabs*zphabs*po



MODEL: phabs*po



Intrinsic Absorption



FRII-HEGs median N_h
 $3.8 * 10^{23} cm^{-2}$

FRII-LEGs median N_h
 $3.0 * 10^{22} cm^{-2}$

Preliminary results and future work

- $L[\text{OIII}] \text{ FRI} < L[\text{OIII}] \text{ FRII - LERG} < L[\text{OIII}] \text{ FRII - HERG}$
- *X-ray results:*
 - 50% FRII-LERG absorbed in X-ray band, but...
 - $\text{NH FRI} < \text{NH FRII - LERG} < \text{NH FRII - HERG}$

Are FRII LEG intermediate objects? → transition phase?

Next steps:

1. *analysis of XMM-Newton data for 5 sources, already studied with Chandra*
2. *Fuel estimate (surrounding gas)*