Large-scale radio morphology and nuclear accretion in FRII-low-excitation radio galaxies

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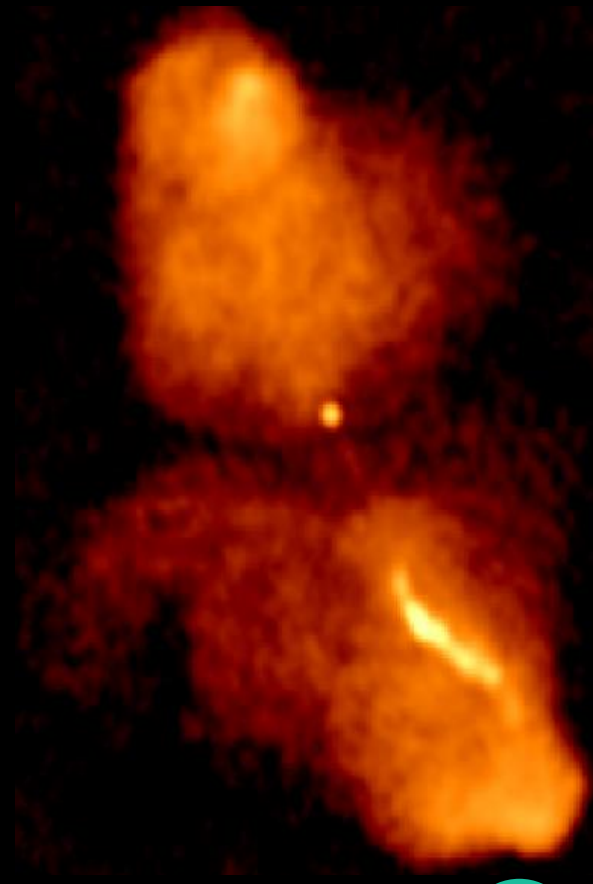

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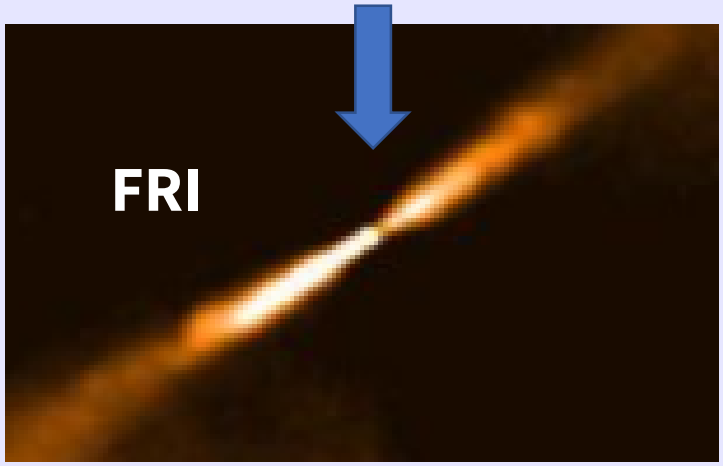
Radio and Optical classification

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

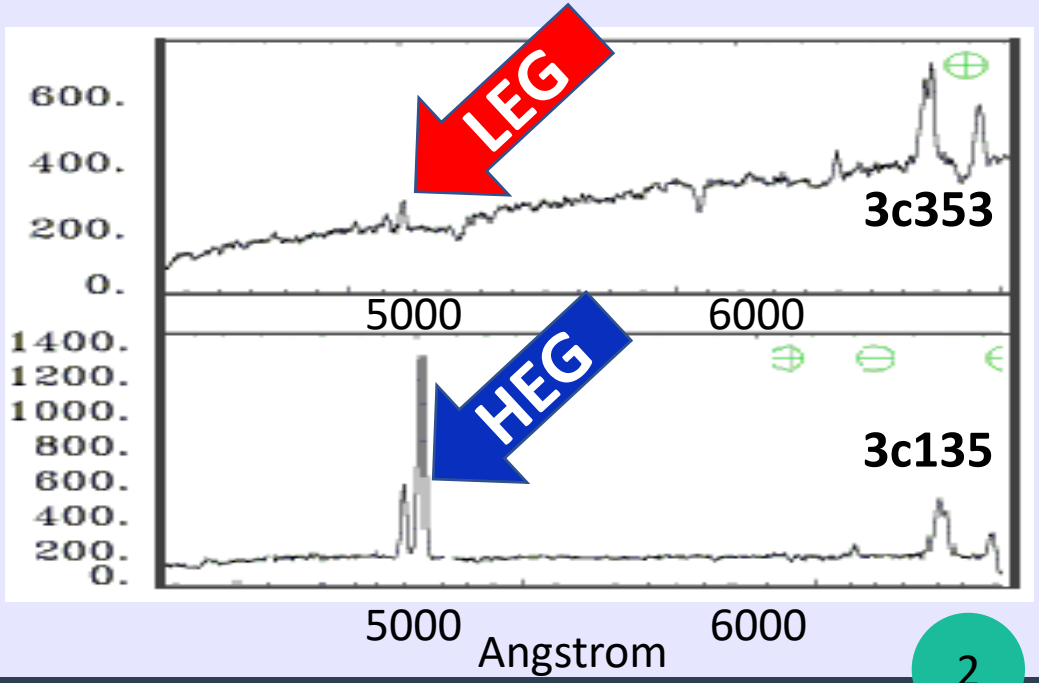


OPTICAL:

EI<0.95 LEG

EI>0.95 HEG

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



Buttiglione et al. (2009,2010,2011)

Scientific context

Cross-correlation between Radio and Optical classifications

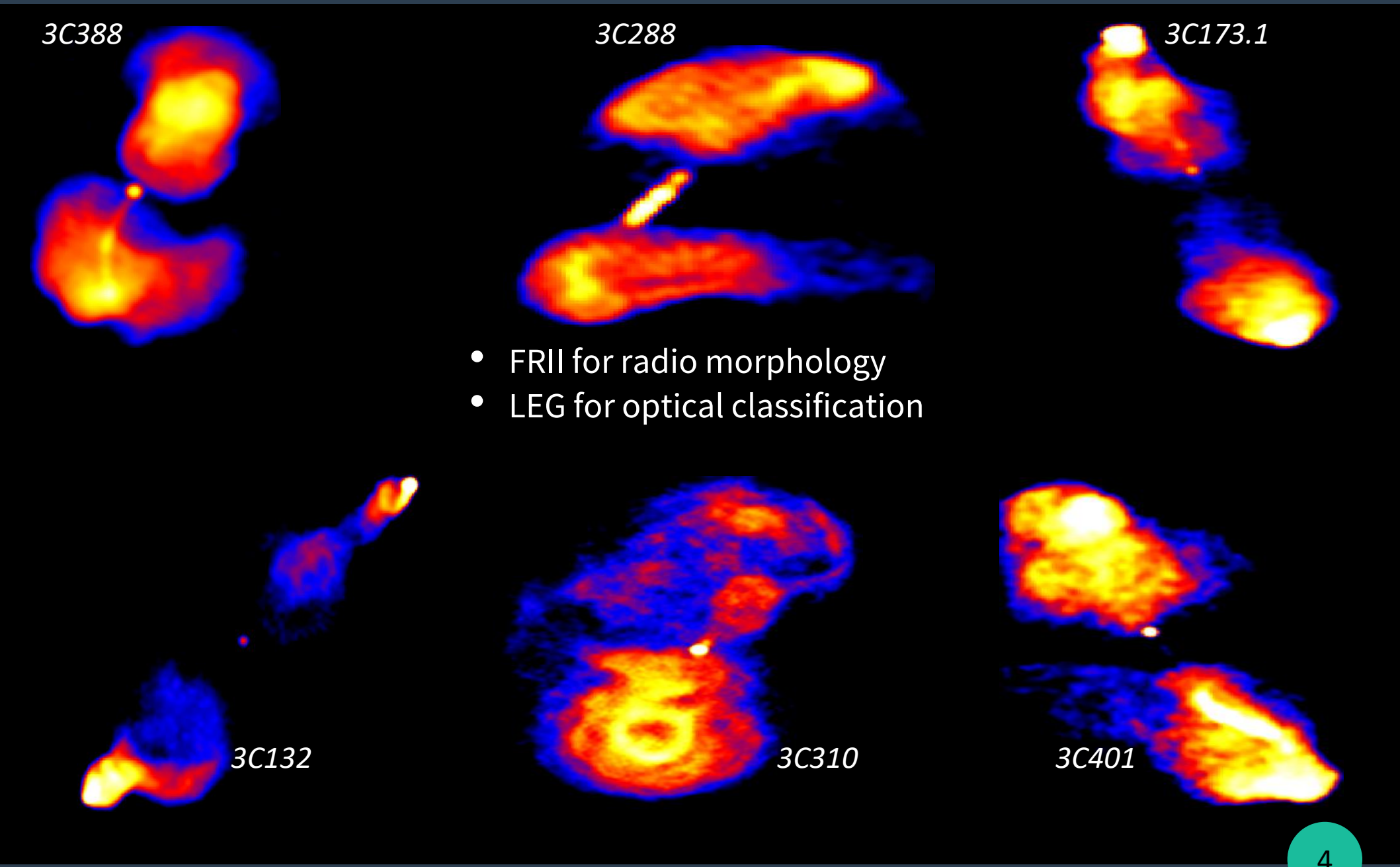
FRII-HEG: efficient (COLD) accretion → powerful radio emission on large scales and high optical excitation

FRI-LEG: inefficient (HOT) accretion → low radio emission and low optical excitation

FRII-LEG: ???

FRII-LEGs

VLA images of FRII-LERs (1.4 GHz)

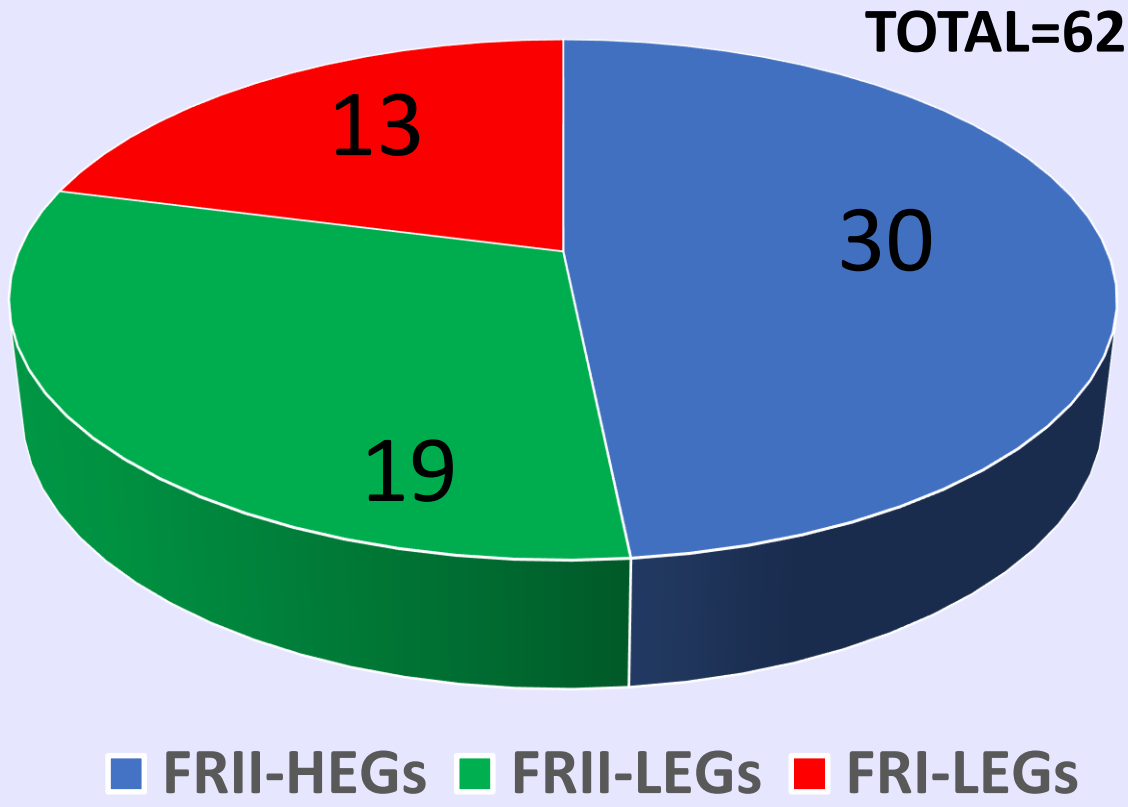


- FRII for radio morphology
- LEG for optical classification

The Sample

Available data:

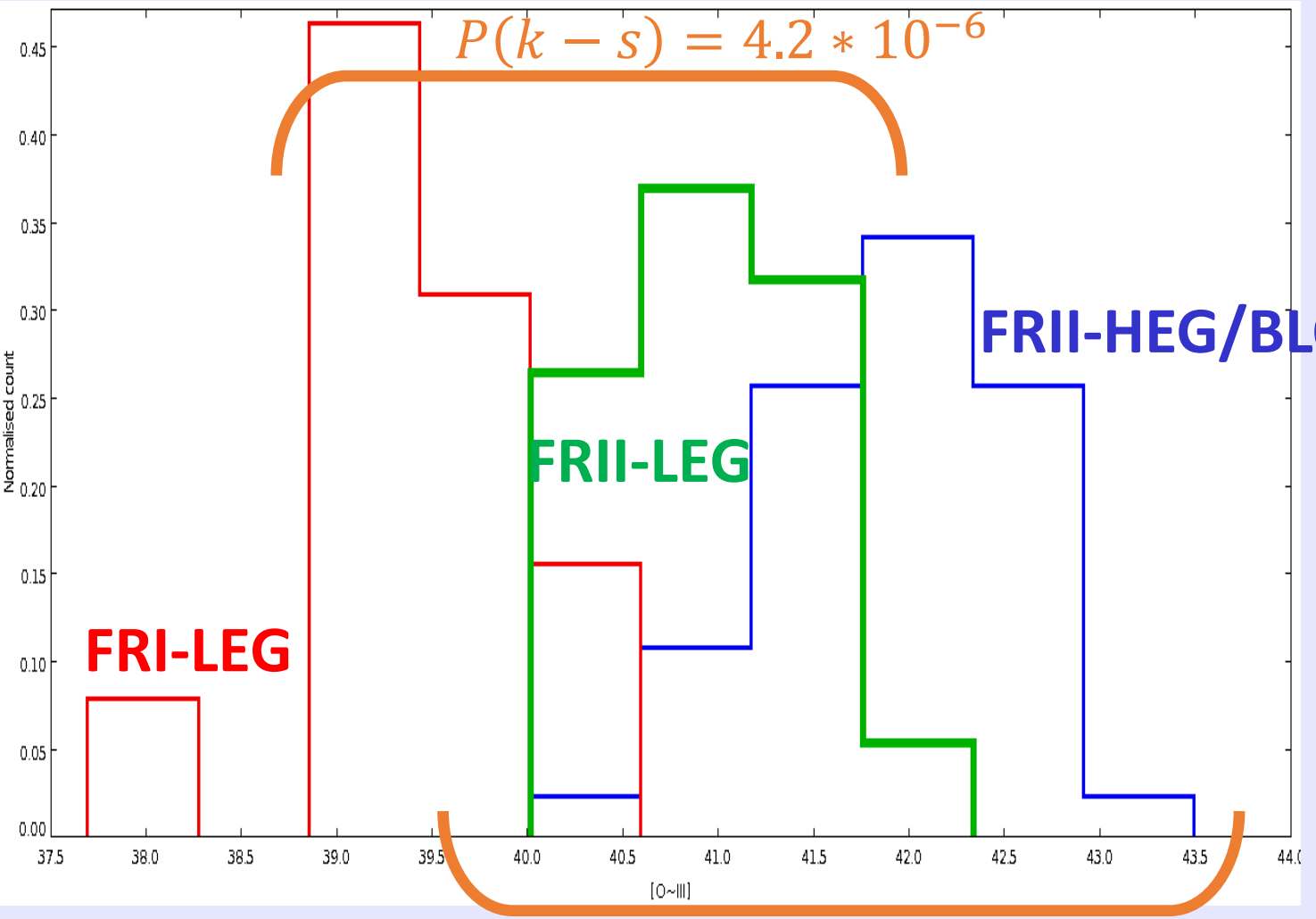
- *3CR catalogue*
- *113 sources (northern sky)*
- *z<0.3*
- *Radio data: 178MHz and 5GHz luminosity*
- *Optical spectra: high and low excitation lines*
- *H-band magnitude*



Comparison of the populations on the basis of:

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

[OIII] Luminosity



- L(FRII-LEG) ≠ L(FRII-HEG/BLO)
- L(FRI-LEG) ≠ L(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…

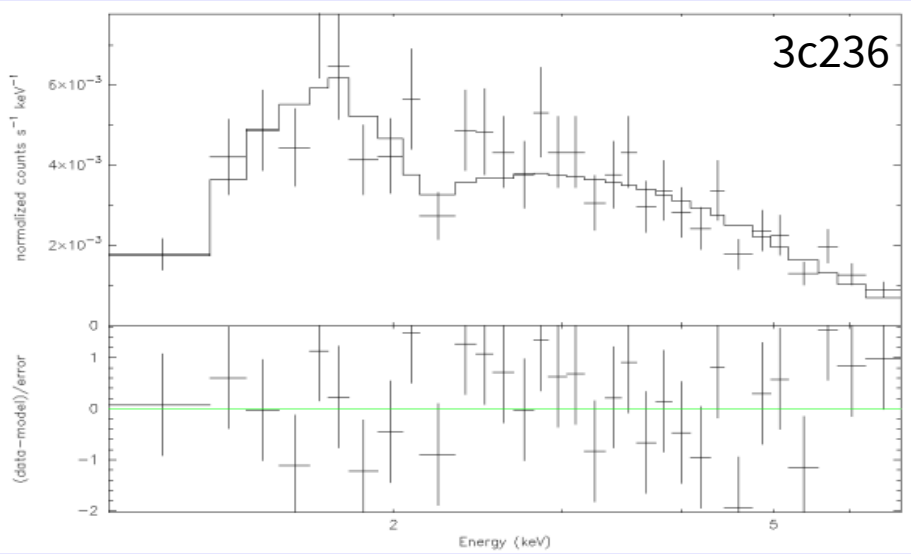
Intrinsic absorption is, on average, **10** times larger for **FRII-HEG**s than for **FRII-LEG**s

Median luminosity (2-10KeV)

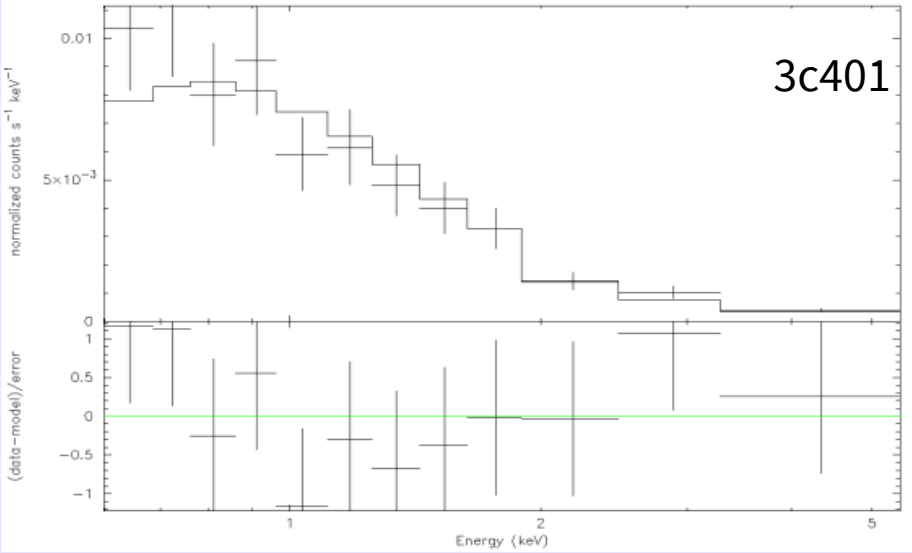
FRII-HEGs=$4.0 * 10^{43}\ erg/s$

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

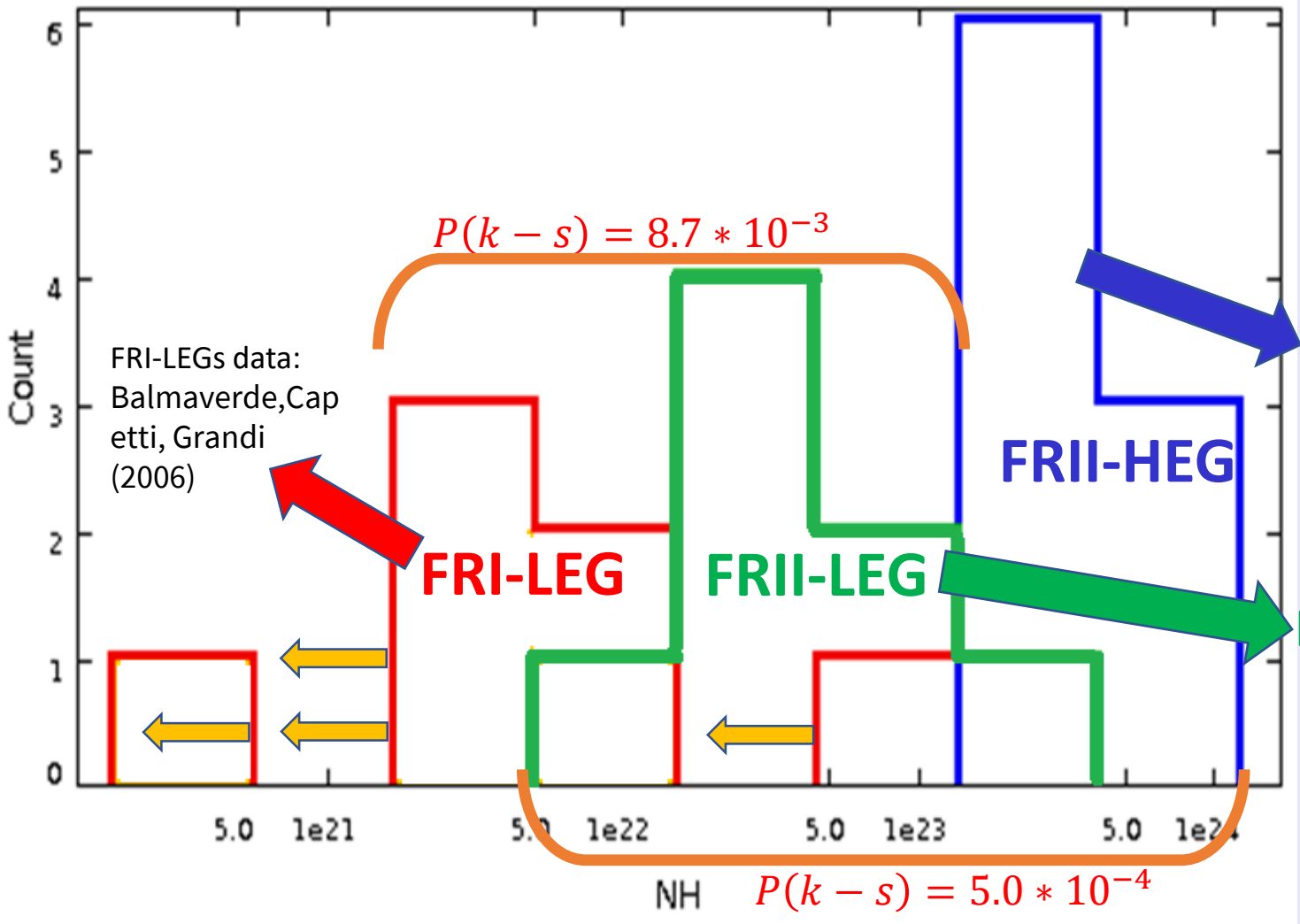
MODEL: phabs*zphabs*po



MODEL: phabs*po



Intrinsic Absorption



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

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

Preliminary results and future work

- *L[OIII] FRI < L[OIII] FRII –LERG < L[OIII] FRII –HERG*

- *X-ray results:*
  - *50% FRII-LERG absorbed in X-ray band , but…*
  - *NH FRI < NH FRII –LERG < NH FRII –HERG*

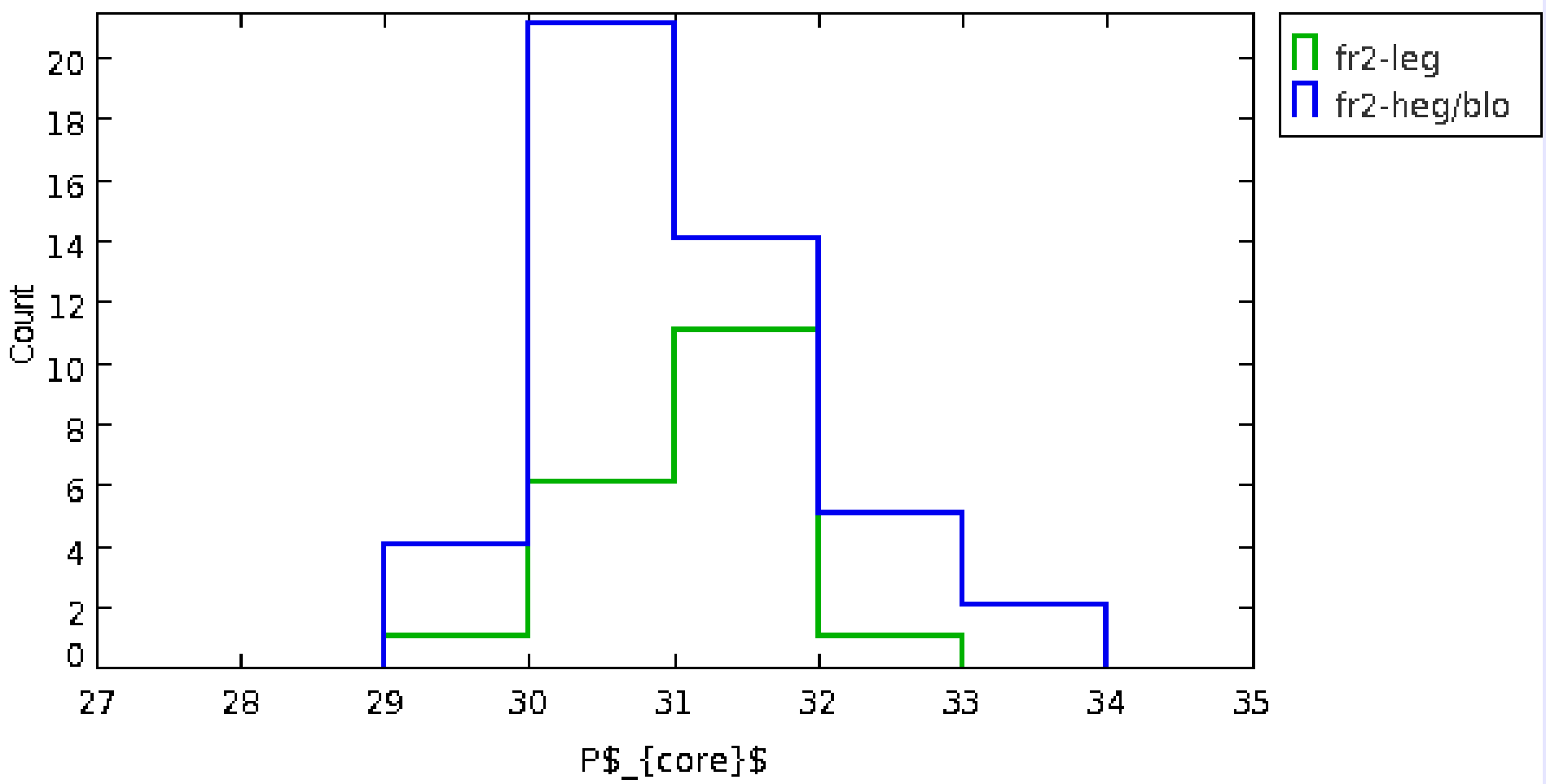
  Are FRII LEG intermediate objects ? → transition phase ?

Next steps:

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

Grazie dell'attenzione!

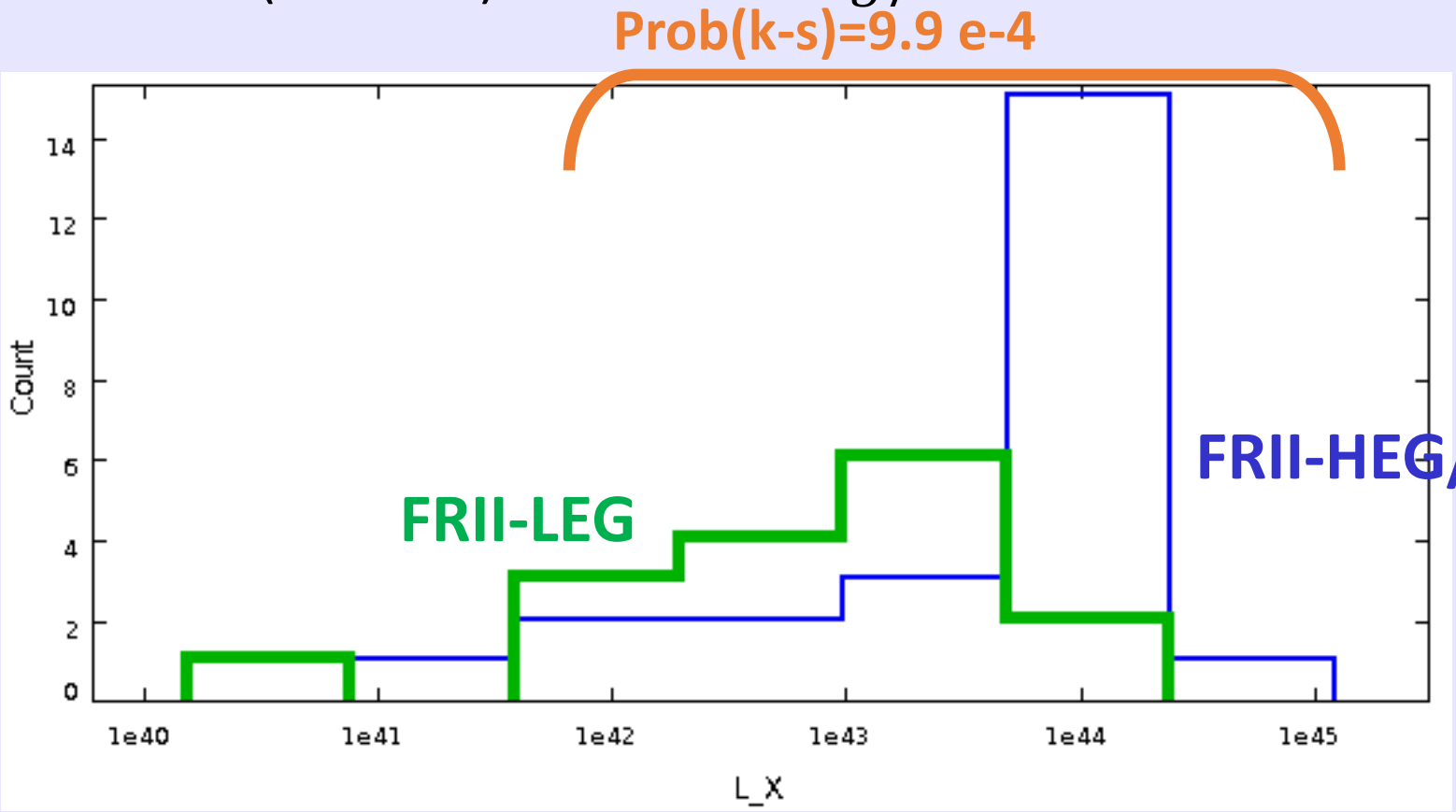
Core Power (5GHz)



X-ray luminosity

FRII-HEGs: median(2-10 KeV)=$4.0 * 10^{43}\ erg/s$

FRII-LEGs: median(2-10KeV)=$1.0 * 10^{43}\ erg/s$



MEDIAN FRII-BLO/HEG=$1.* 10^{44}$