An X-ray/radio sample of Active Galactic Nuclei

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- Brief introduction
- Results
- Conclusions

1. What does Active Galactic Nuclei mean?

- The term AGN refers to:
  - *Extreme luminosities* (L~10^{42} – 10^{46} erg s^{-1}) not produced by stars
  - Luminosity comes from a very compact region (nucleus) → implies the presence of *SMBH*
  - The main and more efficient mechanism to produce energy is accretion → *ACCRETION DISK*

2. Classification of AGN

- radio loud (powerful jets):
  - e.g: radio galaxies, quasars, blazars…
- radio quiet
  - radio quiet quasars (RQQs)
    - Veron ‘06: $M_{ABS} < -23$
  - Seyfert
    - Veron ‘06: $M_{ABS} > -23$

3. Unification Model

- Geometrical effects are important:

➢ **Seyfert 1s**

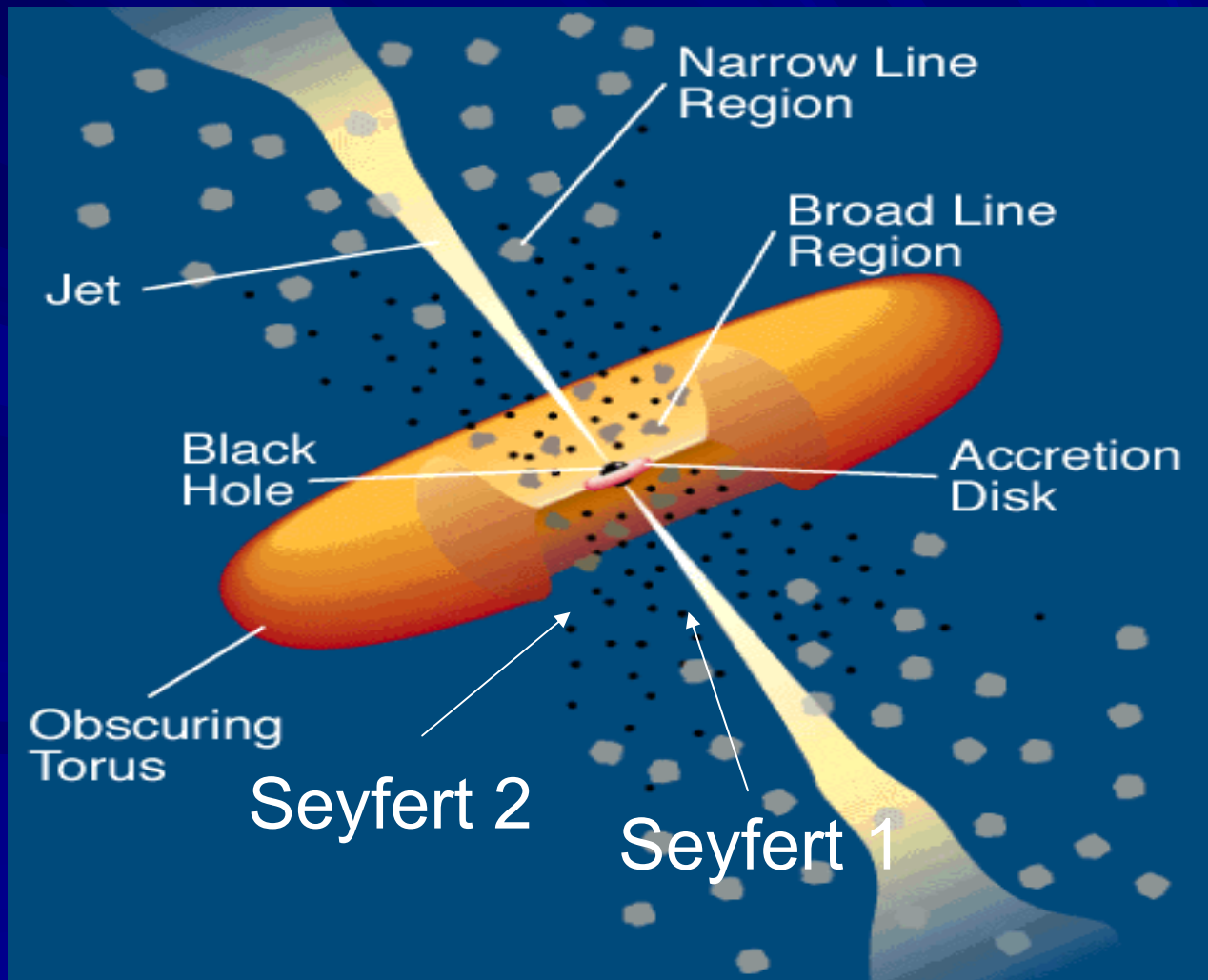
↓

Narrow and broad lines

➢ **Seyfert 2s**

↓

Only narrow lines

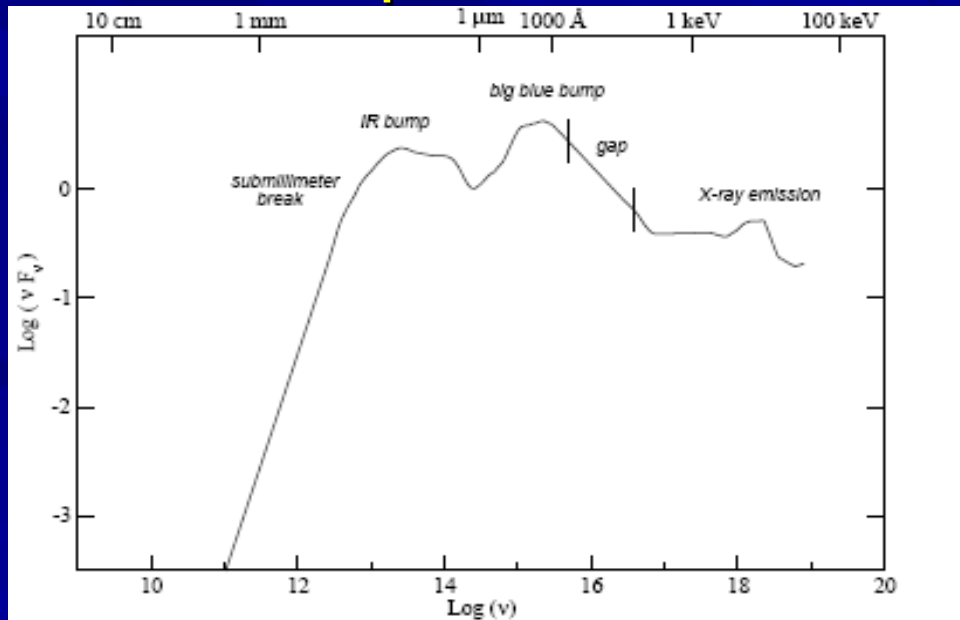


4. AGN emissions:

- Optical/UV band: “big blue bump”→ Accretion Disk
- IR band: thermal emission → Dust (torus)
- Radio → Jet
- X-ray → Comptonization of disk photons
  - Soft: 0.5-2keV
  - Hard: 2-10keV

➢ **Wide spectrum**

➢ **Emission in all bands**



5. Advantages of a multiband analysis

- Each component has a different origin
- Better knowledge of the properties of an AGN
- Main goal of this project: DATA CORRELATION
  - X-ray data (XMM Newton)
  - Radio and optical data (catalogues)
    - Vizier:*http://vizier.u-strasbg.fr/viz-bin/VizieR*
    - NED:*http://nedwww.ipac.caltech.edu/*
    - ADS:*http://adswww.harvard.edu/*
    - SIMBAD:*http://simbad.u-strasbg.fr/*

6. Data

- X-ray:
  - 116 Type 1 AGN targeted by XMM-Newton
  - Luminosities in both bands: hard & soft
  - Main spectral properties (iron line, spectral index…)
- Optical:
  - M_{ABS} to distinguish between Quasars and Seyfert
- Radio:
  - Flux in 6cm (5GHz) and 20cm (1.4GHz)

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REFERENCES (RQQ):
(1) Veron 2006 Quasars and Active Galactic Nuclei
(2) Kellerman 1989 VLA observations of objects in the Palomar Bright Quasar Survey
(reference in Veron for data, some with upper limit (#) <0.25mJy)
(3) Kuhn 2001 A Search for Signatures of Quasar Evolution
(reference in Veron for data, with upper limit (#))
(4) Condon 1998
(5) Gregory 1996
REFERENCES (Sy1):
(1) Veron 2006 Quasars and Active Galactic Nuclei
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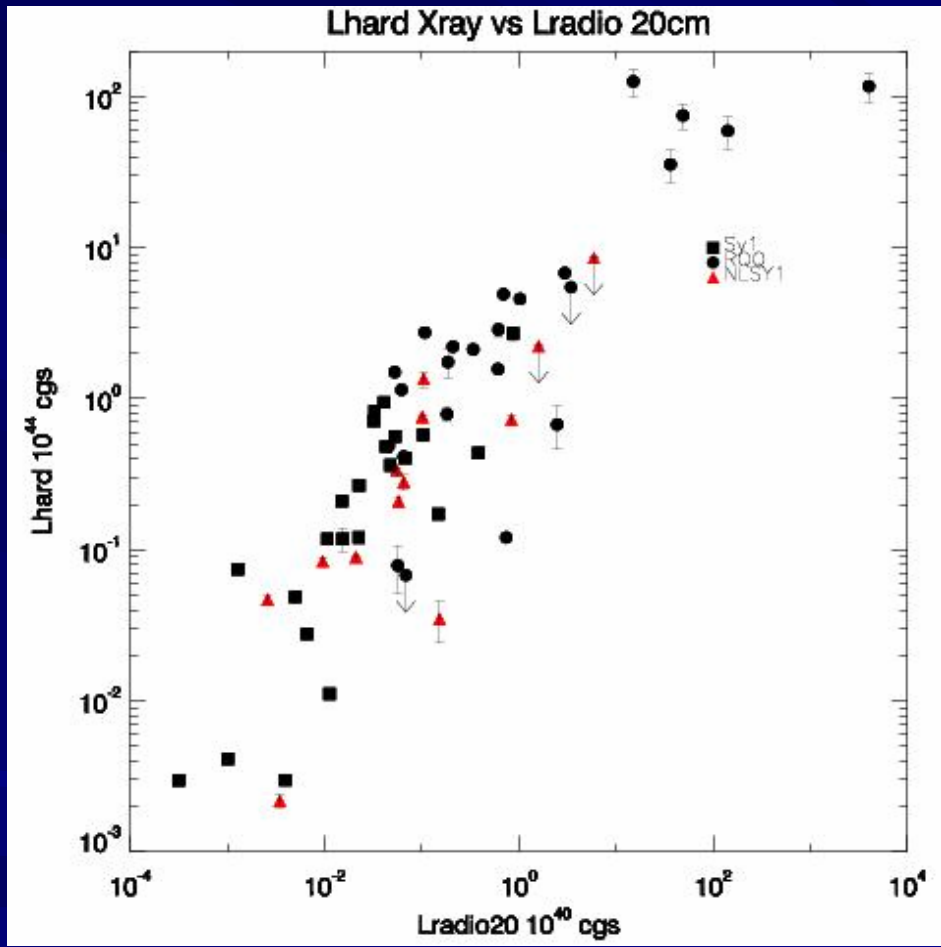
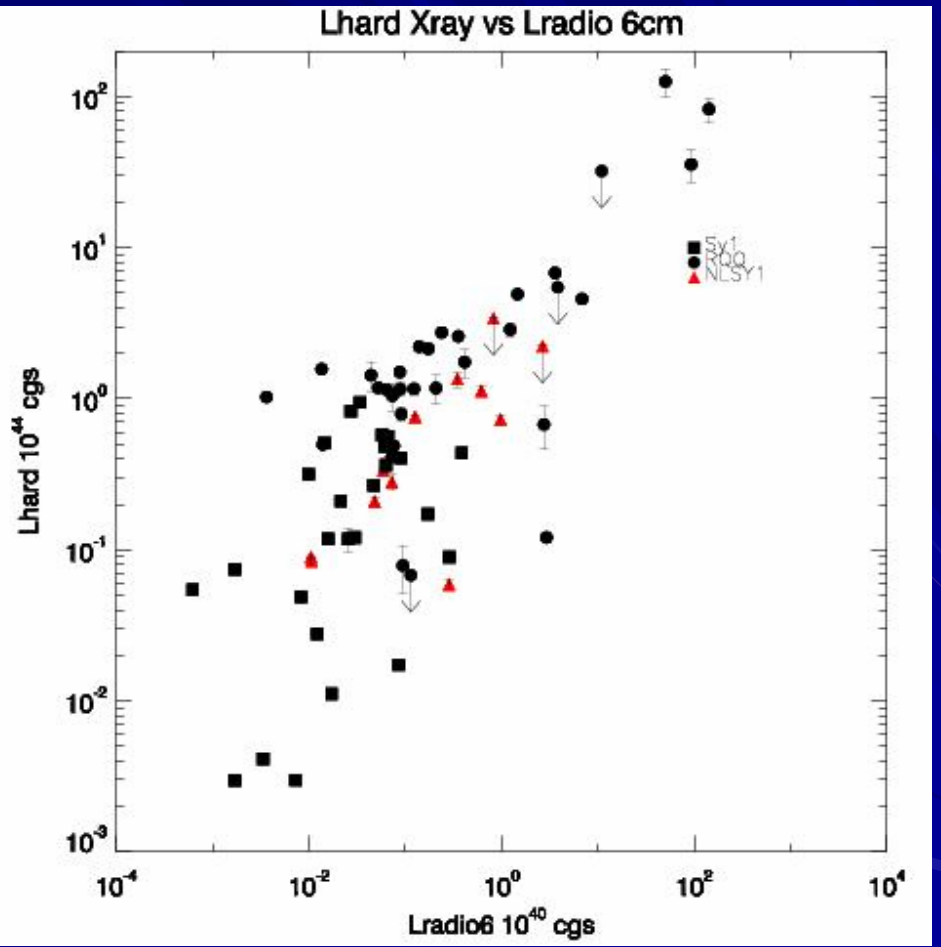
(reference in Veron for data, some with upper limit (#) <0.25mJy)
(3) Gregory 1991
REFERENCES(NLSY)
(1) Veron 2006 Quasars and Active Galactic Nuclei
(2) Kellerman 1989 VLA observations of objects in the Palomar Bright Quasar Survey

7. Example of a table of data: NLSY

COORDENATES	NAME	RAJ2000	DEJ2000	F6CM	RF	F20CM	RF	MABS
107.172917 -49.551778	1H0707-495	07 08 41.5	-49 33 06					-20.9
340.663939 29.725364	AKN564	22 42 39.3	+29 43 32	0.009	1	0.028	1	-21.0
207.143750 26.368611	E1346+266	13 48 34.3	+26 22 07			0.001	1	-25.0
201.330333 -38.41486	IRAS13224-3809	13 25 19.2	-38 24 54			0.006	1	-24.2
204.328032 24.384242	IRAS13349+2438	13 37 18.8	+24 23 04	0.007	1	0.020	1	-24.1
13.395585 12.693390	IZW1	00 53 34.9	+12 41 36	0.003	1	0.008	1	-23.4
37.522704 -8.997943	MRK1044	02 30 05.5	-08 59 53			0.003	1	-20.3
21.885635 19.178833	MRK359	01 27 32.5	+19 10 44			0.004	1	-20.2
220.531097 35.439701	MRK478	14 42 07.5	+35 26 23	0.001	1	0.003	1	-23.4
239.790109 35.029865	MRK493	15 59 09.6	+35 01 47	0.001	1	0.003	1	-20.7
184.610456 29.812872	MRK766	12 18 26.5	+29 48 47	0.006	1	0.040	1	-20.1
311.586954 -2.812579	MRK896	20 46 20.8	-02 48 45	0.038	1			-20.8
31.957764 2.715532	NAB0205+024	02 07 49.8	+02 42 55	0.002	1			-24.2
213.311942 -3.207487	NGC5506	14 13 14.8	-03 12 26	0.132	1	0.331	1	-17.9
211.317479 25.926369	PG1402+261	14 05 16.2	+25 55 34	0.001	1	0.001	1	-24.5
222.786542 27.157500	PG1448+273	14 51 08.8	+27 09 27	0.001	1	0.004	1	-23.0
236.376000 48.769194	PG1543+489	15 45 30.2	+48 46 10	0.001	1	0.002	1	-25.0
339.032000 13.732028	PG2233+134	22 36 07.7	+13 43 55	0.0005	2			-25.0
24.982505 6.322593	PHL1092	01 39 55.8	+06 19 21					-25.2
158.660829 39.641158	RE1034+396	10 34 38.6	+39 38 29			0.026	1	-21.4
46.664875 0.062000	RXJ0306.6+0003	03 06 39.5	+00 03 44			0.004	1	-20.8
50.813792 -49.518389	RXJ0323.2-4931	03 23 15.3	-49 31 07					-21.7
340.481250 -44.081944	RXJ2241.8-4405	22 41 55.3	-44 04 58					-26.9
14.333101 -22.383083	TONS180	00 57 20.2	-22 22 56					-23.3

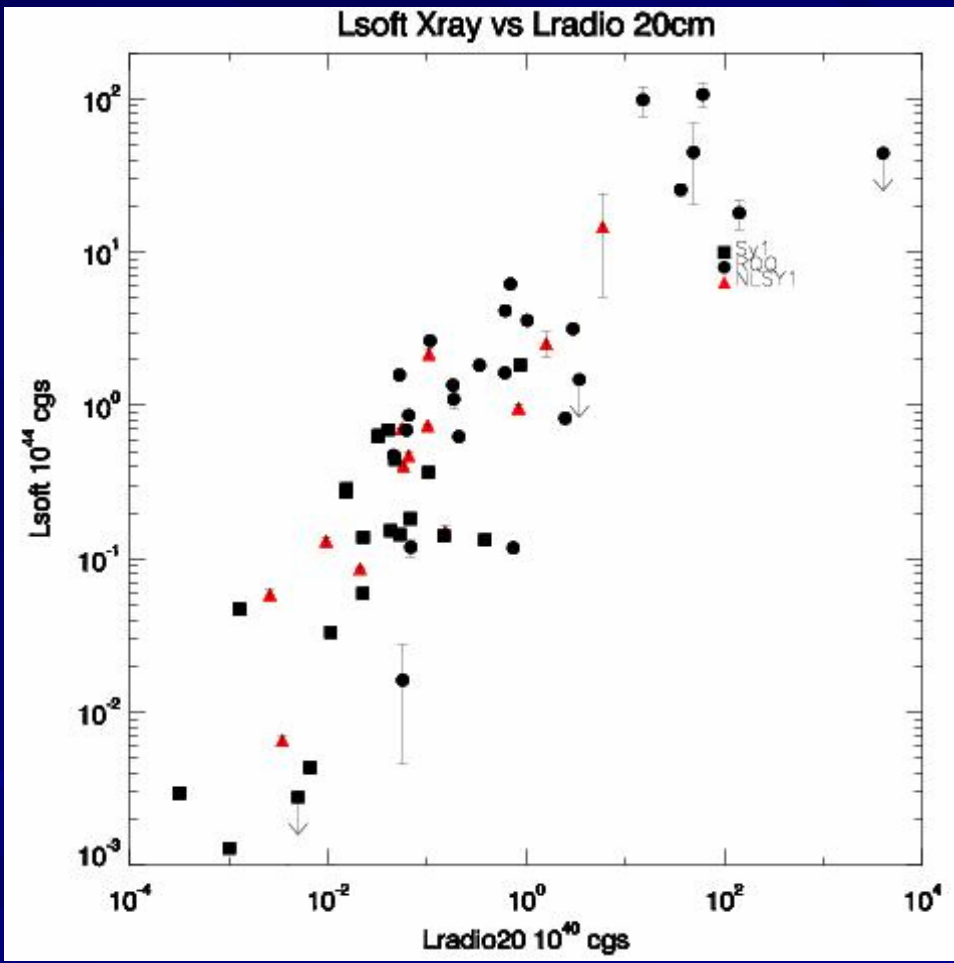
8. Final results: HIGH ENERGY band [2-10keV]

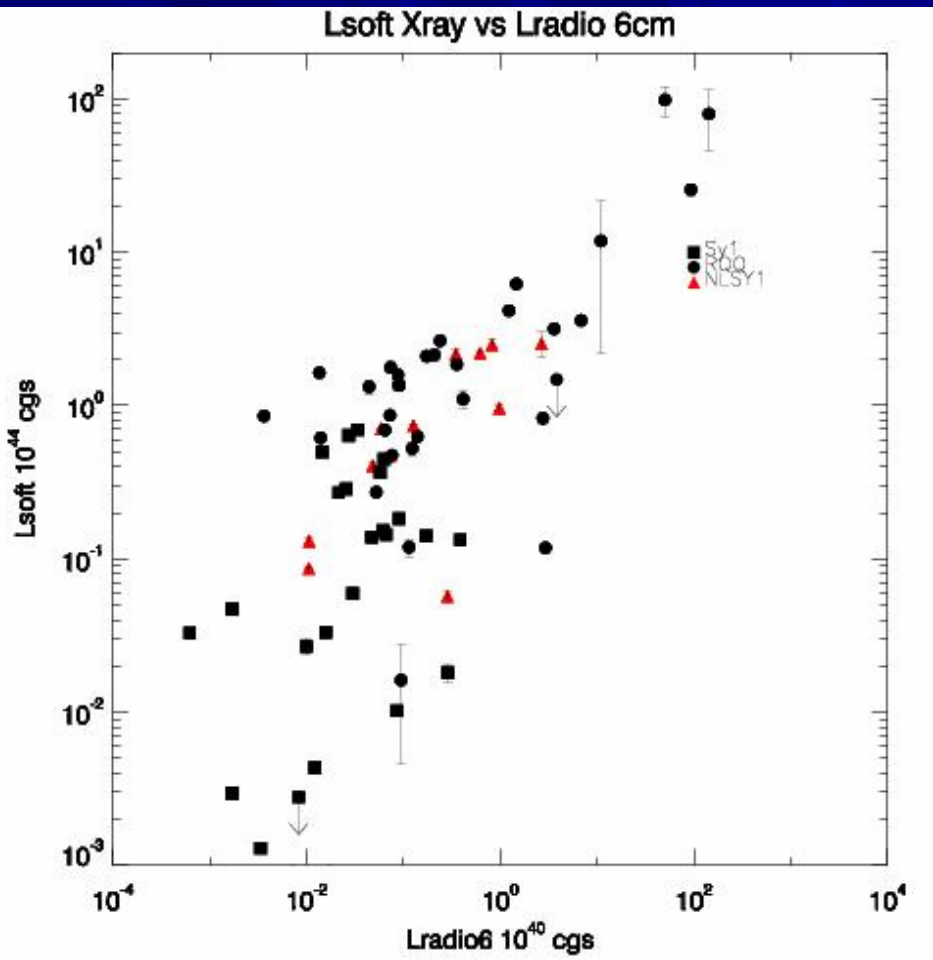




→ GOOD CORRELATION: no differences between objects

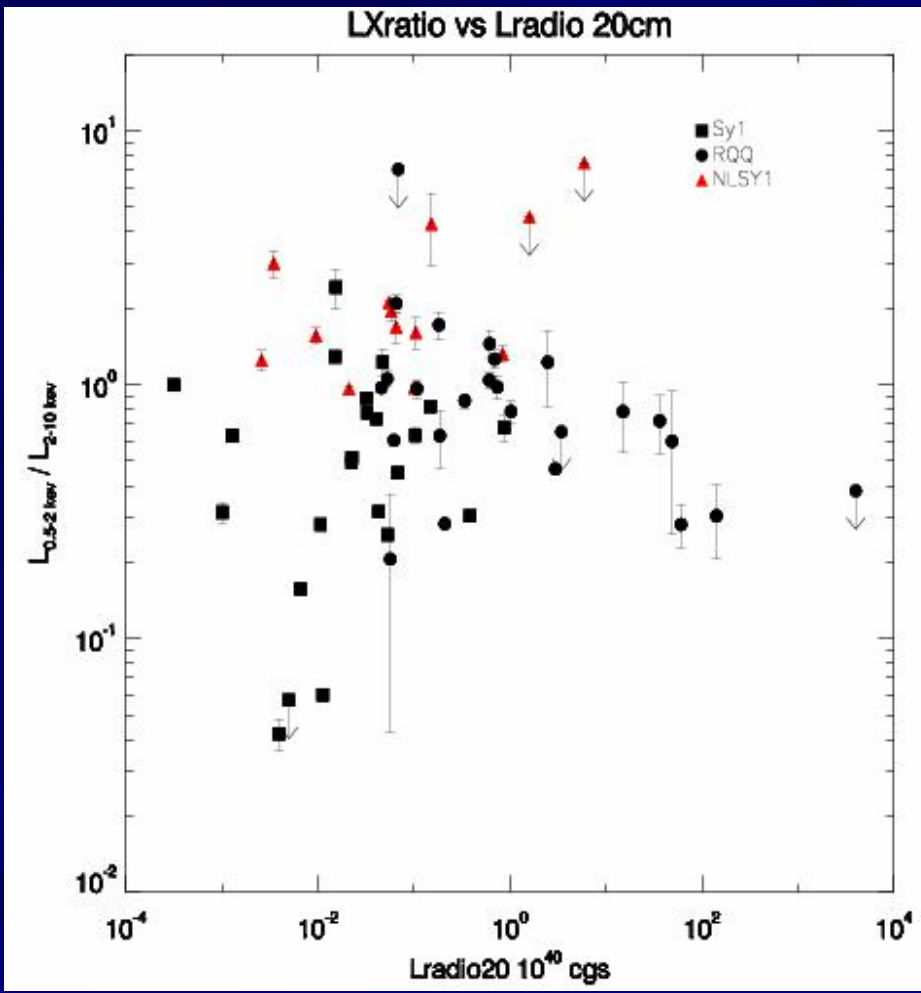
8. Final results: LOW ENERGY band [0.5-2keV]

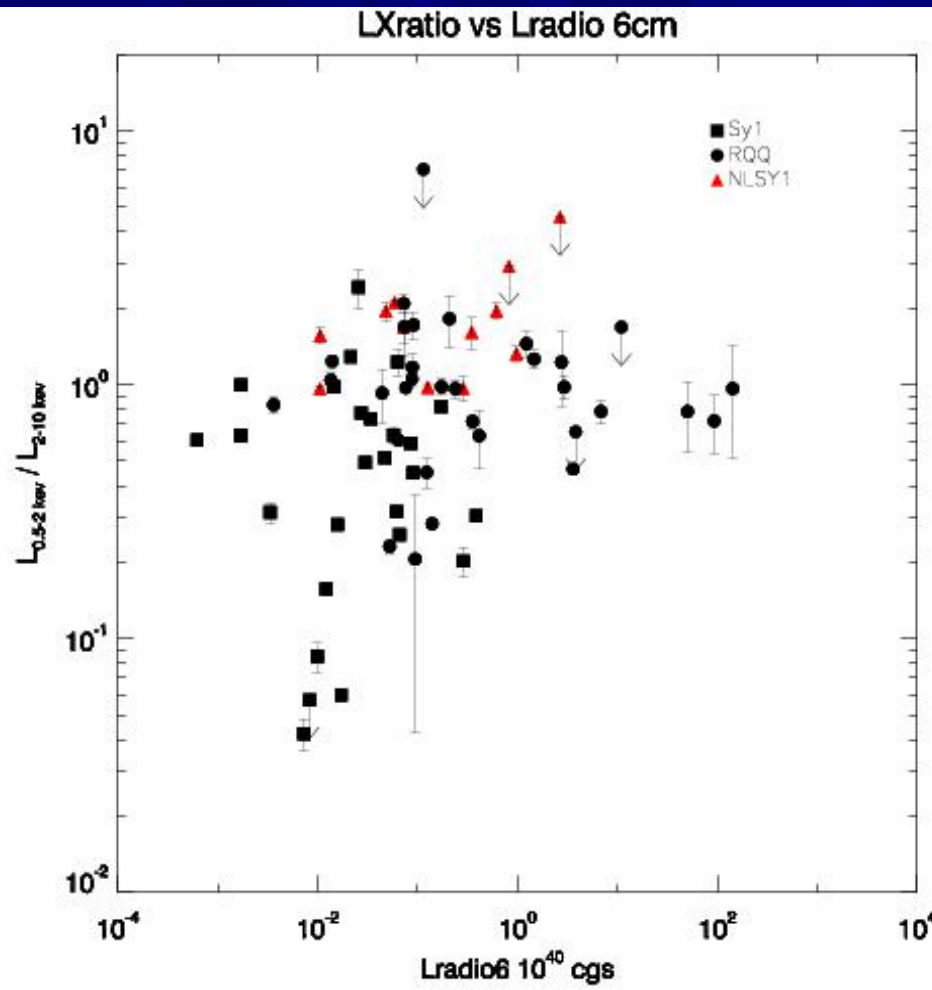




→ GOOD CORRELATION: no differences between objects

8. Final results: ratio SOFT/HIGH bands





→ NLSY (red): higher soft excess than other sources

→ No evidence of correlation with radio

9. Further analysis

- Searching FWHM Hβ in literature to reclassify sources:
  - Narrow lines < 2000km/s
  - Broad lines > 2000km/s
- Analysis in other bands
- Further analysis with other parameters and correlations

10. Conclusions

- Search in catalogs for data:
  - M_{ABS} to separate Quasars and Seyfert
  - Radio fluxes looking for correlations
  - FWHM to reclassify in NL and BL
- Results:
  - Good correlation between X-ray/radio
    - Both emissions related with main parameters of AGN (mass, accretion rate…)
    - Not depends on the object
  - Large soft excess in NLSY