AGN TORUS DISAPPEARANCE

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On the LINER nuclear obscuration, Compton-thickness and the existence of the dusty torus

Clues from *Spitzer*/IRS spectra

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O. González-Martín, EWASS, Tenerife 2015

INTRODUCTION

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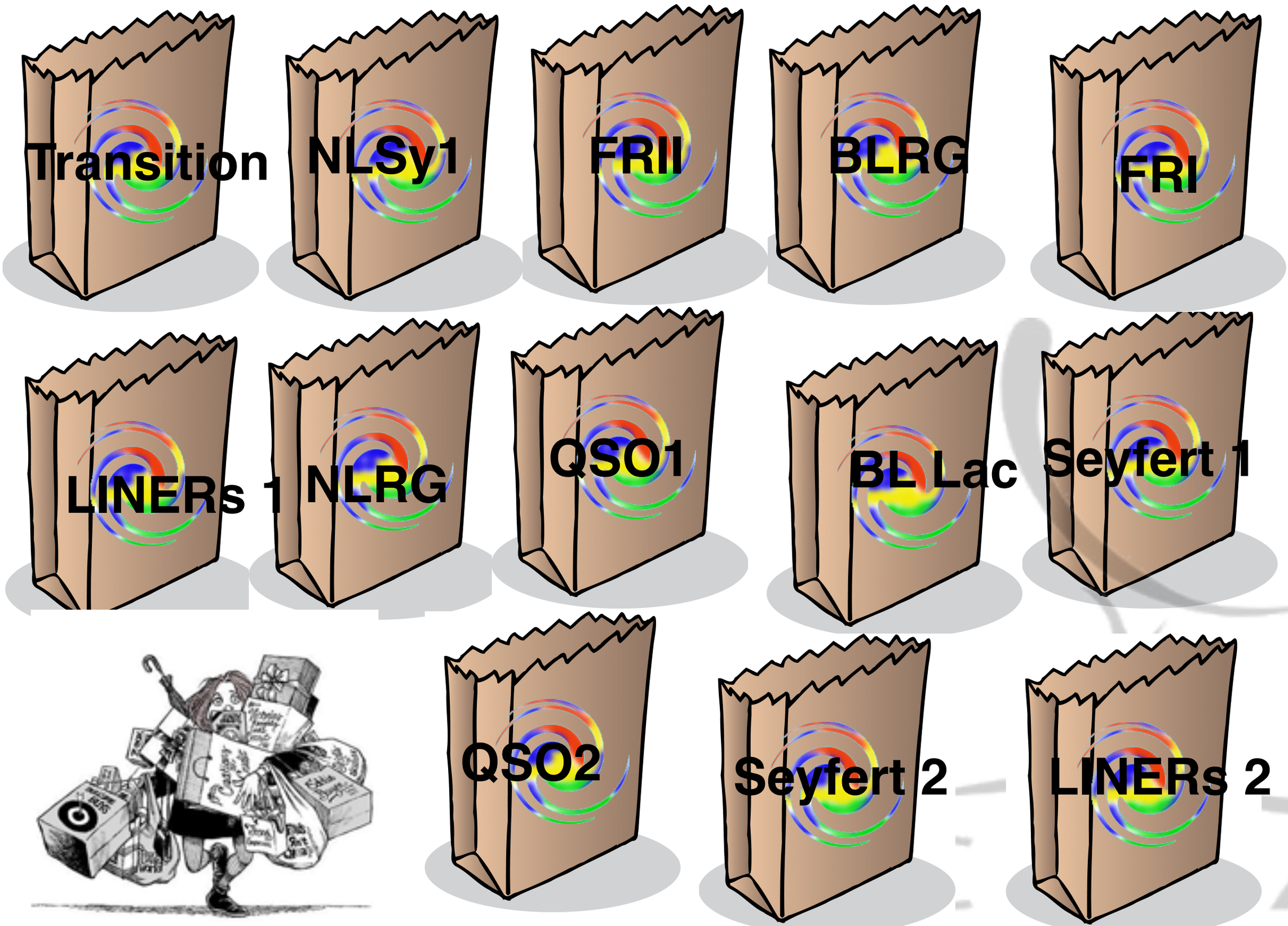

INTRODUCTION

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THE AGN/NORMAL GALAXY CONNECTION : SUMMARY [1]

A. Lawrence 1999

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ABSTRACT

The connection between normal and active galaxies is reviewed, by summarizing our progress on answering nine key questions. (1) Do all galaxies contain massive dark objects (MDOs)? (2) Are these MDOs actually supermassive black holes? (3) Why are the dark objects so dark? (4) Do all galaxies contain an Active Galactic Nucleus (AGN)? (5) Are the "dwarf AGN " really AGN? (6) Does AGN activity correlate with host galaxy properties? (7) How are AGN fuelled? (8) Is AGN activity related to starburst activity? (9) How do quasars relate to galaxy formation?

INTRODUCTION

THE AGN OBSCURING TORUS — END OF THE "DOUGHNUT" PARADIGM?

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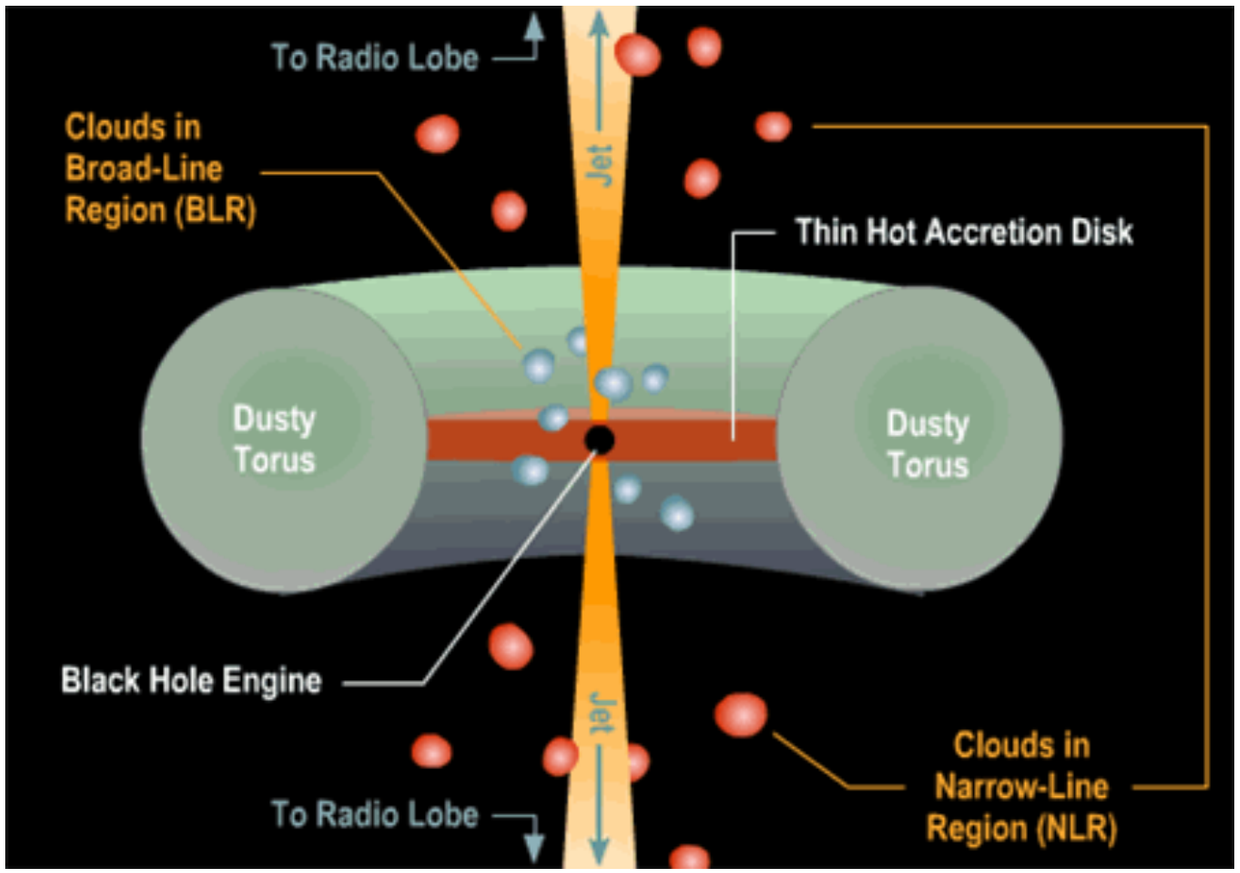
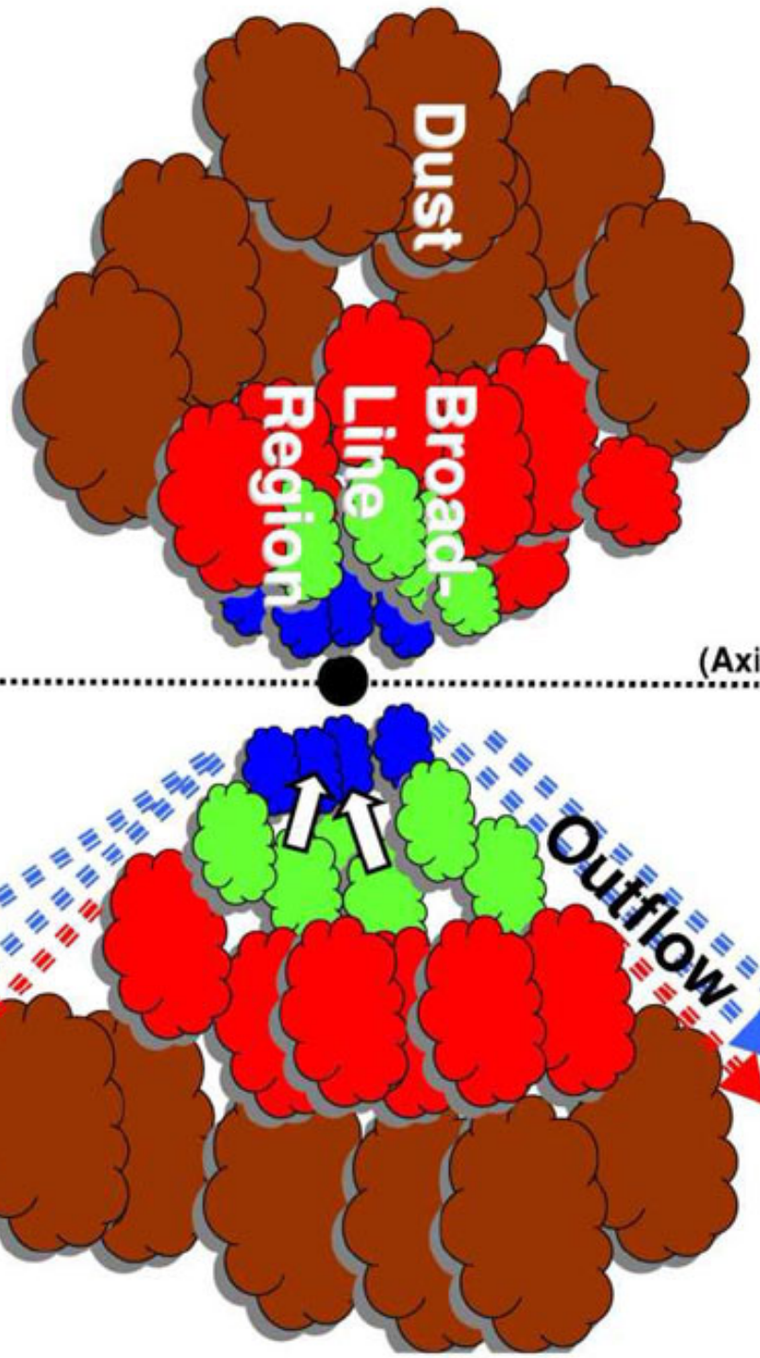
ABSTRACT

Unified schemes of active galactic nuclei (AGN) require an obscuring dusty torus around the central engine. The compact sizes (only a few pc) determined in recent high-resolution observations require that the obscuring matter be clumpy and located inside the region where the black-hole gravity dominates over the galactic bulge. This location is in line with the scenario depicting the torus as the region of the clumpy wind coming off the accretion disk in which the clouds are dusty and optically thick. We study here the outflow scenario within the framework of hydromagnetic disk winds, incorporating the cloud properties determined from detailed modeling of the IR emission from clumpy tori. We find that torus clouds were likely detected in recent water maser observations of NGC 3079. In the wind scenario, the AGN main dynamic channel for release of accreted mass seems to be switching at low luminosities from torus outflow to radio jets. The torus disappears when the bolometric luminosity decreases below $\sim 10^{42}$ erg s^{-1} because the accretion onto the central black hole can no longer sustain the required cloud outflow rate. This disappearance seems to have been observed in both LINERs and radio galaxies. With further luminosity decrease, suppression of cloud outflow spreads radially inward from the disk's dusty, molecular region into its atomic, ionized zone, resulting in disappearance of the broad emission line region at lower luminosities, yet to be determined.





SAMPLE

40 LINERs/LLAGN observed with Spitzer/IRS (ULIRGs excluded)

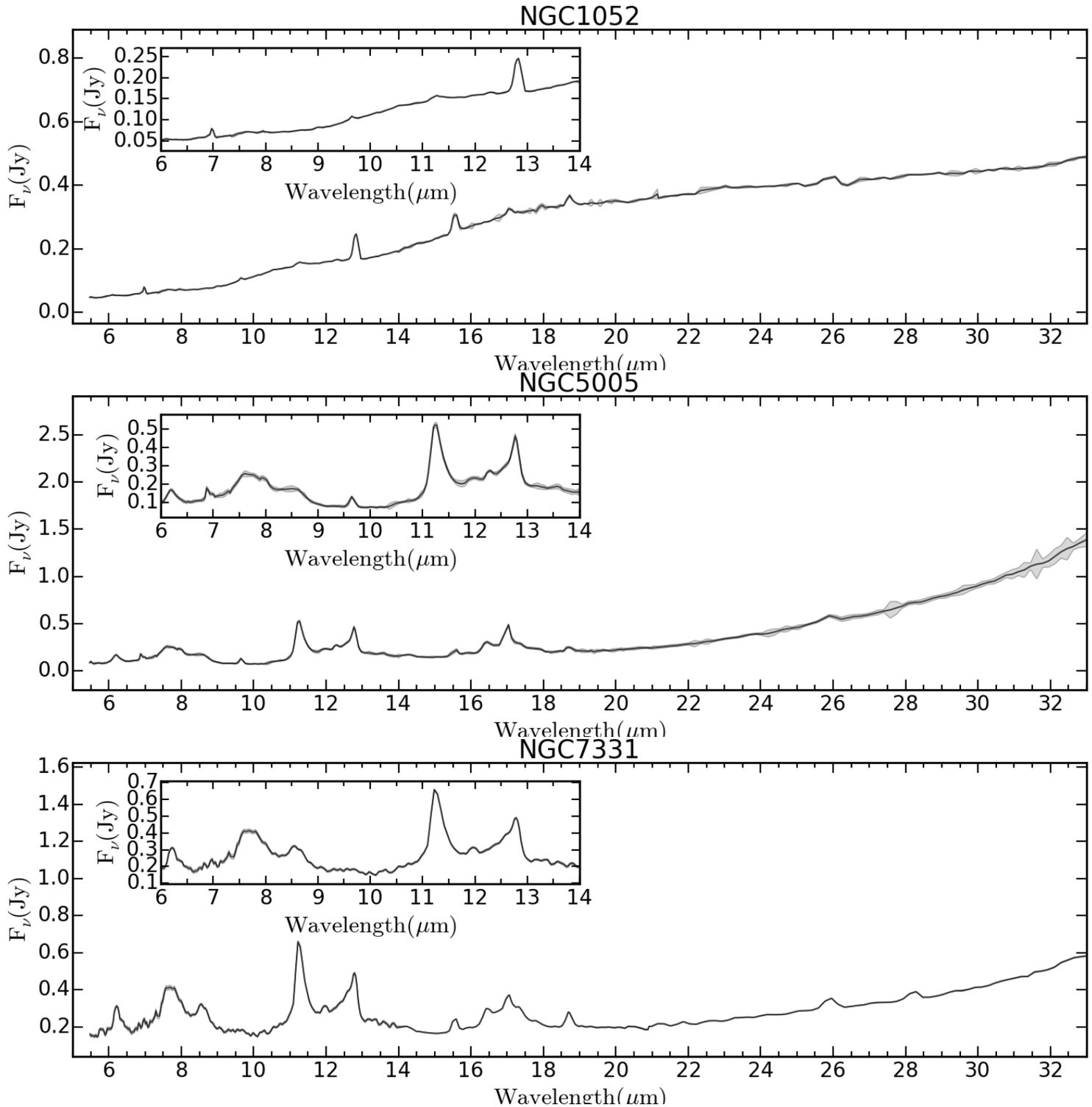
Comparison samples:

Type -1 Seyferts: 11

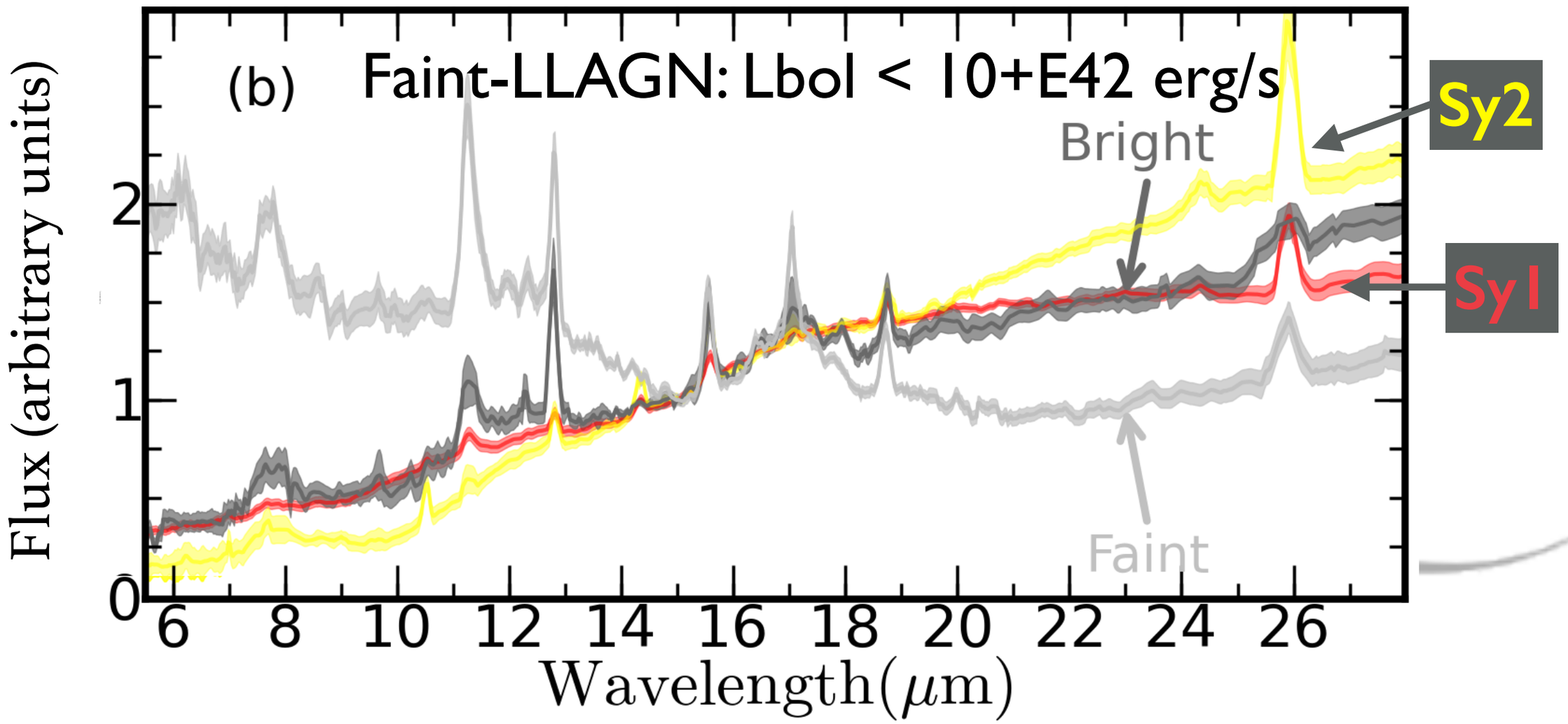
Type-2 Seyferts: 31 (19 Compton-thick)

PG QSOs: 26

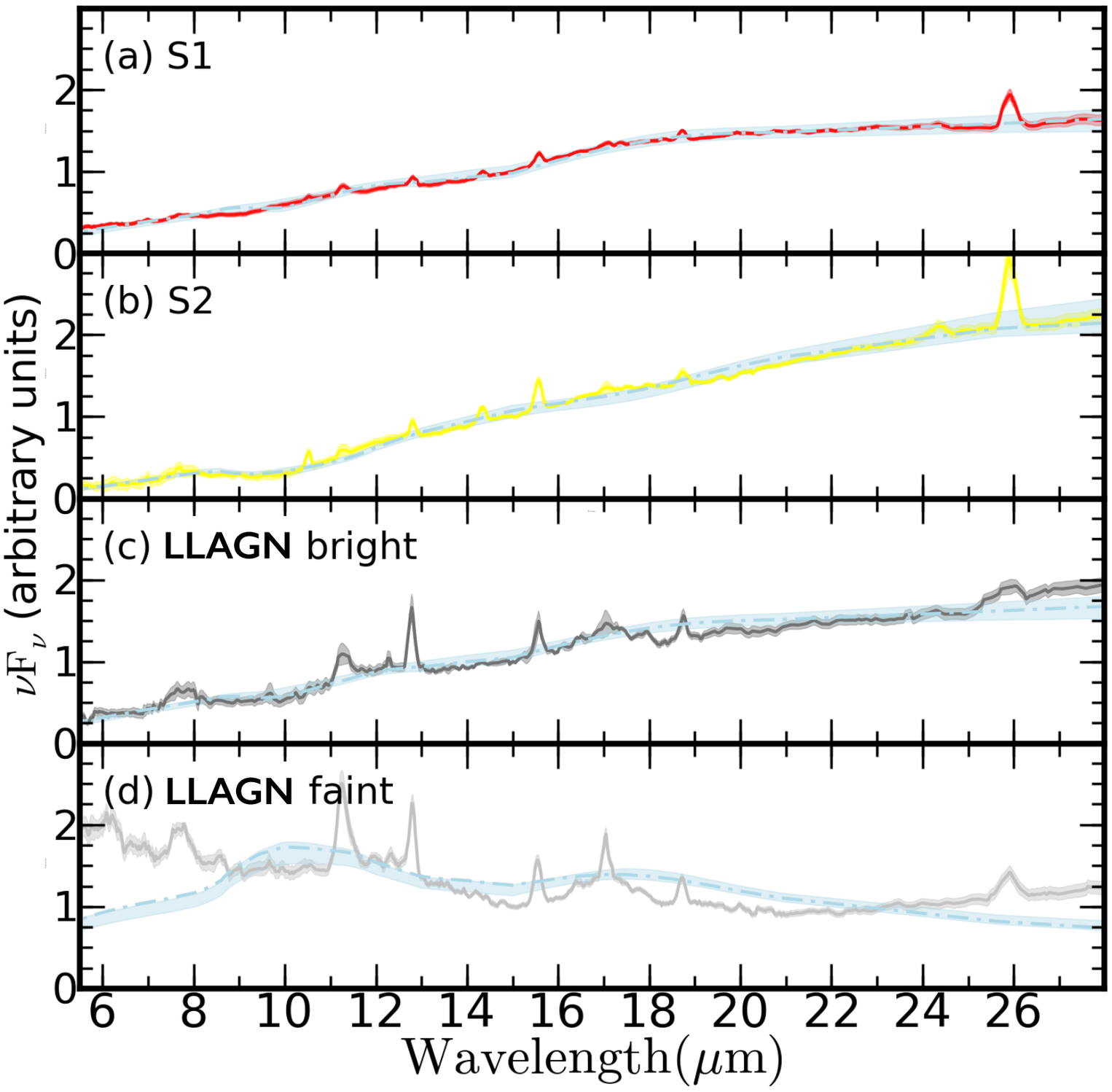
Starbursts: 21



FAMILIES OF LLAGN



TORUS DISAPPEARANCE

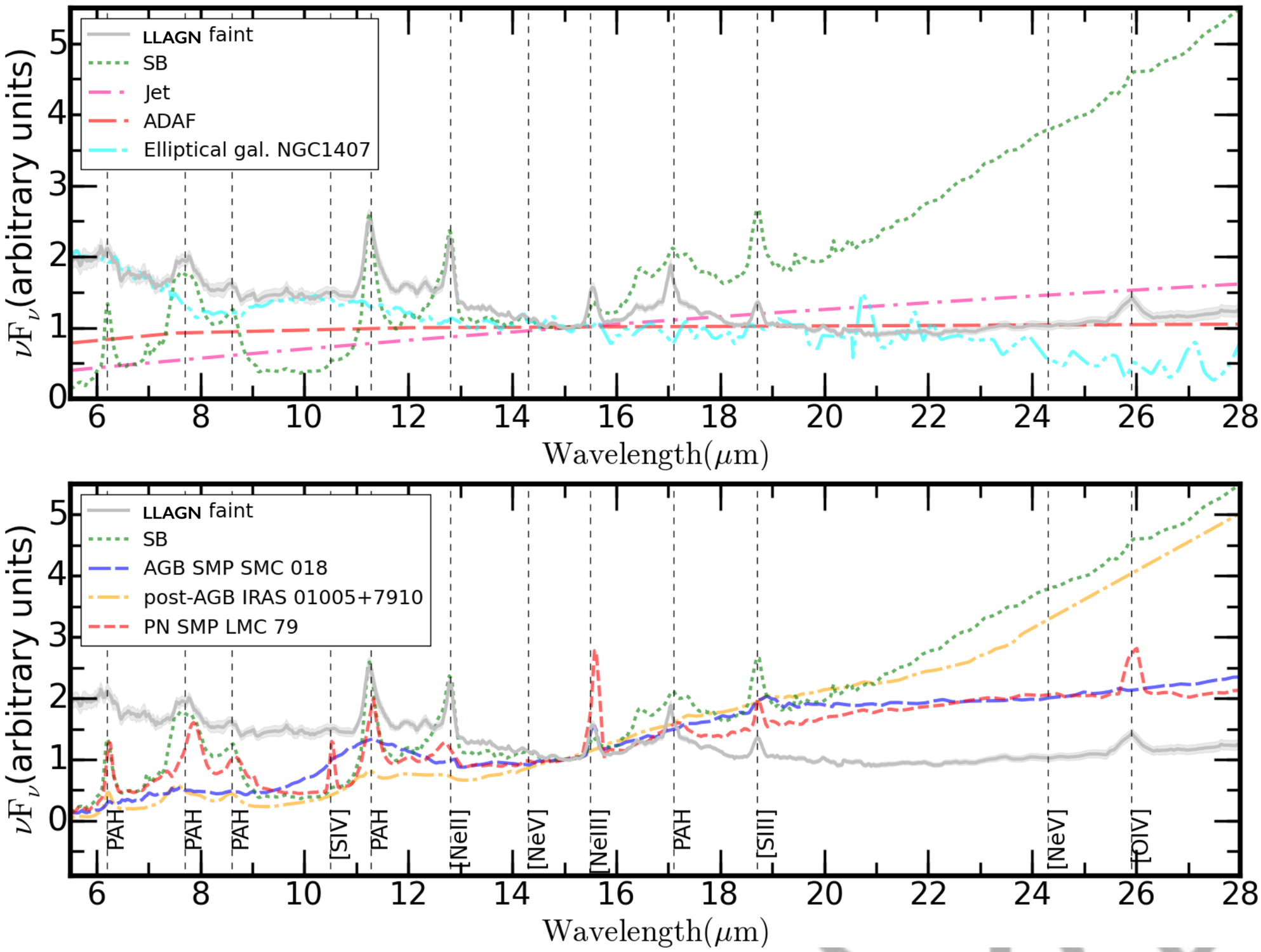


Torus model:
Nenkova+02

BayesClumpy:
Asensio Ramos
& Ramos
Almeida+09

RyA

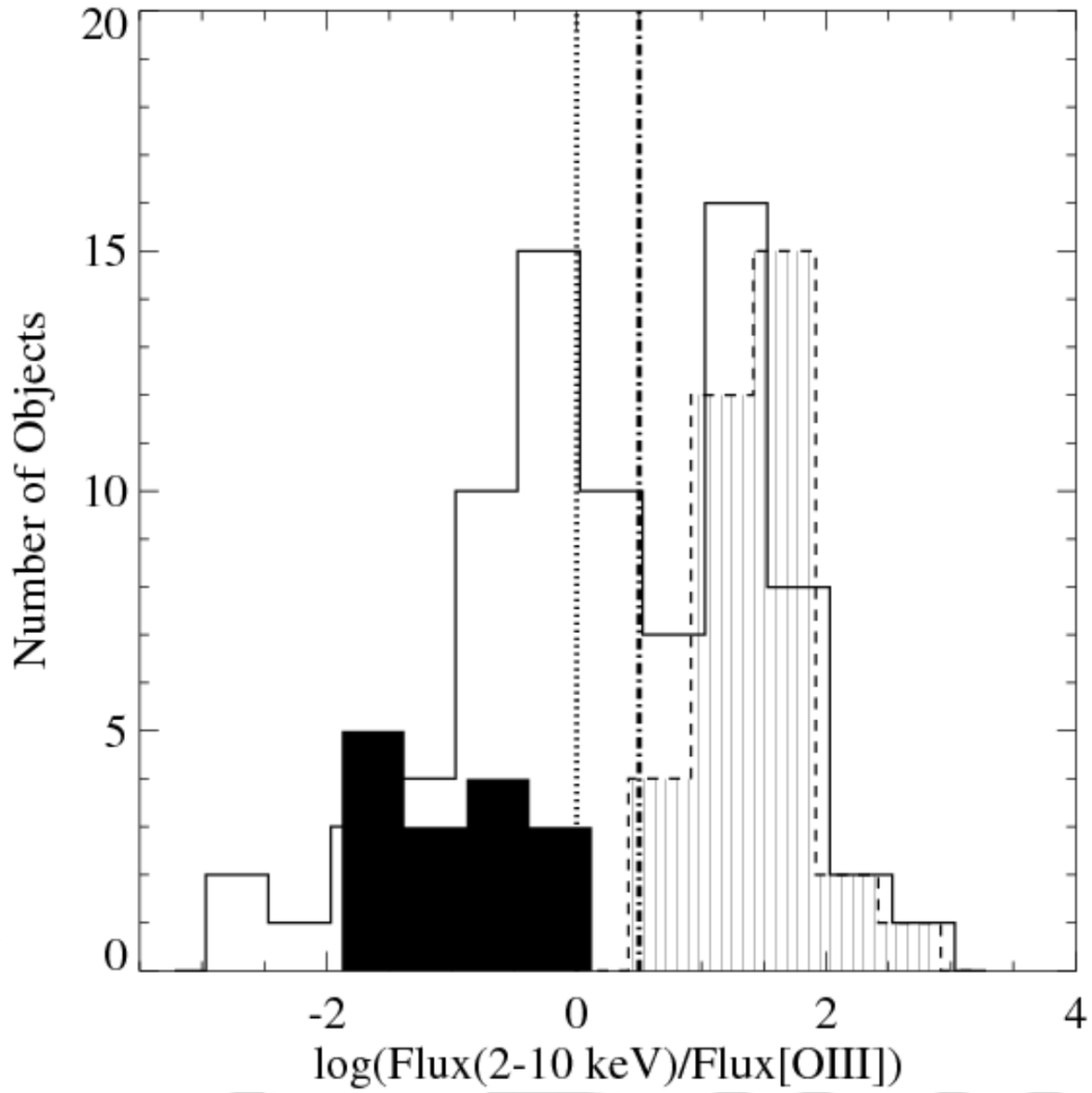
TORUS DISAPPEARANCE



X-RAY HIGHLY OBSCURED BUT WITHOUT A TORUS

50% of LINERs/LLAGN are Compton- thick candidates (20-30% in Seyferts, Panessa+06)

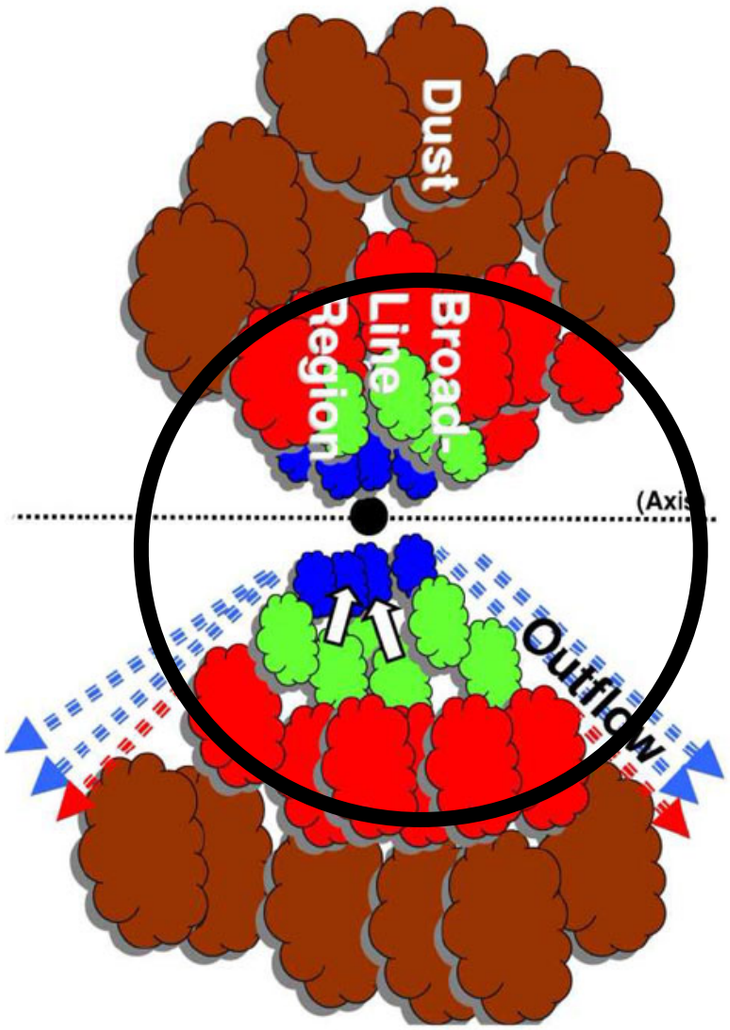
Gonzalez-Martin+09



SPECULATING...

THEORY 1

Location close to the center

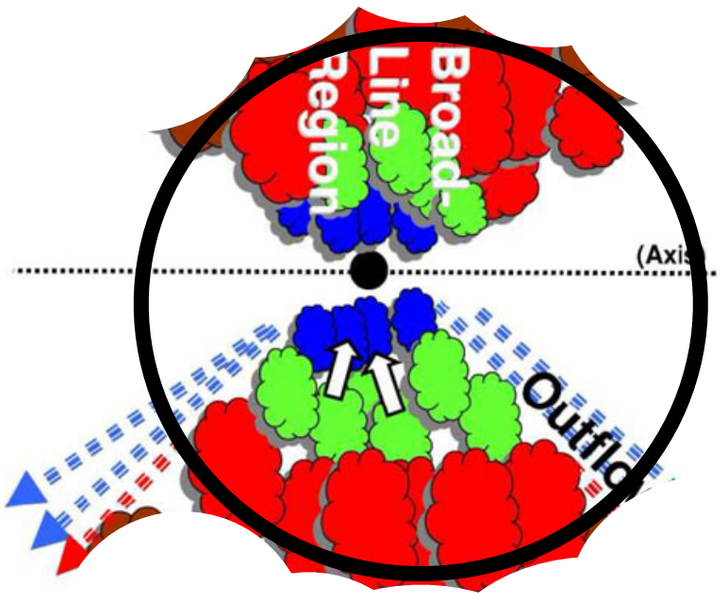


Sublimation radius

SPECULATING...

THEORY 1

Location close to the center

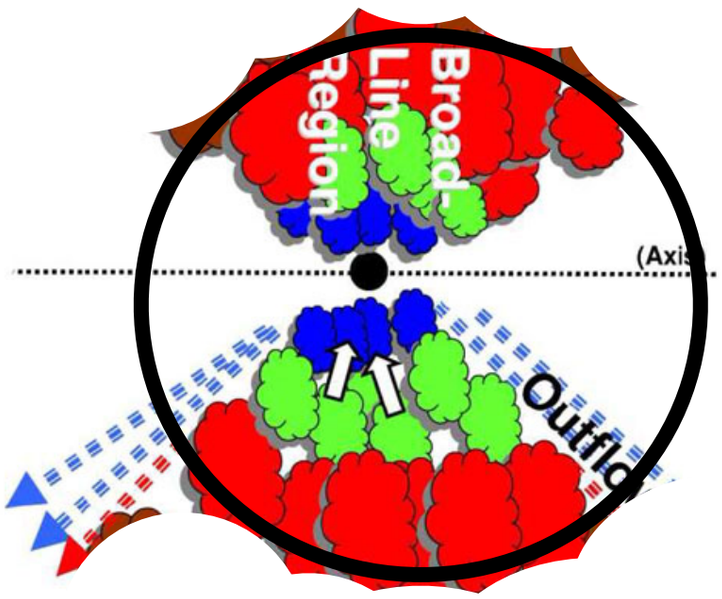


Sublimation radius

SPECULATING...

THEORY 1

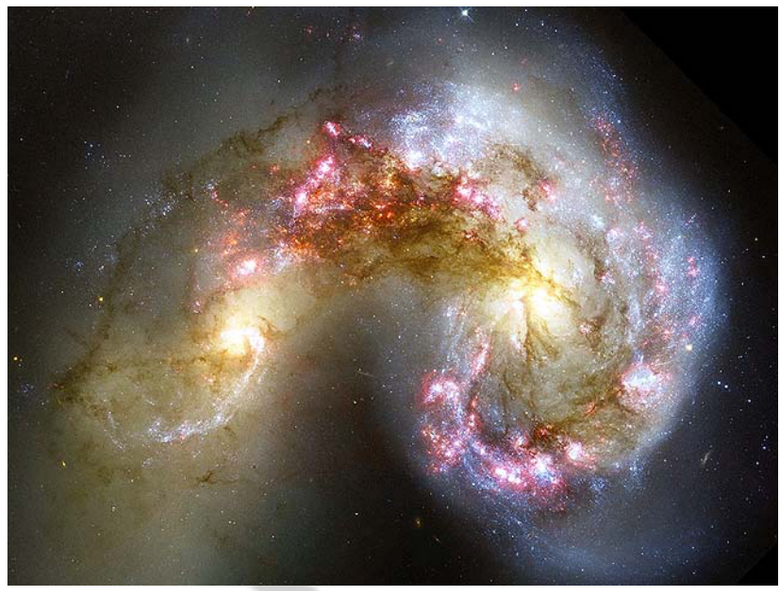
Location close to the center



Sublimation radius

THEORY 2

Location far from the center



Highly obscured LLAGN -> NH>10E24!
Circumnuclear environment
Many of them are ULIRGs -> mergers?
Are LLAGN the switching on/off the activity?

SUMMARY

The mid-infrared emission of bright LINERs/LLAGN is dominated by the torus. This torus disappears below Lbol = 10E+42 erg/sec as predicted by Elitzur & Shlosman (2006). Below that limit, the mid-infrared emission of faint LINERs/LLAGN is dominated probably by a combination of elliptical galaxy and PNe. The X-ray obscuration either is within the dust sublimation radius or in the host.

González-Martín et al. 2015, A&A 578A, 74G

Thanks!