Thanks to ESA & ESA Education Office for financial support

May 30th 2008 – X-ray Universe 2008 – Granada, Spain

Spectral Energy Distribution of Hyper-Luminous Infrared Galaxies

Ángel Ruiz[1]

Francisco J. Carrera[1]**, Francesca Panessa**[2]**, Giovanni Miniutti**[3]

1: Instituto de Física de Cantabria (CSIC-UC)
2: INAF/IASF – Roma
3: Laboratoire APC - Paris

What is all the fuss about?

- Supermassive Black Holes in centers of most local galaxies **(Kormendy & Gebhardt, 2001)**
- Correlation between mass of central BH and spheroid **(Magorrian et al. 1998; McLure & Dunlop,2002)**
- Similar evolution of X-ray AGN and optical galaxies **(Silvermann et al. 2005)**

What is all the fuss about?

- Supermassive Black Holes in centers of most local galaxies **(Kormendy & Gebhardt, 2001)**
- Correlation between mass of central BH and spheroid **(Magorrian et al. 1998; McLure & Dunlop 2002)**
- Similar evolution of X-ray AGN and optical galaxies **(Silvermann et al. 2005)**

Conected growth of central BH through accretion and spheroid through star formation

AGN-galaxy co-evolution

- **Strong evidence of AGN-galaxy co-evolution:**
  - Conection between the growth of central SMBH through **accretion** and spheroid through **star formation**
- **How to observe AGN-galaxy coeval:**
  - **Star formation** takes place in heavily obscured environments: need penetrating radiation:
    - **X-rays** (of course!): thermal bremsstrahlung, binaries
    - **MIR-FIR-submm**: radiation absorbed and re-emitted
    - Radio
  - SMBH growth through accretion produces **AGN activity**:
    - **X-rays** are the ”smoking gun”, **but**:
      - Most accretion power in the Universe absorbed **(Fabian & Iwasawa 1999)**
      - X-ray background synthesis model require most AGN in the Universe absorbed **(Gilli et al. 1999)**
    - ”Warm” **MIR-FIR** colours: direct emission absorbed and re-emitted
    - Radio

AGN-galaxy co-evolution

- **Strong evidence of AGN-galaxy co-evolution:**
  - Connection between the growth of central SMBH through **accretion** and spheroid through **star formation**
- **How to observe AGN-galaxy coeval:**

Happy marriage of X-ray and MIR-FIR astronomy:
coincidence in time of
Chandra, XMM-Newton, Suzaku, Spitzer, Akari, Herschel...

  - Radio
  - SMBH growth through accretion produces **AGN activity**:
    - **X-rays** are the ”smoking gun”, **but**:
      - Most accretion power in the Universe absorbed (Fabian & Iwasawa 1999)
      - X-ray background synthesis model require most AGN in the Universe absorbed (Gilli et al. 1999)
    - ”Warm” **MIR-FIR** colours: direct emission absorbed and re-emitted
    - Radio

Observing AGN-galaxy co-evolution in X-rays and MIR-FIR

- **Multi-wavelength surveys: AEGIS, GOODS, COSMOS** (see Brusa's talk)
- **Targeted MIR observations of X-ray sources:**
  - X-ray absorbed broad line QSO (see Page's talk)
- **Targeted X-ray observations of MIR-FIR-emiting objects:**
  - Ultraluminous IR Galaxies (Franceschini et al. 2003, Teng et al. 2005, Poster G-1 by Anabuki)
  - **Hyperluminous IR Galaxies** (this talk, Ruiz et al. 2007)

Why HLIRGs?

- $L_{8\text{-}1000\mu m} = 10^{12}\text{-}10^{13}\ L_{sol}$: **ULIRGS**
  - Powered by starburst (STB) and some (~50%) harbour AGN (Farrah et al. 2003)
  - Fraction of AGN increases with IR luminosity (Veilleux et al. 1999)
  - Most in interacting systems (Farrah et al. 2001)
  - Sample in X-rays: composite, STB dominated (Franceschini et al. 2003; Teng et al. 2005)
- $L_{8\text{-}1000\mu m} > 10^{13}\ L_{sol}$: **HLIRGS** (Rowan-Robinson 2000 [RR00])
  - Most with AGN contribution (RR00, Farrah et al. 2002a)
  - Only some interacting (~30%) (Farrah et al. 2002b)
    - ***Not trivially high luminosity tail of ULIRGs***
  - Some present heavy obscuration in X-rays, even Compton-Thick (Wilman et al. 2003, Iwasawa et al. 2005; Nandra et al. 2007)

Why HLIRGs?

- $L_{8\text{-}1000\mu m} = 10^{12}\text{-}10^{13}\ L_{sol}$: ULIRGS
  - Powered by starburst (STB) and some (~50%) harbour AGN

- HLIRGs:
  - Strong star formation: > 1000 $M_{\odot}$ / yr
  - High AGN fraction
- Good laboratory to investigate star formation and BH growth:
  - Young galaxies experiencing burst of star formation?
  - Transient phase in AGN evolution?
  - ....

    - *Not trivially high luminosity tail of ULIRGs*
  - Some present heavy obscuration in X-rays, even Compton-Thick (Wilman et al. 2003, Iwasawa et al. 2005; Nandra et al. 2007)

An XMM-Newton study of HLIRGs: Sample

- Out of the 45 **RR00 sample**, those with:
  - Public XMM-Newton data as of Dec. 2004
  - Own XMM-Newton AO-5 data
  - z < ~2: avoid strong biasing due to high z QSOs
- 14 objects in final sample:
  - All SED fitting in MIR/FIR
    (RR00, Farrah et al. 2002, Verma et al. 2002)

	Source	Type (opt)	z	AGN / STB (IR SED fitting)	CT?
2	IRAS F00235+1024	Starburst	0.575	0.5/0.5	✓
	IRAS 07380-2342	Starburst	0.292	0.6/0.4	X
4	IRAS 00182-7112	QSO 2	0.327	0.35/0.65	✓
	IRAS 09104+4109	QSO 2	0.442	1/0	✓
	IRAS 12514+1027	Seyfert 2	0.3	0.4/0.6	✓
	IRAS F15307+3252	Seyfert 2	0.926	0.7/0.3	✓
8	PG 1206+459	QSO	1.158	1/0	X
	PG 1247+267	QSO	2.038	1/0	X
	IRAS F12509+3122	QSO	0.780	0.6/0.4	X
	IRAS 13279+3401	QSO	0.36	0.7/0.3	X
	IRAS 14026+4341	QSO 1.5	0.323	0.6/0.4	X
	IRAS F14218+3845	QSO	1.21	0.2/0.8	X
	IRAS 16347+7037	QSO	1.334	0.8/0.2	X
	IRAS 18216+6418	QSO	0.297	0.6/0.4	X

Not detected with XMM-Newton

Source	*Model*	log $L_{0.5-2}$	log L_{2-10}	*CT?*
IRAS F00235+1024	3σ upper limit	-	<42.4	✓
IRAS 07380-2342	3σ upper limit	-	<42.5	X
IRAS 00182-7112	reflected+narrow line (0.8keV)	<41.9	44.8	✓
IRAS 09104+4109	“thermal”+reflected+narrow line	44.2	45.3	✓
IRAS 12514+1027	thermal+absorbed direct ($4x10^{23}$)	42.2	43.3	✓
IRAS F15307+3252	“direct”	<43.1	43.7→45.5	✓
PG 1206+459	direct	<44.0	45.1	X
PG 1247+267	“thermal”+direct	45.5	45.9	X
IRAS F12509+3122	“thermal”+direct	43.8	44.3	X
IRAS 13279+3401	3σ upper limit	-	<42.2	X
IRAS 14026+4341	3σ upper limit	-	<42.6	X
IRAS F14218+3845	direct	<43.8	44.6	X
IRAS 16347+7037	“thermal”+direct	45.7	46.0	X
IRAS 18216+6418	“thermal”+direct	45.1	45.6	X

Stongly absorbed or no direct continuum

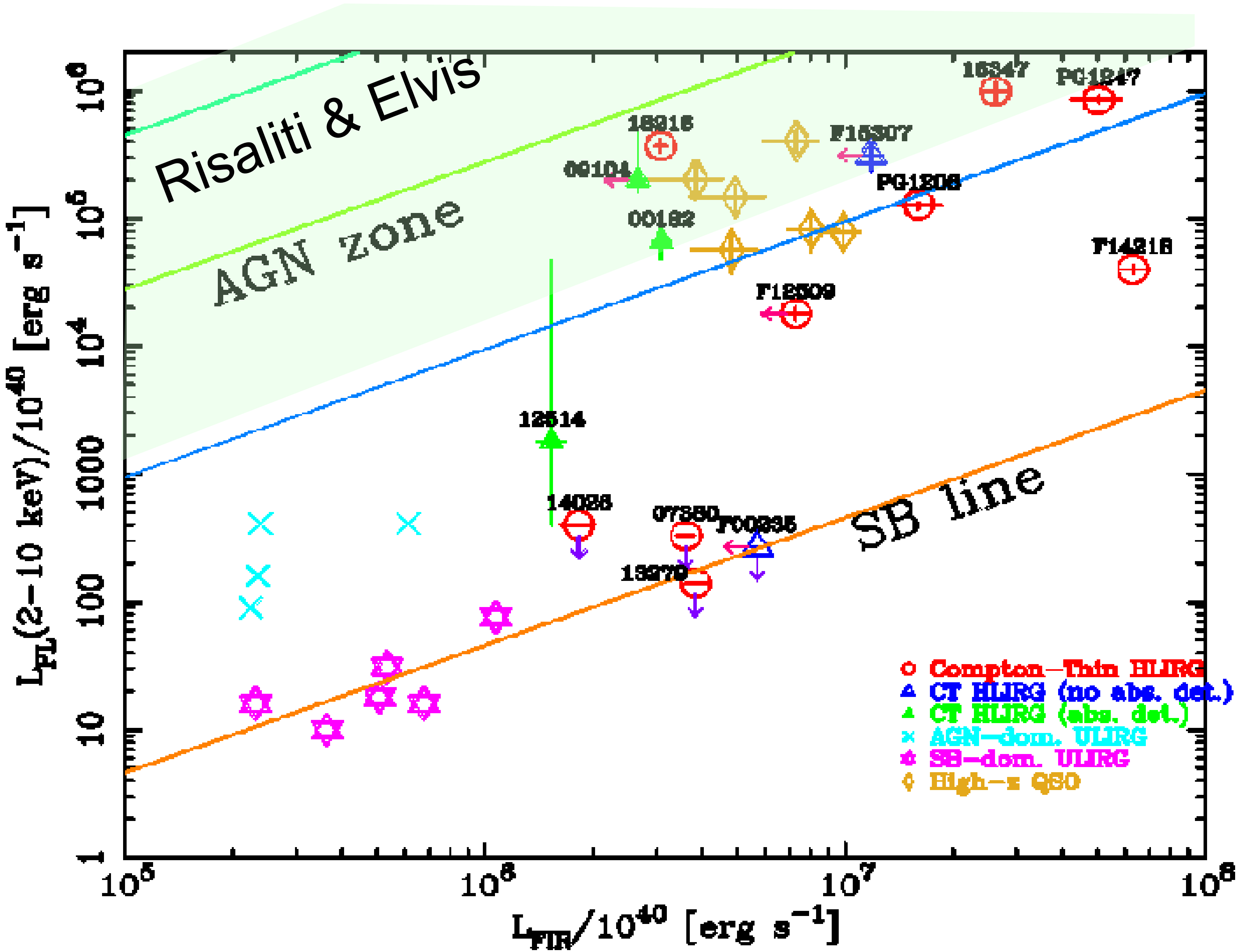
Source	*Model*	log $L_{0.5-2}$	log L_{2-10}	*CT?*
IRAS F00235+1024	3σ upper limit	-	<42.4	✓
IRAS 07380-2342	3σ upper limit	-	<42.5	X
IRAS 00182-7112	reflected+narrow line (0.8keV)	<41.9	44.8	✓
IRAS 09104+4109	"thermal"+reflected+narrow line	44.2	45.3	✓
IRAS 12514+1027	thermal+absorbed direct (4x10^{23})	42.2	43.3	✓
IRAS F15307+3252	"direct"	<43.1	43.7→45.5	✓
PG 1206+459	direct	<44.0	45.1	X
PG 1247+267	"thermal"+direct	45.5	45.9	X
IRAS F12509+3122	"thermal"+direct	43.8	44.3	X
IRAS 13279+3401	3σ upper limit	-	<42.2	X
IRAS 14026+4341	3σ upper limit	-	<42.6	X
IRAS F14218+3845	direct	<43.8	44.6	X
IRAS 16347+7037	"thermal"+direct	45.7	46.0	X
IRAS 18216+6418	"thermal"+direct	45.1	45.6	X

Soft excess: too bright to come from STB

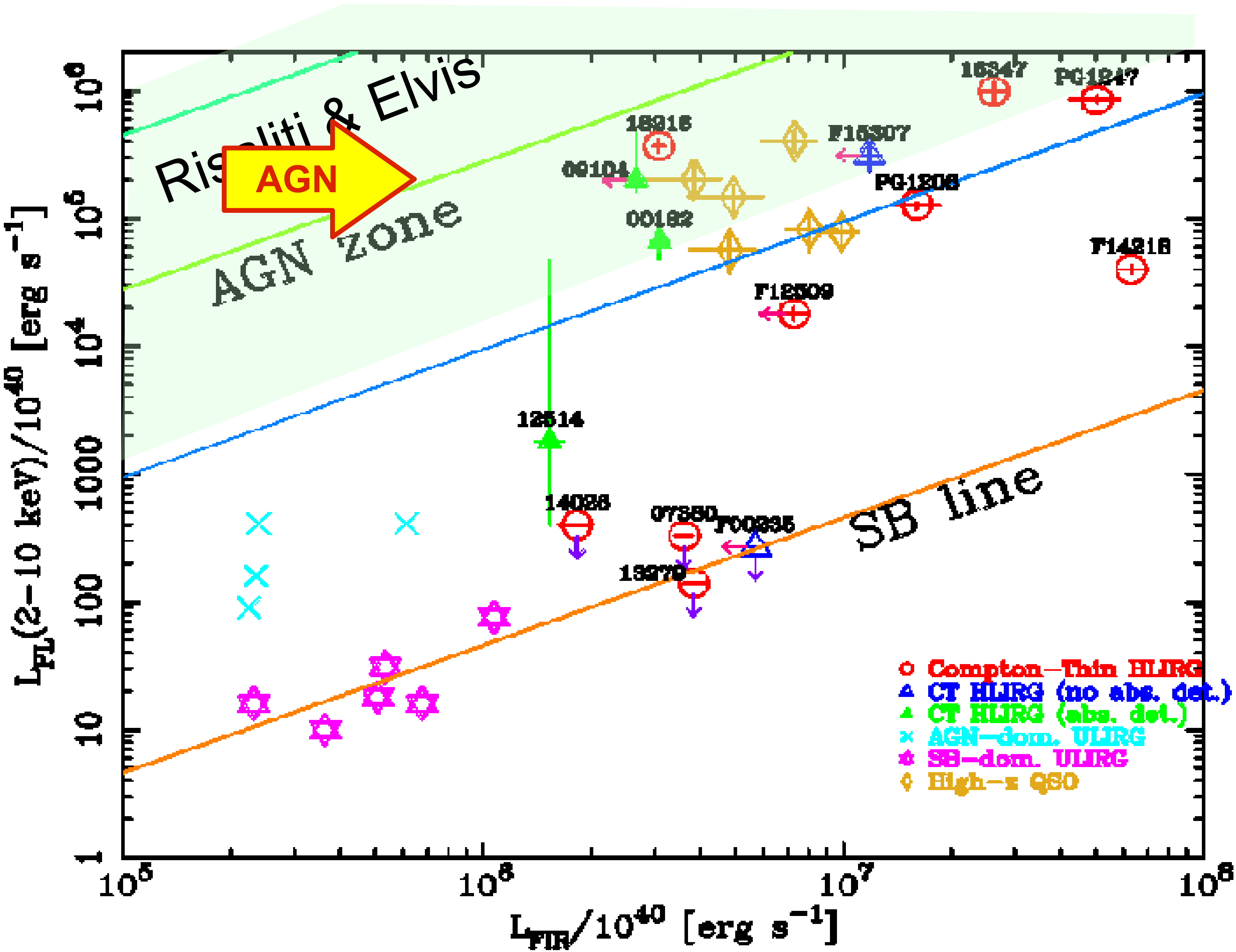
Source	Model	log $L_{0.5-2}$	log L_{2-10}	CT?
IRAS F00235+1024	3σ upper limit	-	<42.4	✓
IRAS 07380-2342	3σ upper limit	-	<42.5	X
IRAS 00182-7112	reflected+narrow line (0.8keV)	<41.9	44.8	✓
IRAS 09104+4109	"thermal"+reflected+narrow line	44.2	45.3	✓
IRAS 12514+1027	thermal+absorbed direct ($4x10^{23}$)	42.2	43.3	✓
IRAS F15307+3252	"direct"	<43.1	43.7→45.5	✓
PG 1206+459	direct	<44.0	45.1	X
PG 1247+267	"thermal"+direct	45.5	45.9	X
IRAS F12509+3122	"thermal"+direct	43.8	44.3	X
IRAS 13279+3401	3σ upper limit	-	<42.2	X
IRAS 14026+4341	3σ upper limit	-	<42.6	X
IRAS F14218+3845	direct	<43.8	44.6	X
IRAS 16347+7037	"thermal"+direct	45.7	46.0	X
IRAS 18216+6418	"thermal"+direct	45.1	45.6	X

Only one detection of thermal emission from STB

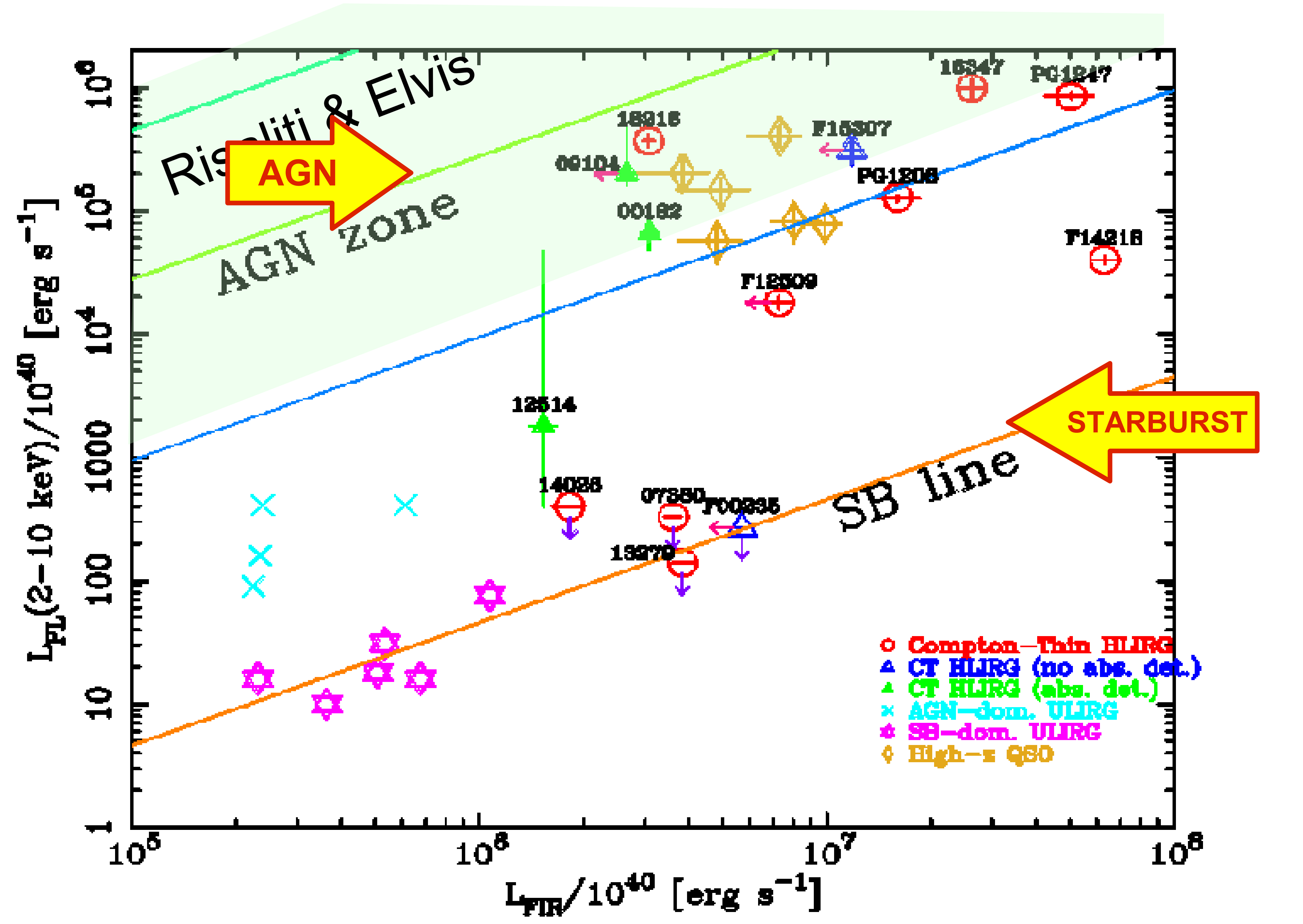
Source	Model	log $L_{0.5-2}$	log L_{2-10}	CT?
IRAS F00235+1024	3σ upper limit	-	<42.4	✓
IRAS 07380-2342	3σ upper limit	-	<42.5	X
IRAS 00182-7112	reflected+narrow line (0.8keV)	<41.9	44.8	✓
IRAS 09104+4109	"thermal"+reflected+narrow line	44.2	45.3	✓
IRAS 12514+1027	thermal+absorbed direct (4×10^{23})	42.2	43.3	✓
IRAS F15307+3252	"direct"	<43.1	43.7→45.5	✓
PG 1206+459	direct	<44.0	45.1	X
PG 1247+267	"thermal"+direct	45.5	45.9	X
IRAS F12509+3122	"thermal"+direct	43.8	44.3	X
IRAS 13279+3401	3σ upper limit	-	<42.2	X
IRAS 14026+4341	3σ upper limit	-	<42.6	X
IRAS F14218+3845	direct	<43.8	44.6	X
IRAS 16347+7037	"thermal"+direct	45.7	46.0	X
IRAS 18216+6418	"thermal"+direct	45.1	45.6	X



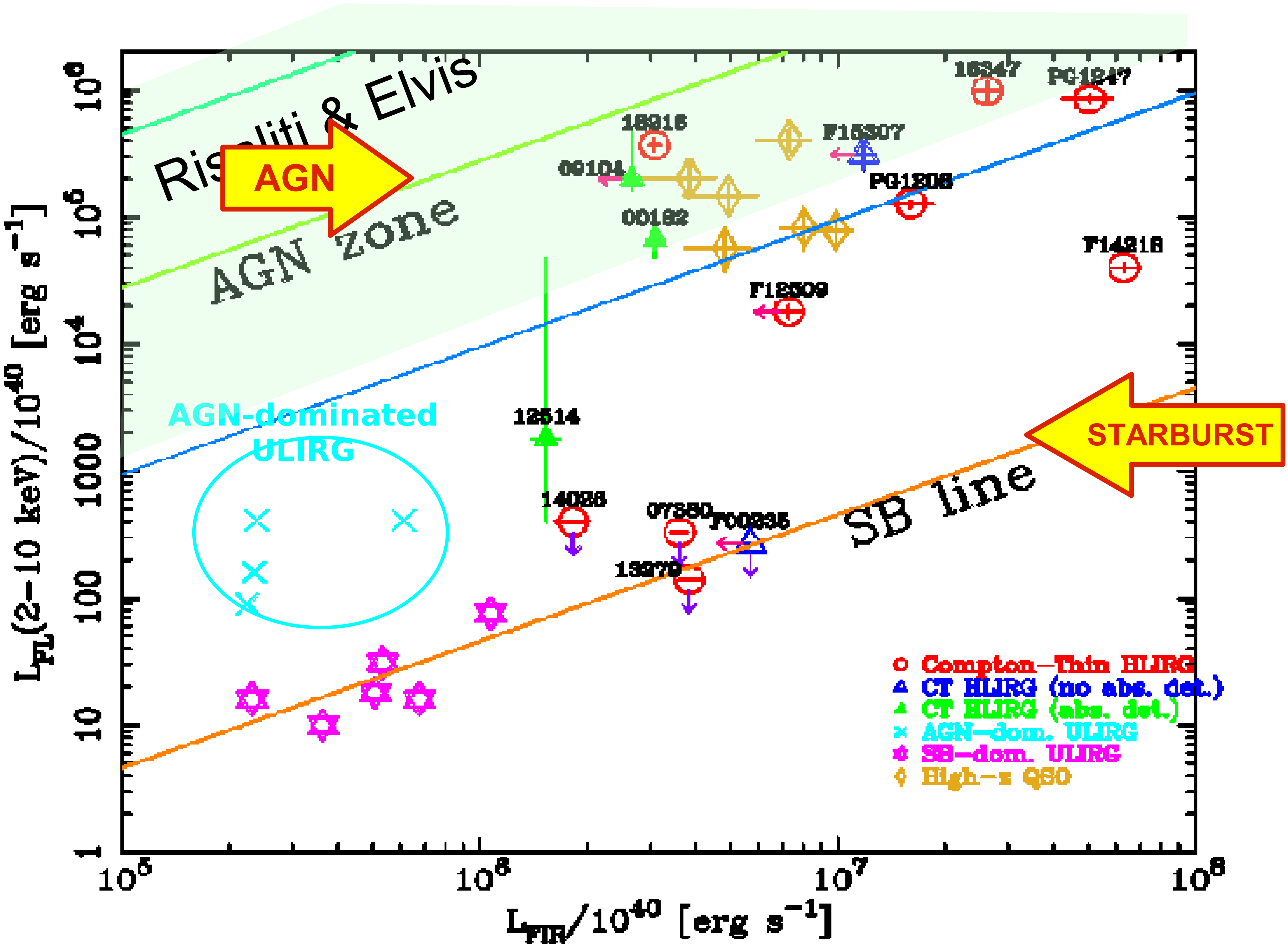
Risaliti & Elvis
AGN zone
SB line
16347
PG1247
18916
F15307
00104
PG1206
00182
F14218
F12509
12514
14026
07380
F00235
15279
Compton-Thin HLIRG
CT HLIRG (no abs. det.)
CT HLIRG (abs. det.)
AGN-dom. ULIRG
SB-dom. ULIRG
High-z QSO
$L_{FL}(2-10\ keV)/10^{40}$ [erg s^{-1}]
$L_{FIR}/10^{40}$ [erg s^{-1}]



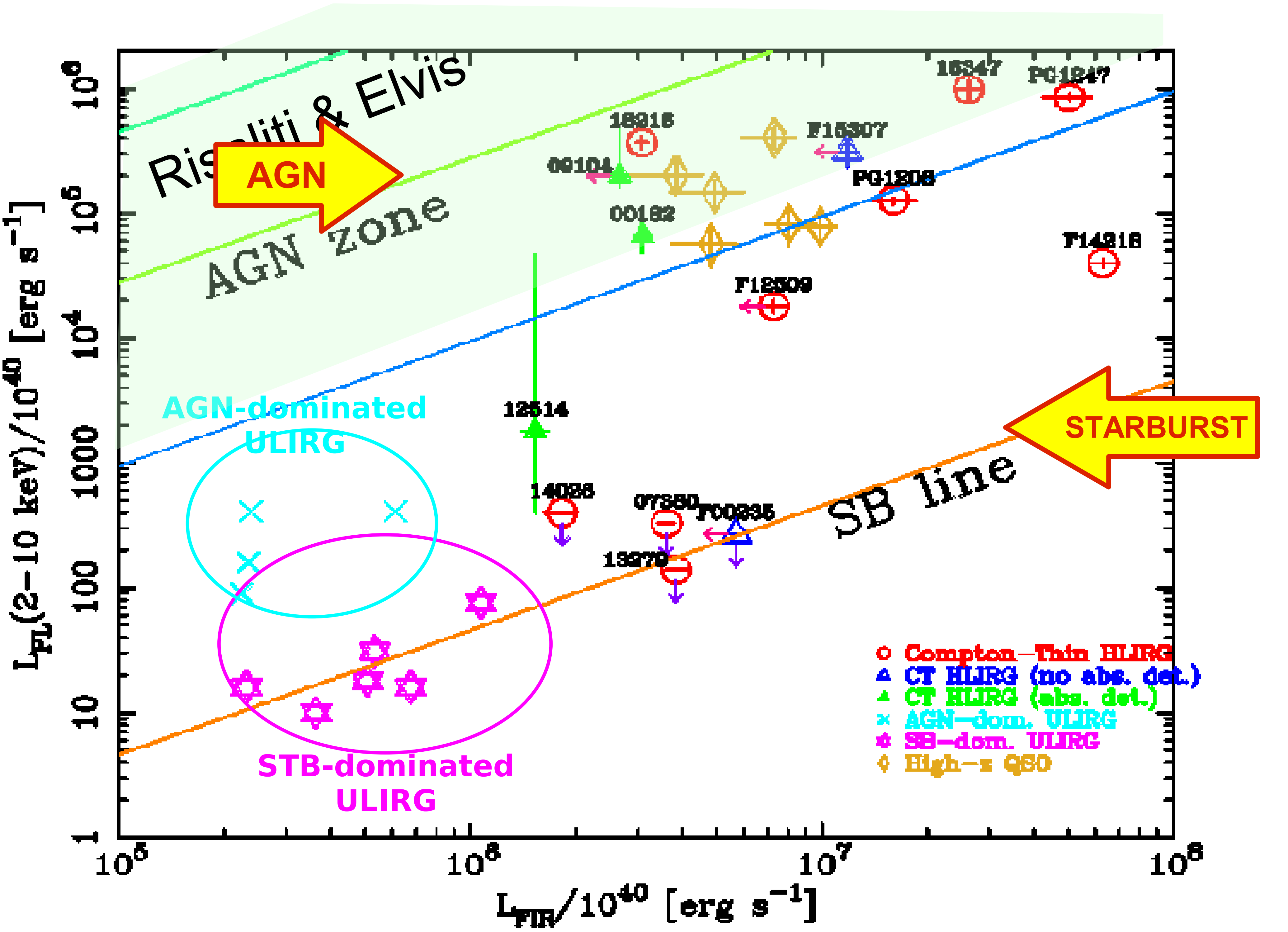
Risaliti & Elvis
AGN
AGN zone
SB line
Compton-Thin HLIRG
CT HLIRG (no abs. det.)
CT HLIRG (abs. det.)
AGN-dom. ULIRG
SB-dom. ULIRG
High-z QSO
$L_{PL}(2-10\ keV)/10^{40}$ [erg s^{-1}]
$L_{FIR}/10^{40}$ [erg s^{-1}]



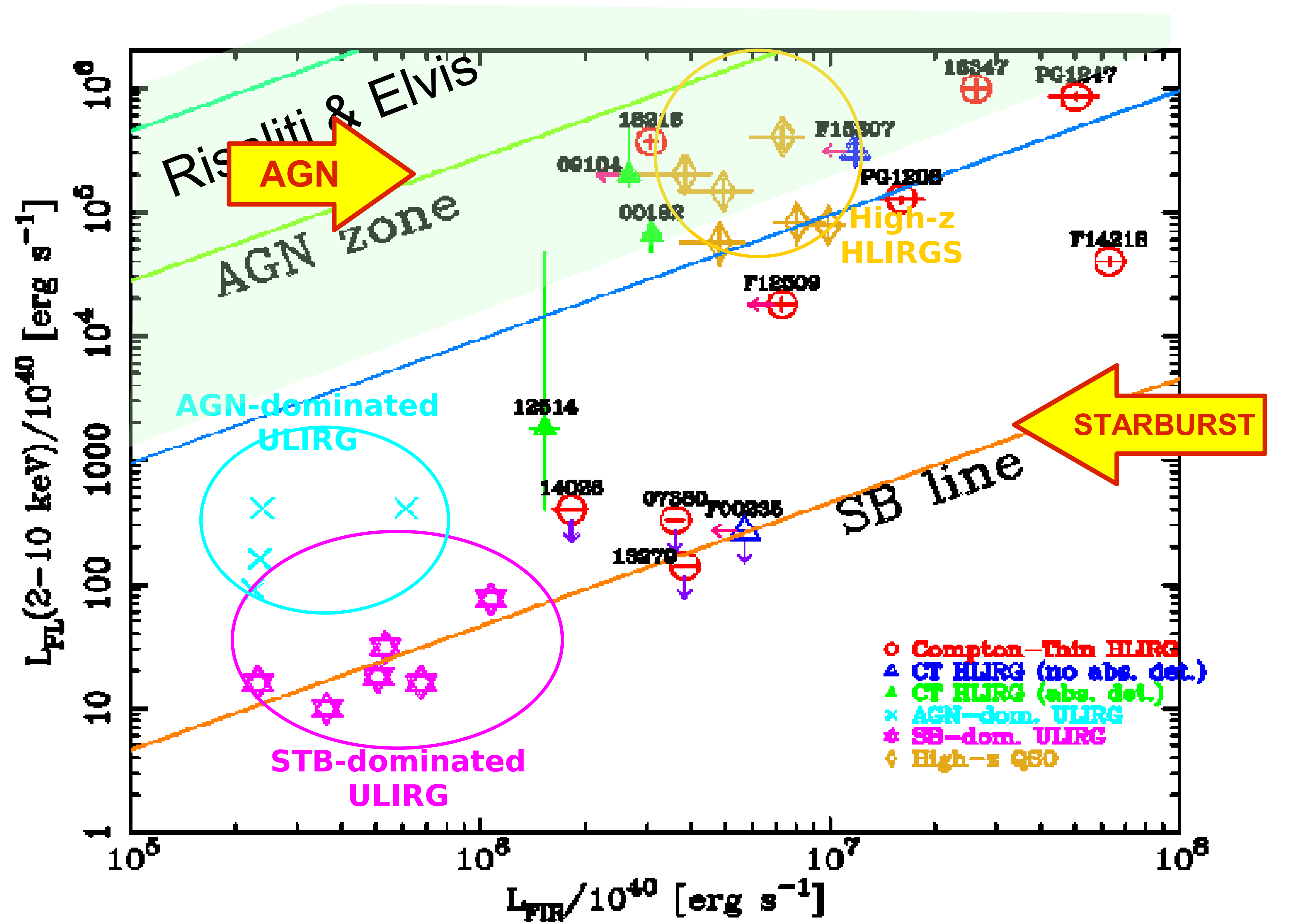
Risaliti & Elvis
AGN
AGN zone
STARBURST
SB line
18347
PG1247
18216
F15307
00104
PG1206
00182
F14218
F12509
12514
14026
07380
F00235
15279
Compton-Thin HLIRG
CT HLIRG (no abs. det.)
CT HLIRG (abs. det.)
AGN-dom. ULIRG
SB-dom. ULIRG
High-z QSO
$L_{FIR}/10^{40}$ [erg s^{-1}]
L_{FL}(2−10 keV)$/10^{40}$ [erg s^{-1}]



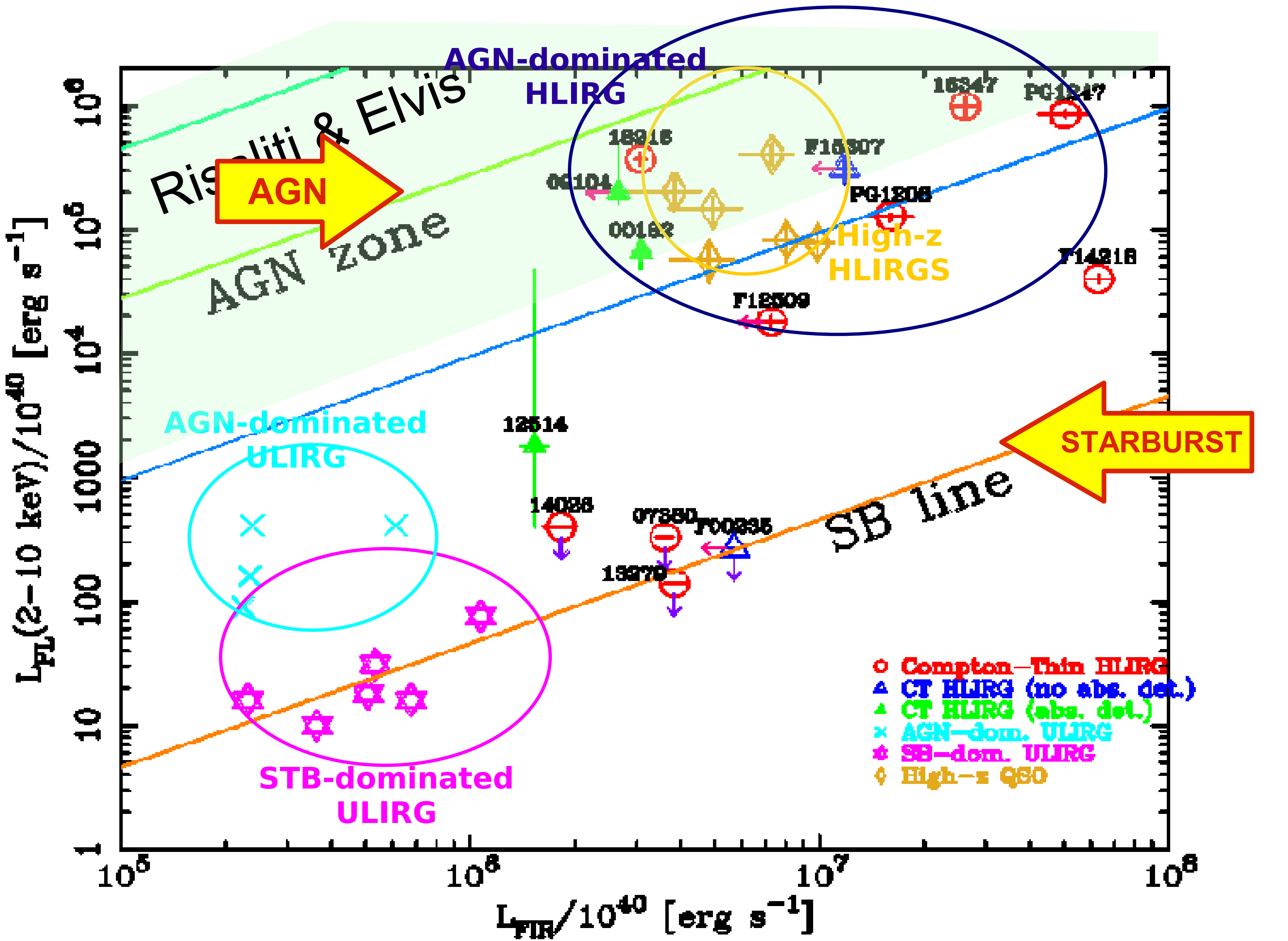
Risaliti & Elvis
AGN
AGN zone
AGN-dominated ULIRG
STARBURST
SB line
16347
PG1247
15916
F15307
00104
PG1206
00182
F14218
F12509
12514
14026
07380
F00235
15279
Compton−Thin HLIRG
CT HLIRG (no abs. det.)
CT HLIRG (abs. det.)
AGN−dom. ULIRG
SB−dom. ULIRG
High−z QSO
$L_{PL}(2-10\ keV)/10^{40}$ [erg s^{-1}]
$L_{FIR}/10^{40}$ [erg s^{-1}]



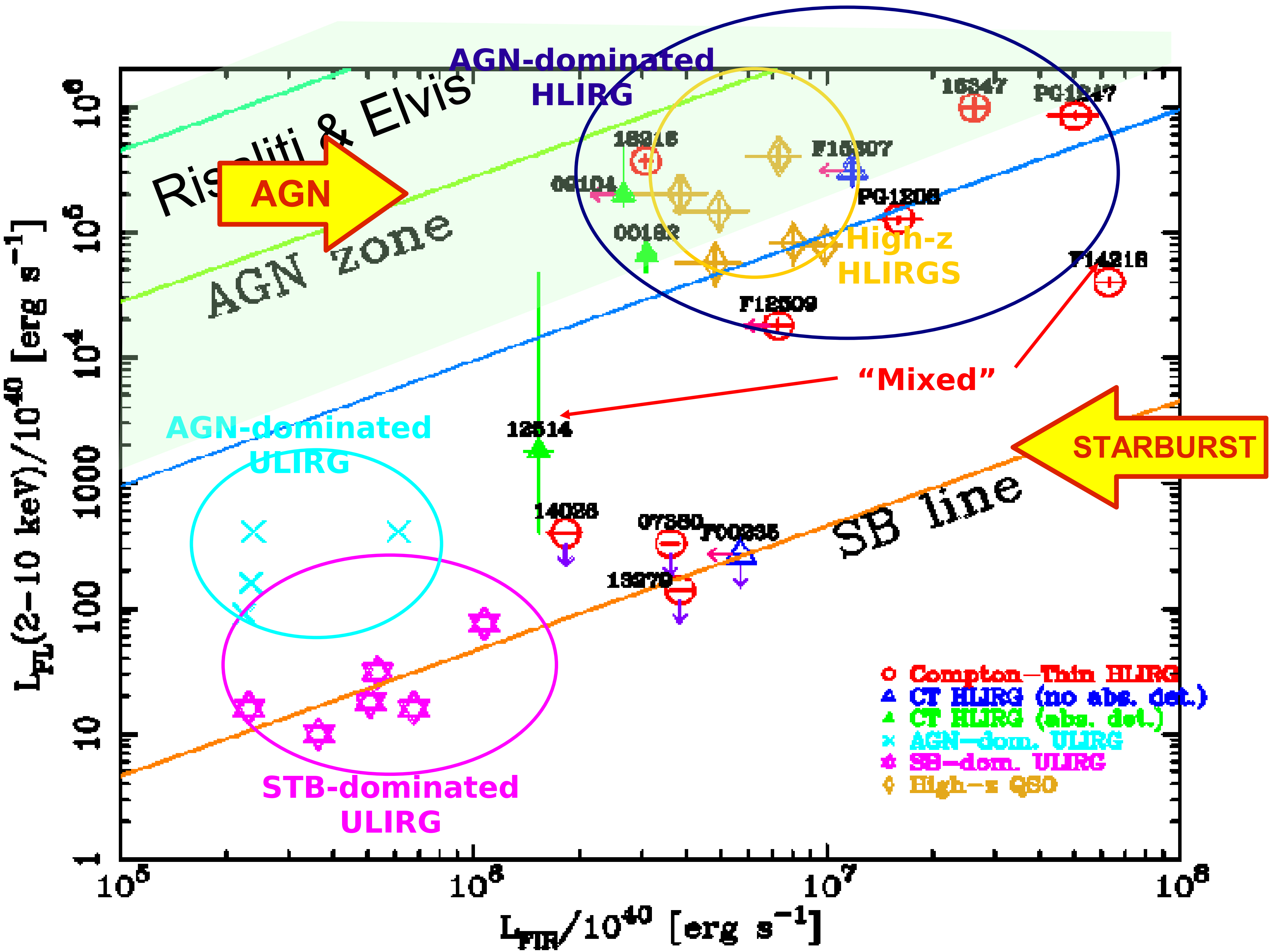
Risaliti & Elvis
AGN
AGN zone
AGN-dominated ULIRG
STB-dominated ULIRG
SB line
STARBURST
Compton-Thin HLIRG
CT HLIRG (no abs. det.)
CT HLIRG (abs. det.)
AGN-dom. ULIRG
SB-dom. ULIRG
High-z QSO
$L_{PL}(2-10\ keV)/10^{40}$ [erg s^{-1}]
$L_{FIR}/10^{40}$ [erg s^{-1}]



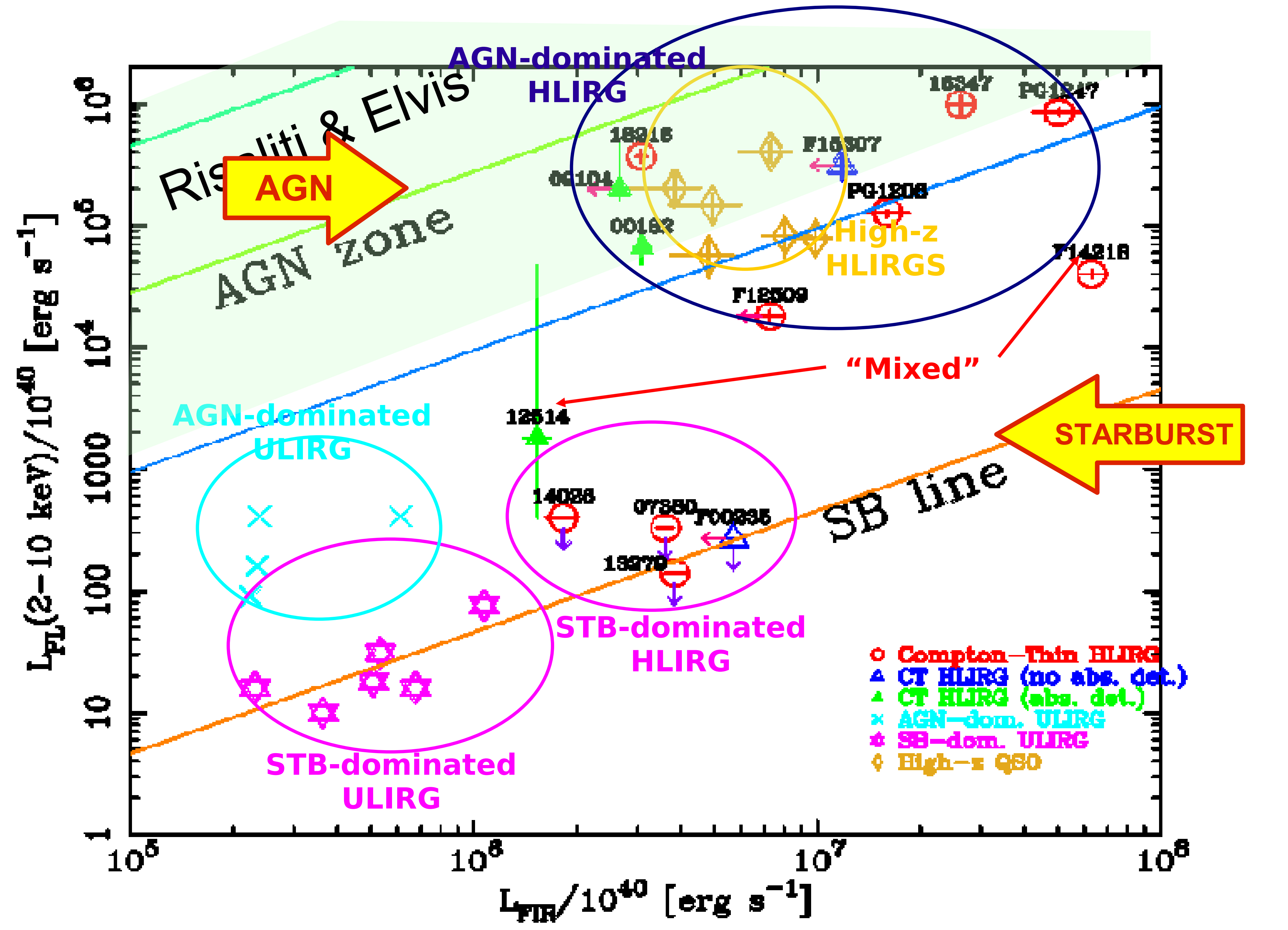
Risaliti & Elvis
AGN
AGN zone
High-z HLIRGS
AGN-dominated ULIRG
STARBURST
SB line
STB-dominated ULIRG
16347
PG1247
18216
F15307
00104
PG1206
00182
F14218
F12509
12514
14026
07380
F00235
13279
Compton-Thin HLIRG
CT HLIRG (no abs. det.)
CT HLIRG (abs. det.)
AGN-dom. ULIRG
SB-dom. ULIRG
High-z QSO
L_PL(2–10 keV)/10^40 [erg s^-1]
L_FIR/10^40 [erg s^-1]

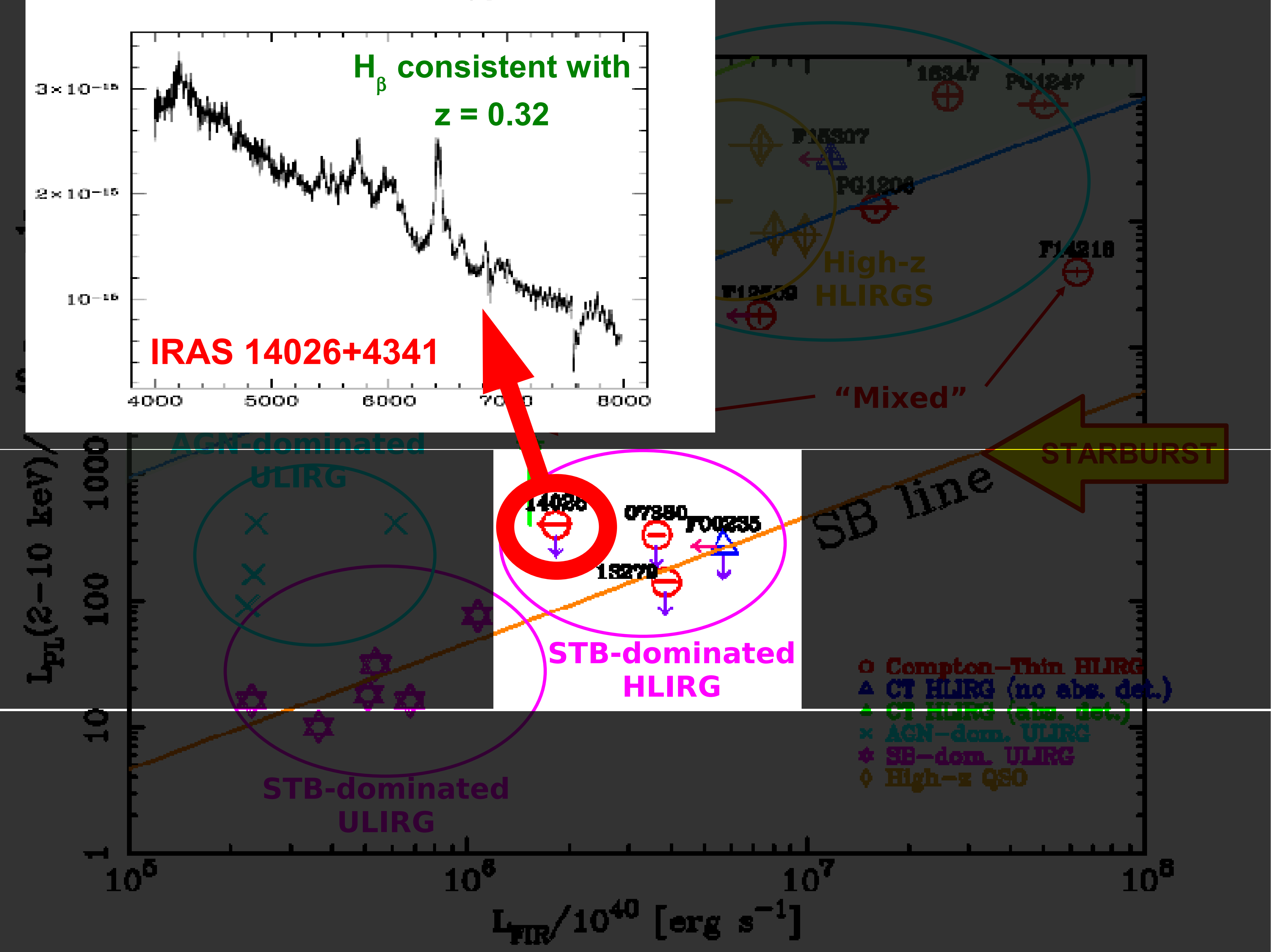


AGN-dominated
HLIRG
Risaliti & Elvis
AGN
AGN zone
High-z
HLIRGS
AGN-dominated
ULIRG
STARBURST
SB line
STB-dominated
ULIRG
Compton−Thin HLIRG
CT HLIRG (no abs. det.)
CT HLIRG (abs. det.)
AGN−dom. ULIRG
SB−dom. ULIRG
High−z QSO
$L_{FIR}/10^{40}$ [erg s^{-1}]
$L_{PL}(2-10$ keV$)/10^{40}$ [erg s^{-1}]

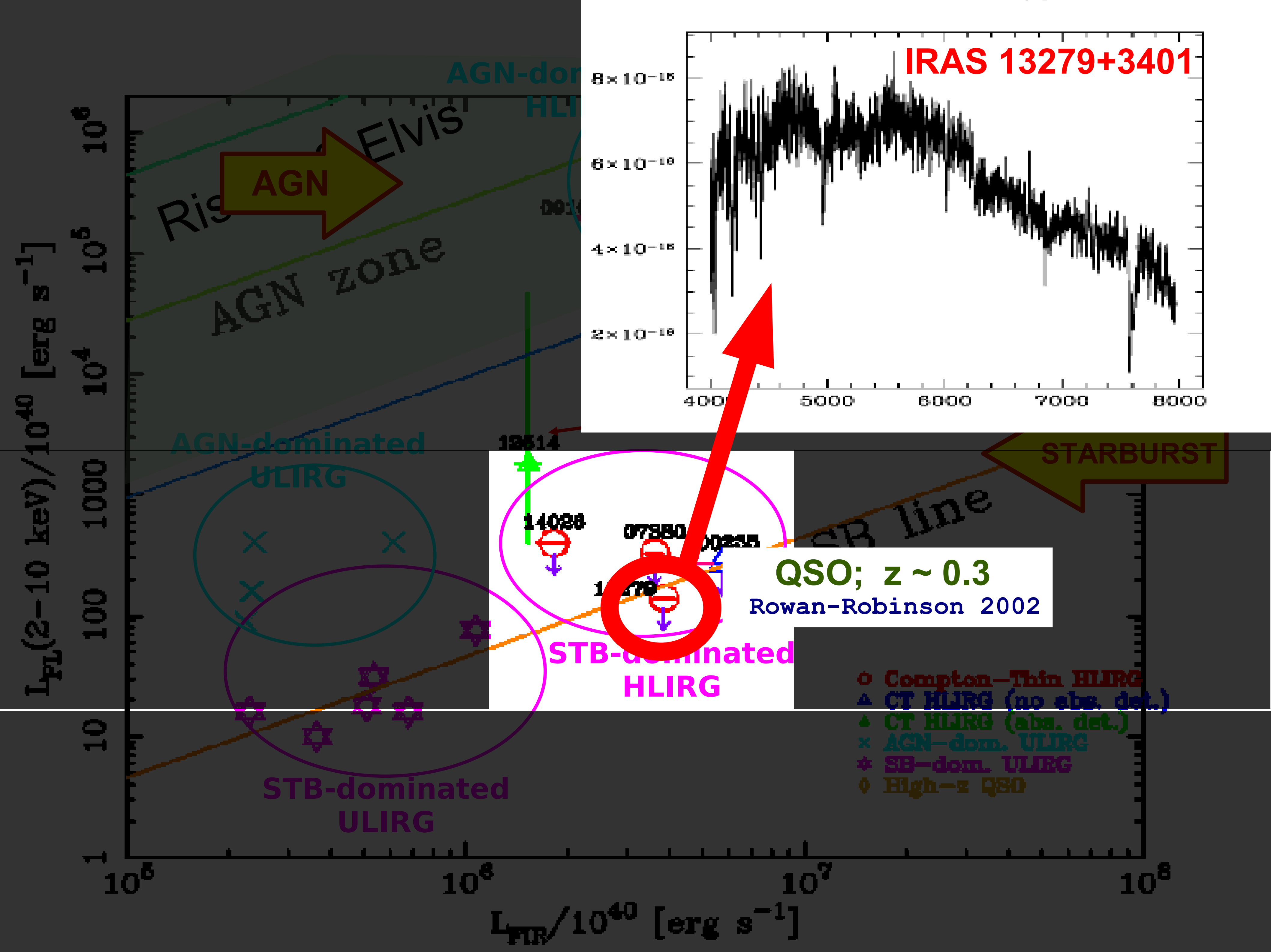


AGN-dominated
HLIRG
Risaliti & Elvis
AGN
AGN zone
High-z
HLIRGS
"Mixed"
STARBURST
SB line
AGN-dominated
ULIRG
STB-dominated
ULIRG
16347
PG1247
18216
F15307
00104
PG1206
00182
F14218
F12509
12514
14026
07380
F00235
13279
Compton-Thin HLIRG
CT HLIRG (no abs. det.)
CT HLIRG (abs. det.)
AGN-dom. ULIRG
SB-dom. ULIRG
High-z QSO
$L_{PL}(2-10\ keV)/10^{40}$ [erg s^{-1}]
$L_{FIR}/10^{40}$ [erg s^{-1}]

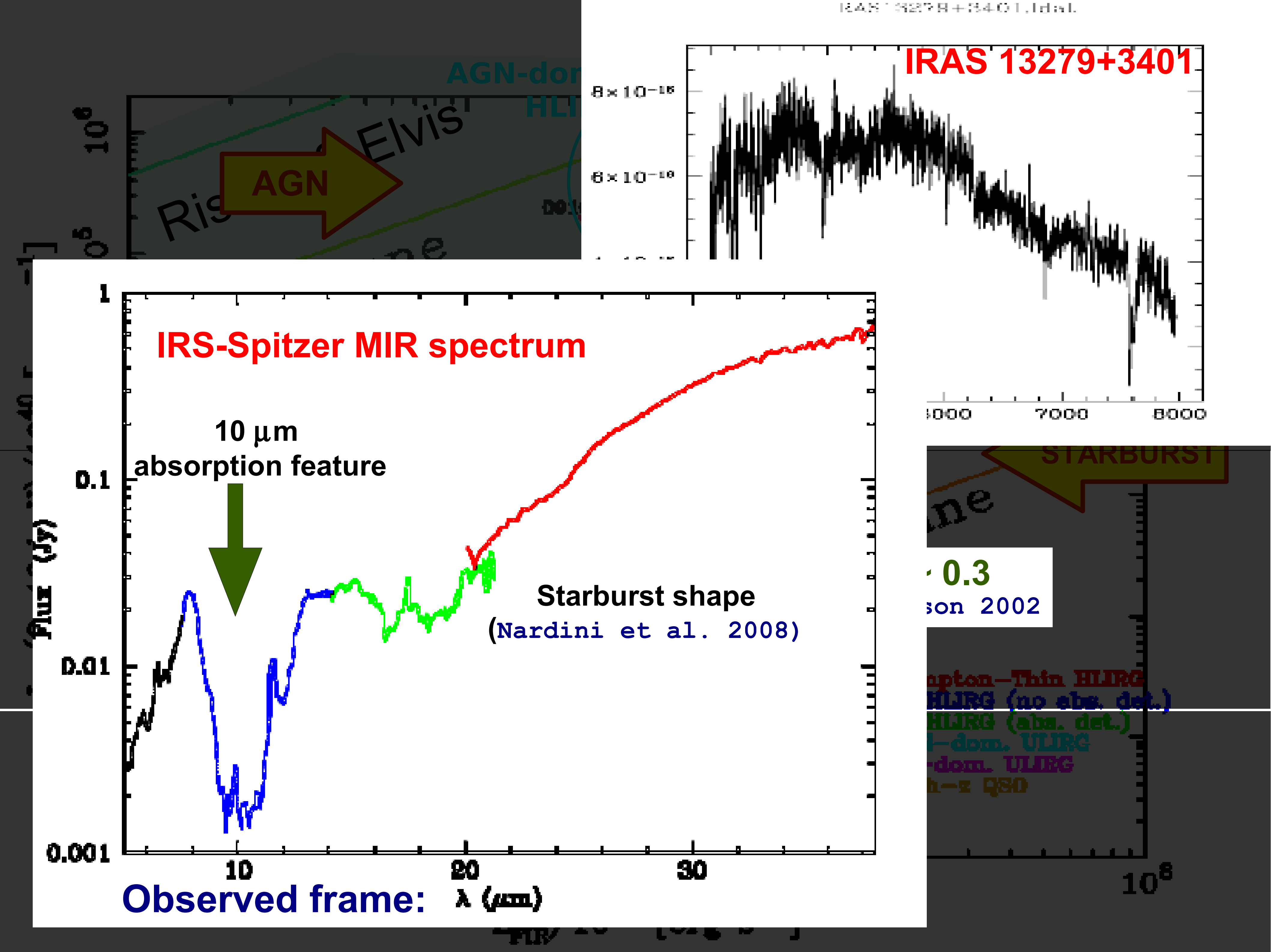

AGN-dominated
HLIRG
Risaliti & Elvis
AGN
AGN zone
High-z
HLIRGS
"Mixed"
AGN-dominated
ULIRG
STARBURST
SB line
STB-dominated
HLIRG
STB-dominated
ULIRG
16347
PG1247
18216
F15307
00104
PG1206
00182
F14218
F12509
12514
14026
07380
F00235
15279
Compton-Thin HLIRG
CT HLIRG (no abs. det.)
CT HLIRG (abs. det.)
AGN-dom. ULIRG
SB-dom. ULIRG
High-z QSO
$L_{FIR}/10^{40}$ [erg s^{-1}]
L_{FL}(2-10 keV)/10^{40} [erg s^{-1}]

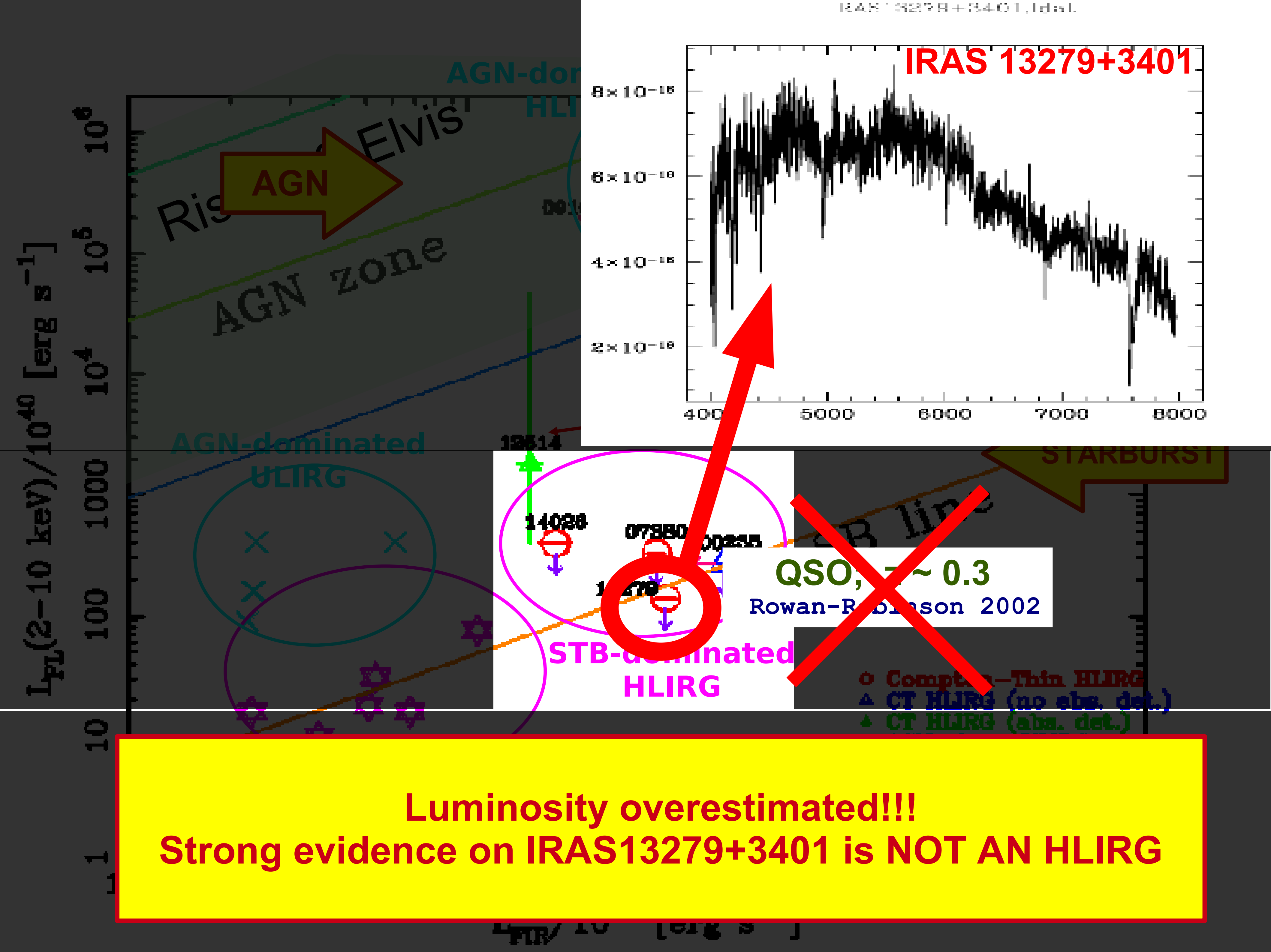


H$_\beta$ consistent with
z = 0.32
IRAS 14026+4341
4000
5000
6000
8000
3×10⁻¹⁵
2×10⁻¹⁵
10⁻¹⁵
16347
PG1247
F15307
PG1206
F14218
F12509
High-z
HLIRGS
"Mixed"
STARBURST
SB line
AGN-dominated
ULIRG
14026
07380
F00235
15279
STB-dominated
HLIRG
STB-dominated
ULIRG
Compton-Thin HLIRG
CT HLIRG (no abs. det.)
CT HLIRG (abs. det.)
AGN-dom. ULIRG
SB-dom. ULIRG
High-z QSO
L_{PL}(2−10 keV)/
$L_{FIR}/10^{40}$ [erg s^{-1}]

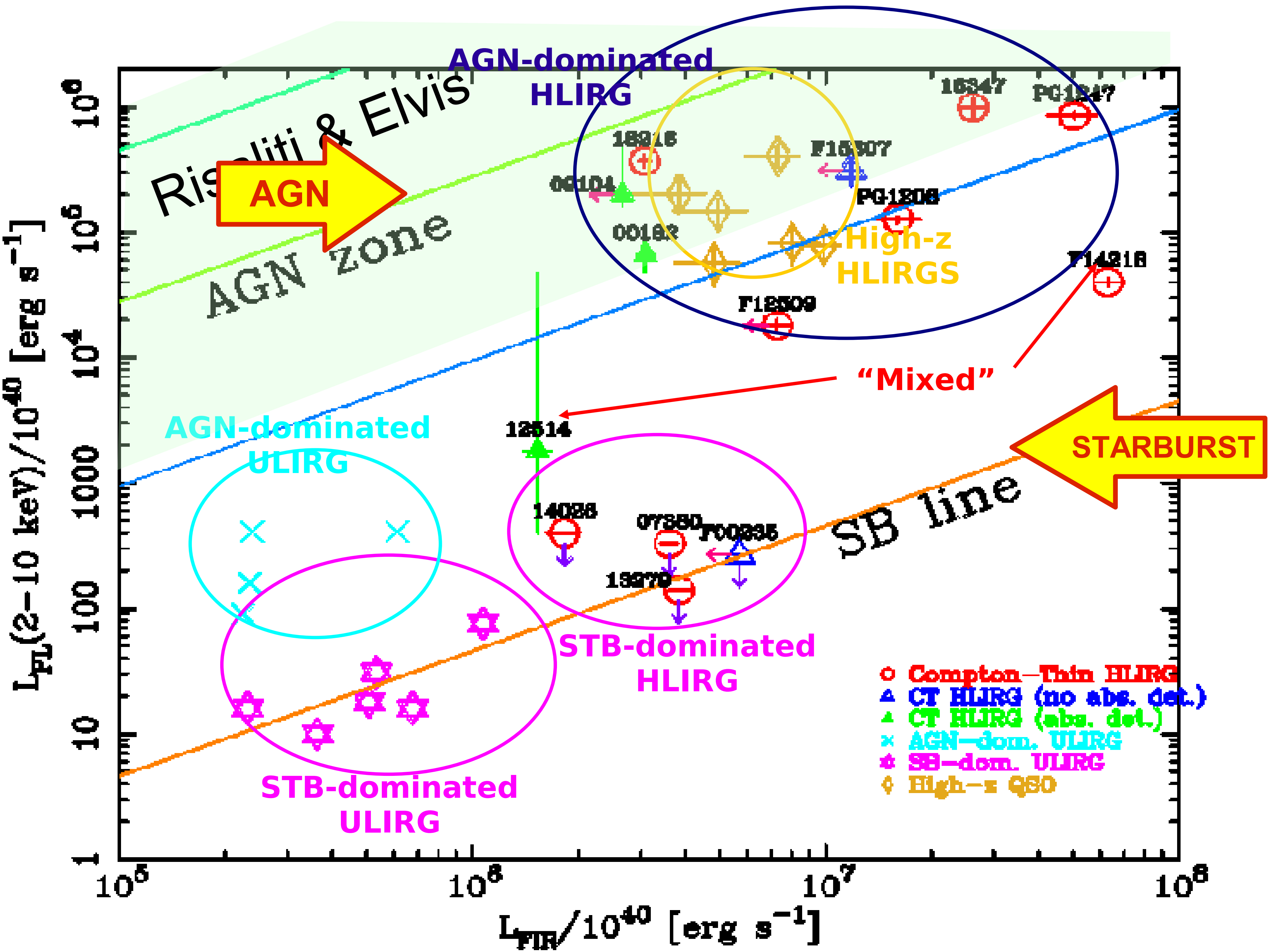


IRAS 13279+3401
4000
5000
6000
7000
8000
AGN
AGN zone
AGN-dominated ULIRG
STARBURST
SB line
QSO; z ~ 0.3
Rowan-Robinson 2002
14026
07380
12514
STB-dominated HLIRG
STB-dominated ULIRG
Compton-Thin HLIRG
CT HLIRG (no abs. det.)
CT HLIRG (abs. det.)
AGN-dom. ULIRG
SB-dom. ULIRG
High-z QSO
$L_{FIR}/10^{40}$ [erg s^{-1}]
$L_{FL}(2-10\ keV)/10^{40}$ [erg s^{-1}]


IRAS 13279+3401
IRS-Spitzer MIR spectrum
10 μm
absorption feature
Starburst shape
(Nardini et al. 2008)
Flux (Jy)
1
0.1
0.01
0.001
10
20
30
7000
8000
Observed frame:
λ (μm)
AGN
Elvis
STARBURST



Luminosity overestimated!!!
Strong evidence on IRAS13279+3401 is NOT AN HLIRG



AGN-dominated
HLIRG
Risaliti & Elvis
AGN
AGN zone
High-z
HLIRGS
"Mixed"
STARBURST
SB line
AGN-dominated
ULIRG
STB-dominated
HLIRG
STB-dominated
ULIRG
15347
PG1247
15215
F15307
00104
PG1206
00182
F14218
F12509
12514
14026
07380
F00235
13279
Compton-Thin HLIRG
CT HLIRG (no abs. det.)
CT HLIRG (abs. det.)
AGN-dom. ULIRG
SB-dom. ULIRG
High-z QSO
$L_{PL}(2-10\ keV)/10^{40}$ [erg s^{-1}]
$L_{FIR}/10^{40}$ [erg s^{-1}]

Spectral Energy Distributions

- Systematic IR excess (or underluminous in X-rays) with respect to local QSO SED:
  - X-ray obscuration?
  - Starburst excess?
  - Departure from standard local SED?
- STB and AGN relative contribution to the total output

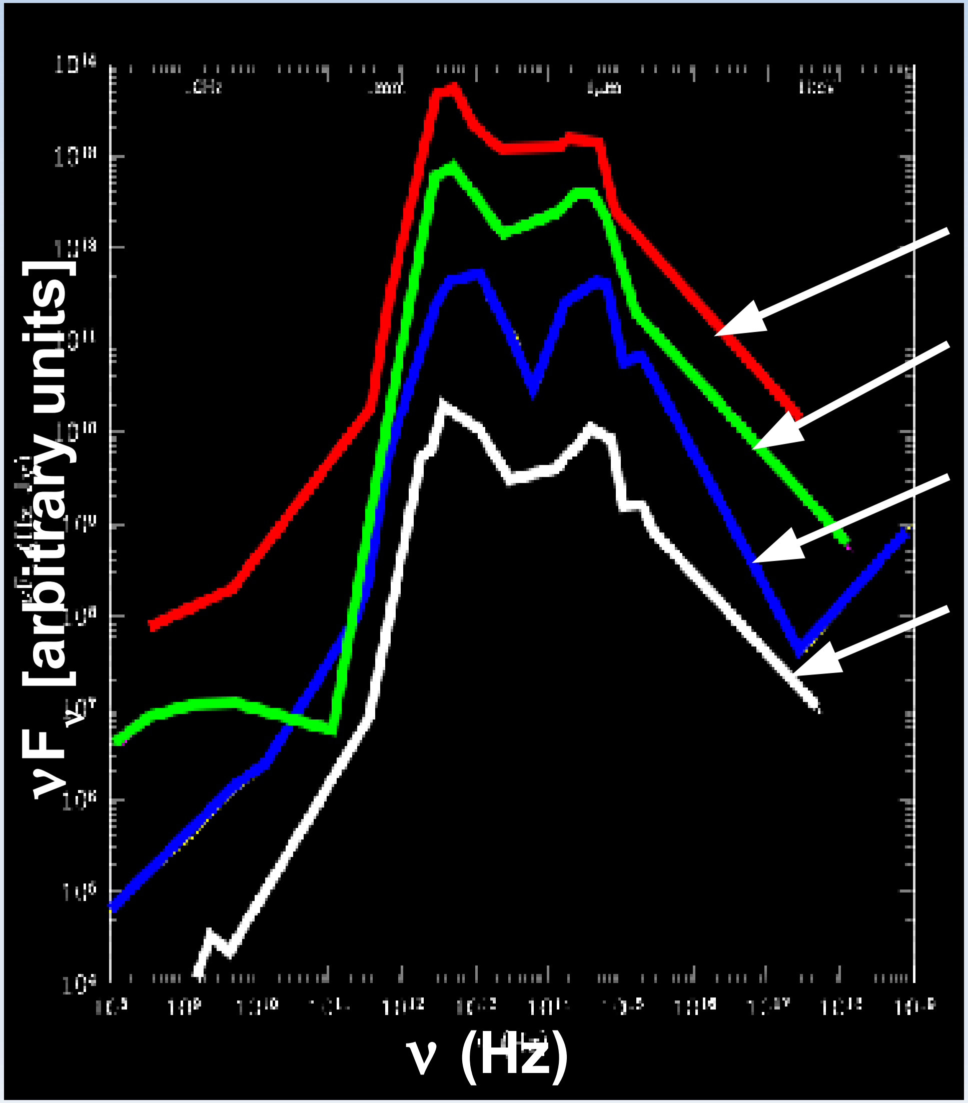
Spectral Energy Distributions

- Systematic IR excess (or underluminous in X-rays) with respect to local QSO SED:
  - X-ray obscuration?
  - Starburst excess?
  - Departure from standard local SED?
- STB and AGN relative contribution to the total output

Build and model the SED of each source in our sample (from radio to X-rays)

Templates

- Well observed SED of local STB and AGN



<u>Starburst:</u>

STB1: NGC 1482

STB2: NGC 4102

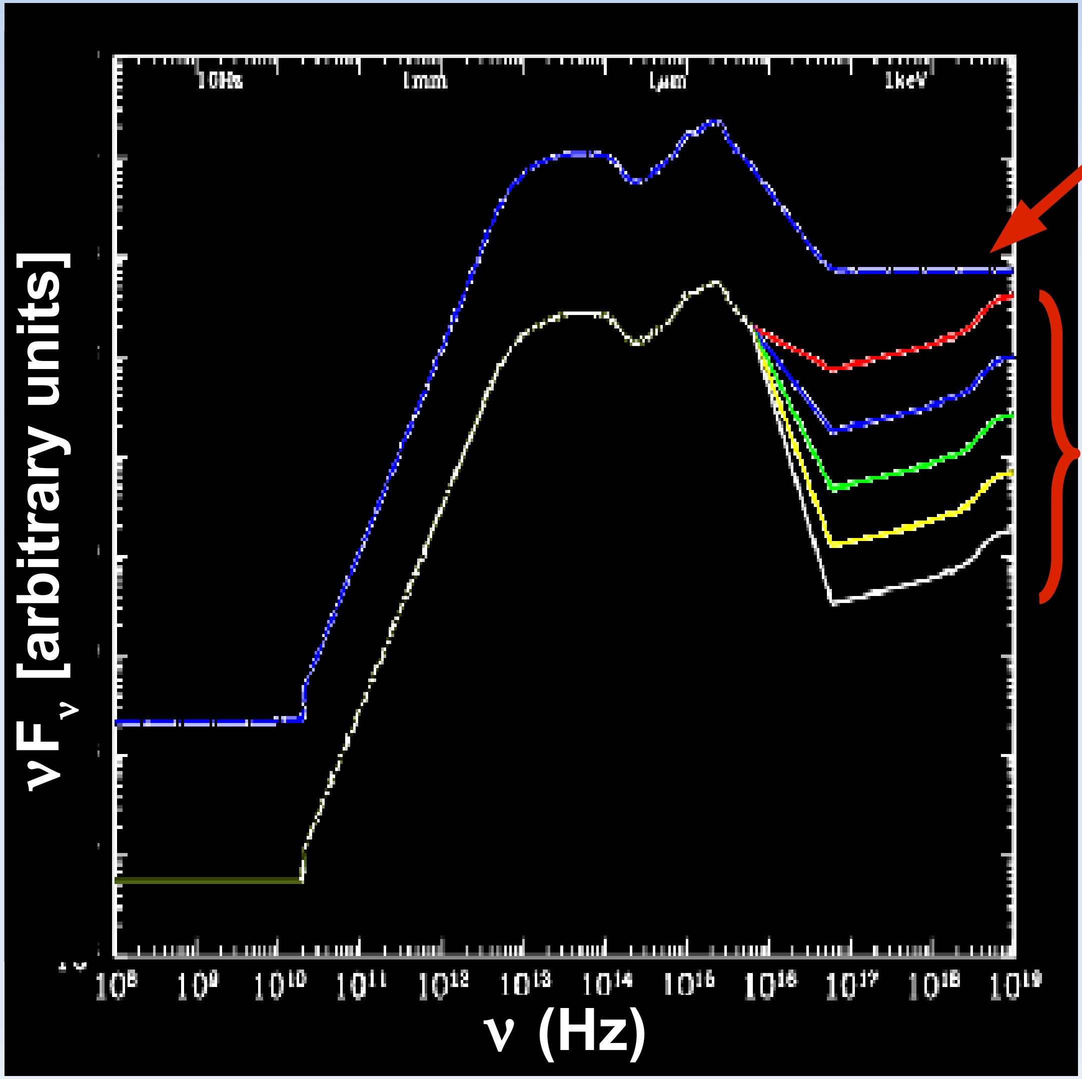
STB3: NGC 5253

STB4: NGC 7714

Different obscuration, width, intensity and peak wavelength

Templates

- Well observed SED of local STB and AGN



Type 1 RQ QSO mean SED:

Elvis et al. 1994: log ν < 12

Richards et al. 2006: log ν > 12

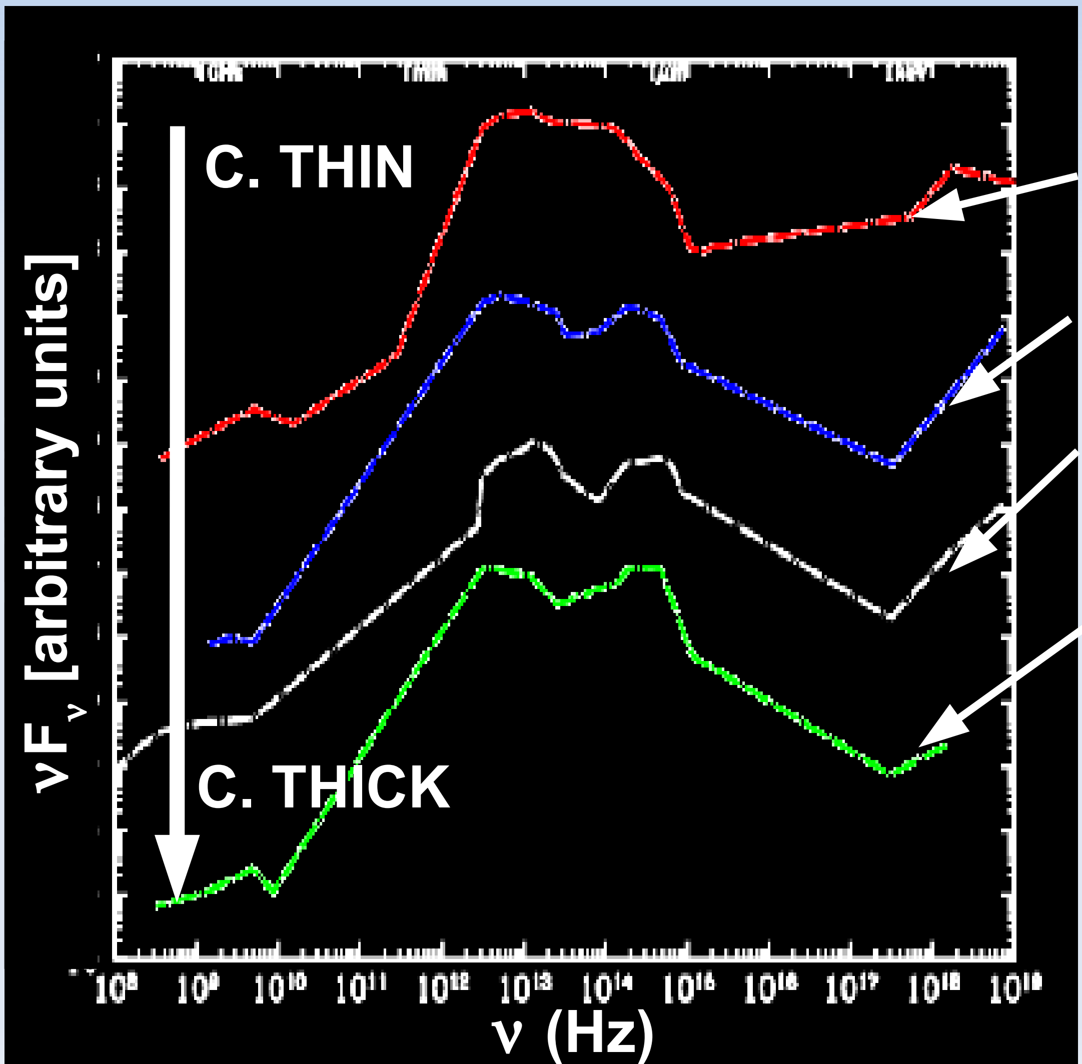
RQ QSO luminosity-dependent SED:

Hopkins, Richards & Hernquist 2007

α_{OX} increase with L_{BOL}

Templates

- Well observed SED of local STB and AGN



AGN3: NGC 5506 (N_H=3x10^{22} cm^{-2})

AGN4: NGC 4507 (N_H=4x10^{23} cm^{-2})

AGN5: Mrk 3 (N_H=1x10^{24} cm^{-2})

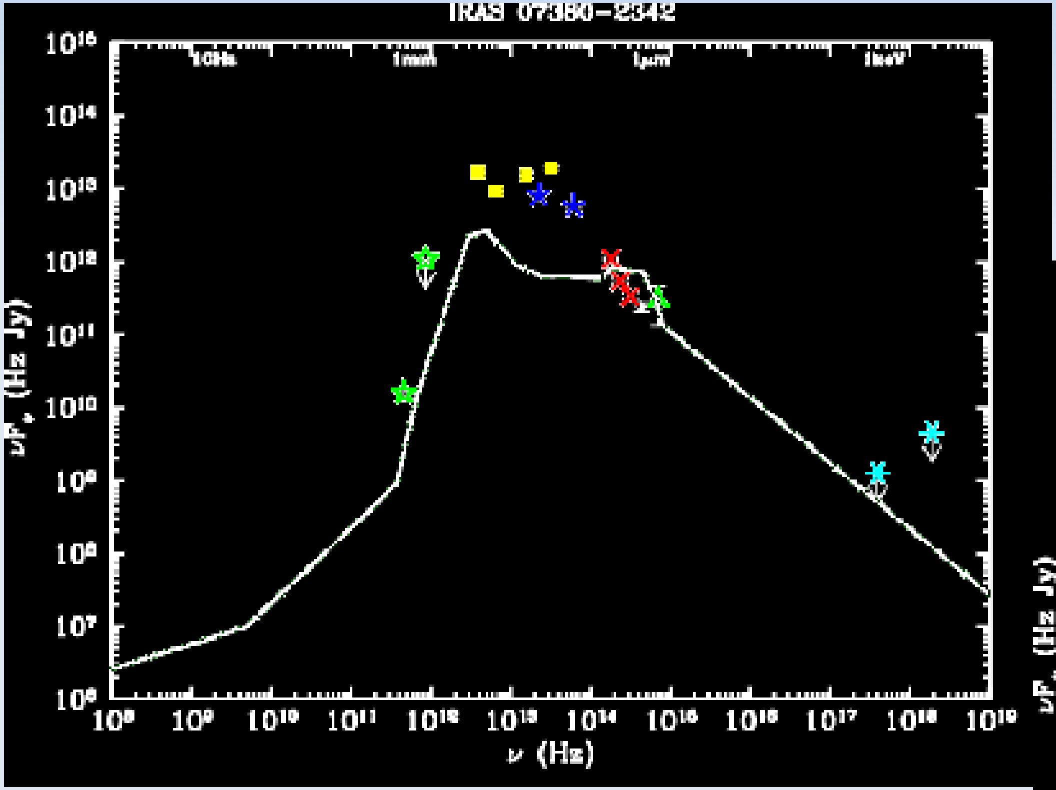
AGN6: NGC 3393 (N_H > 10^{25} cm^{-2})

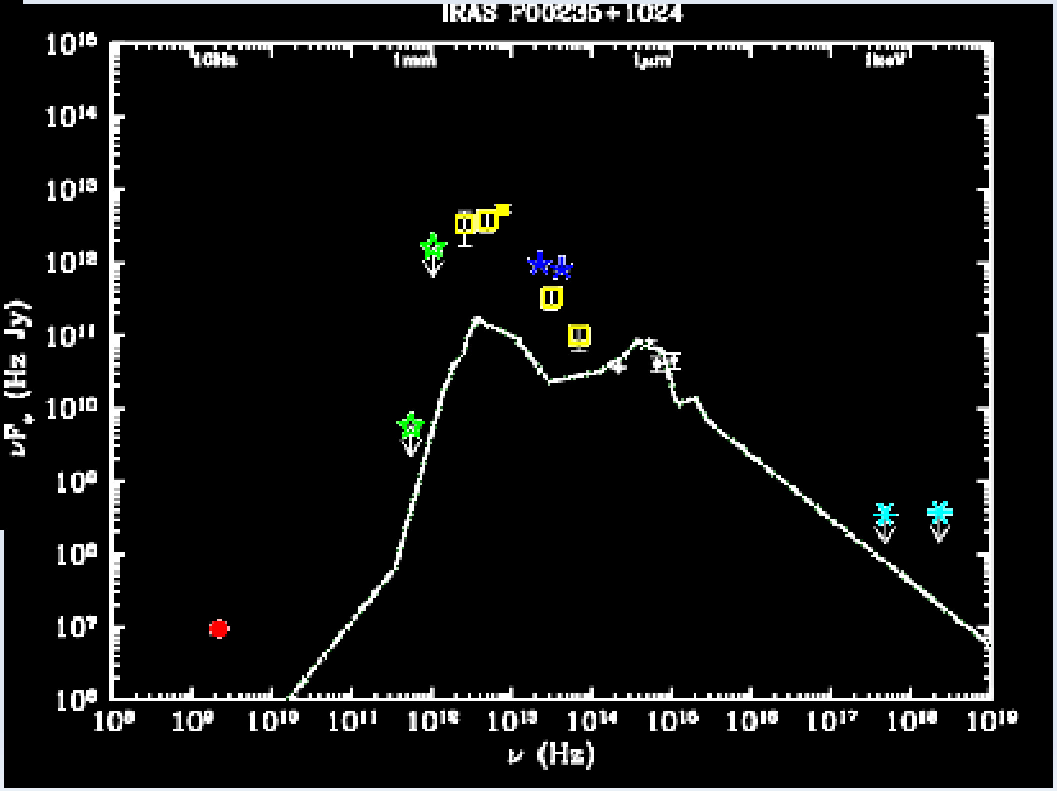
Type 2 AGN
(different obscuration level)

From `Bianchi et al. 2006`
Sy2 sample with
minimal starburst contribution

SEDs of HLIRGs

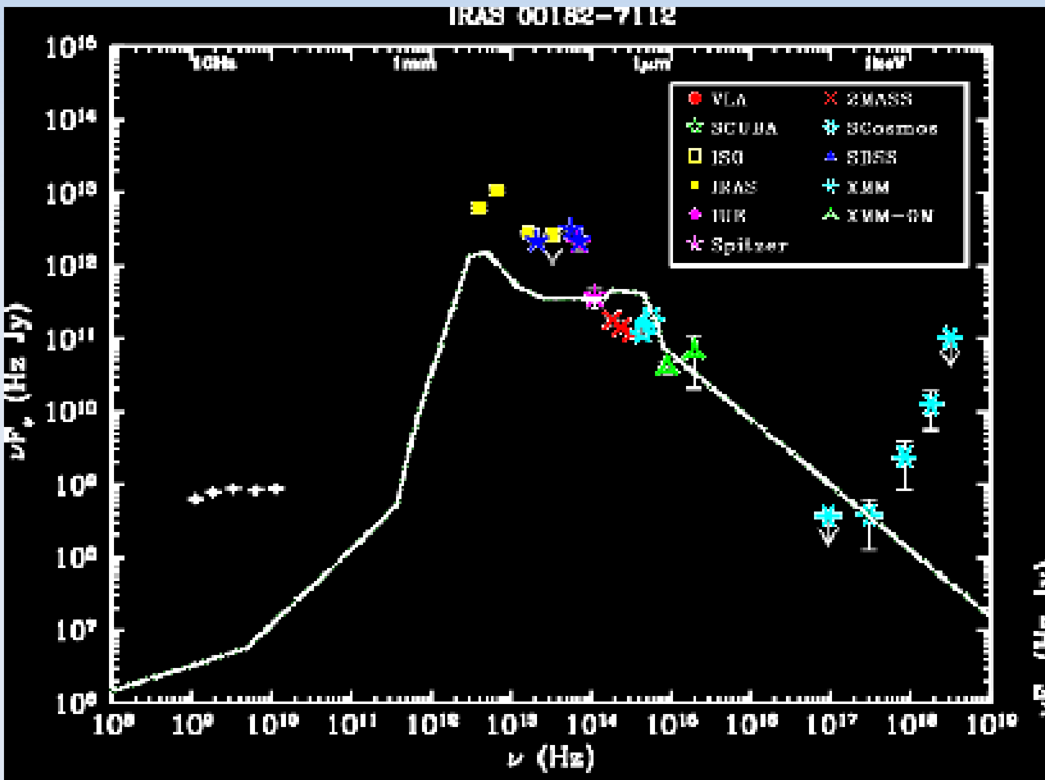
- ***Starburst (opt.)***

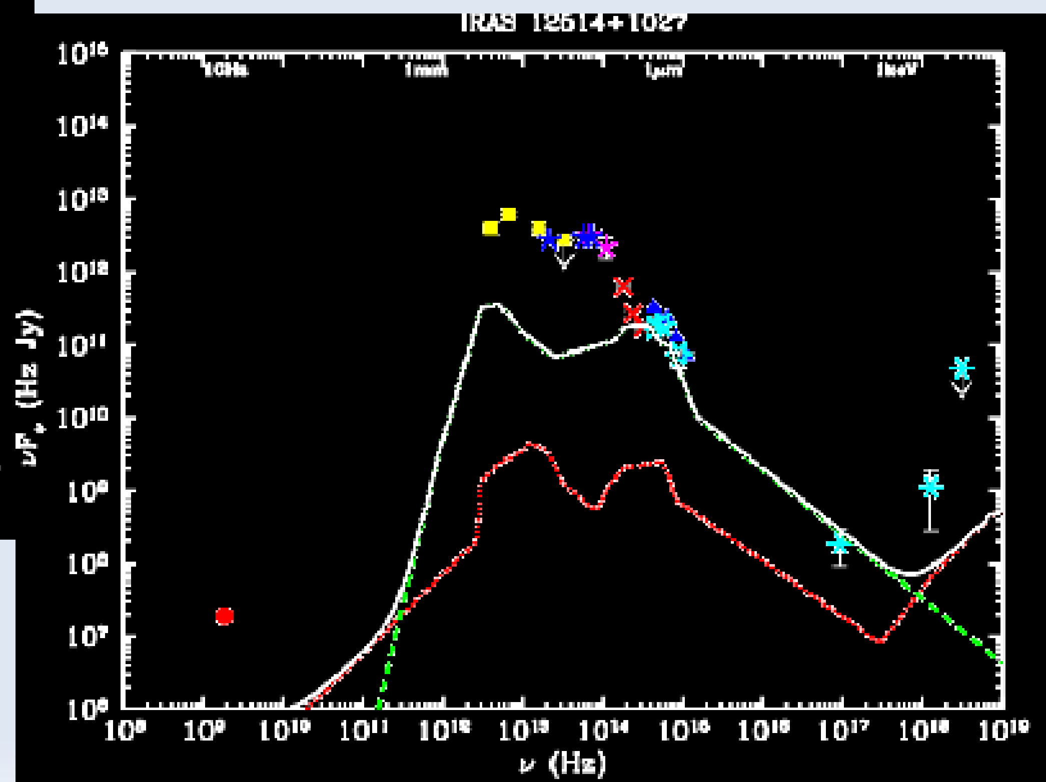




SEDs of HLIRGs

- ***Type 2 AGN sources (opt.)***

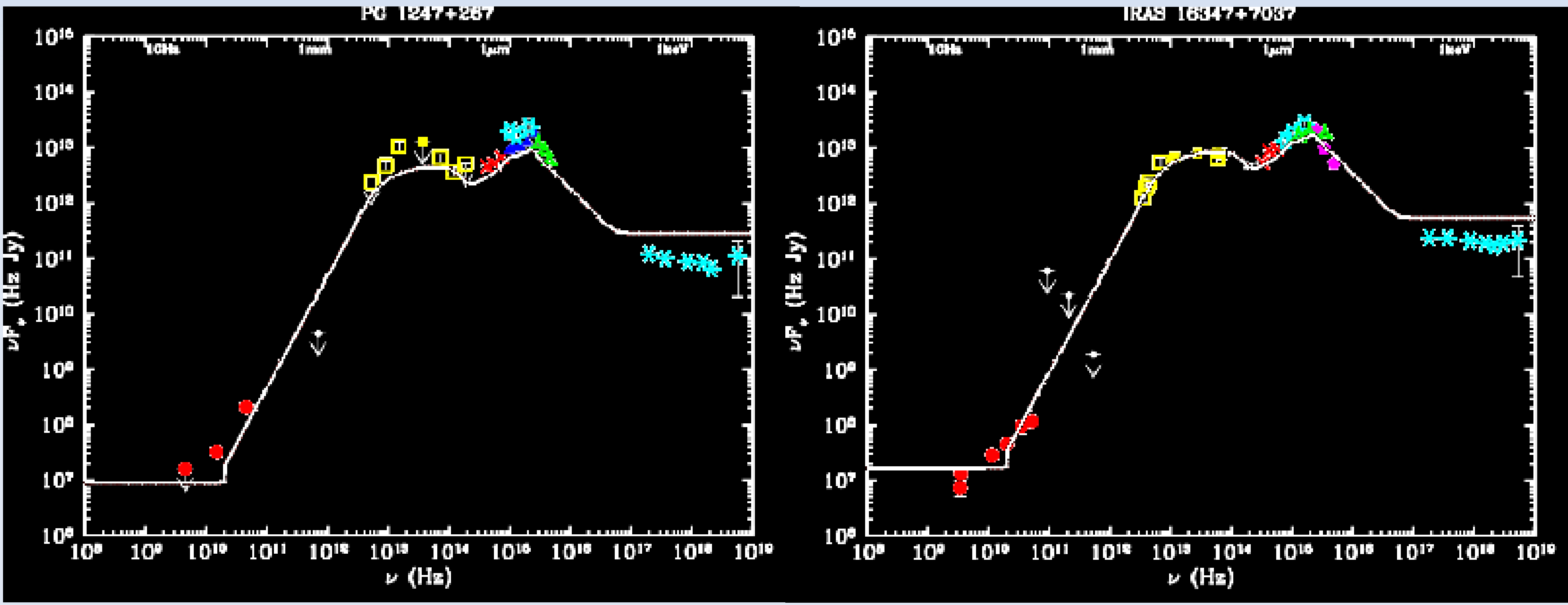




SEDs of HLIRGs

- ***Type 1 AGN sources (opt.)***

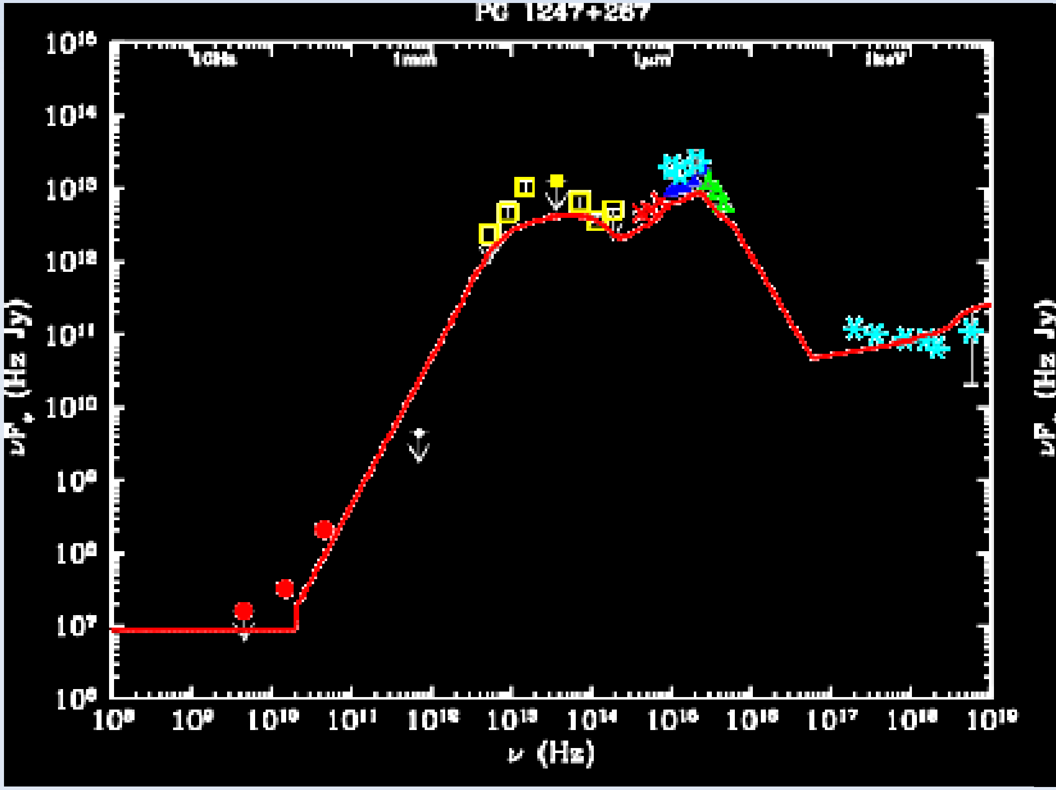
non-Luminosity-dependent SED

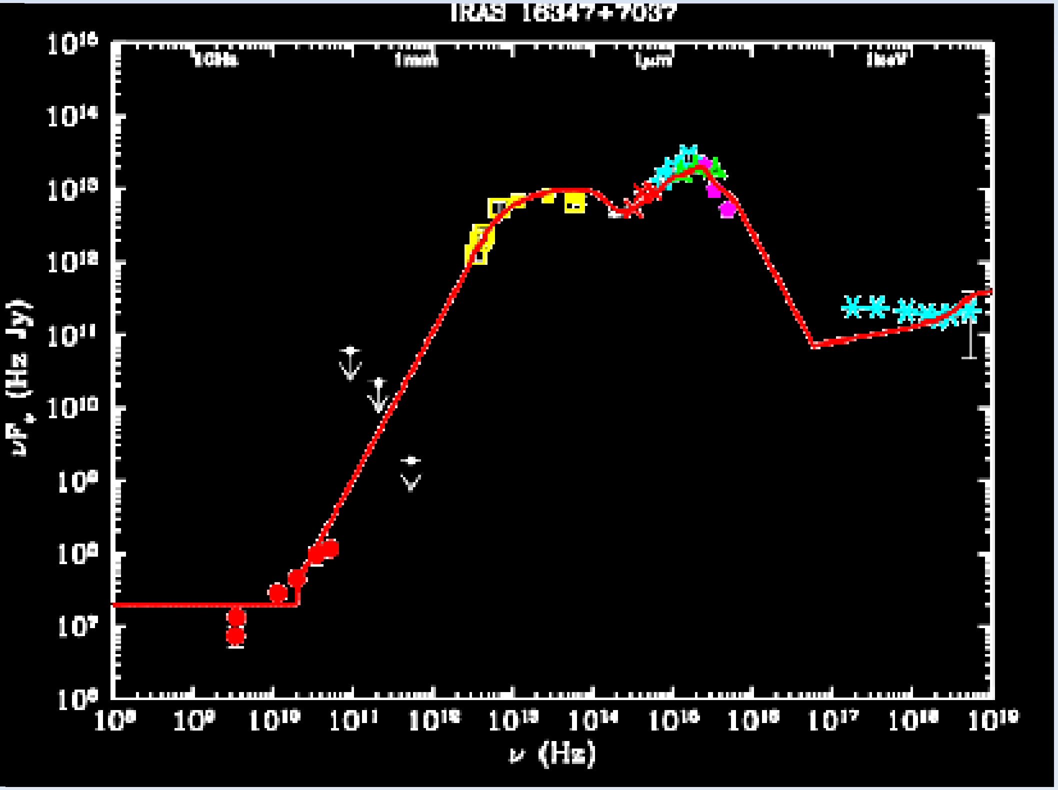


SEDs of HLIRGs

- ***Type 1 AGN sources (opt.)***

Luminosity-dependent SED

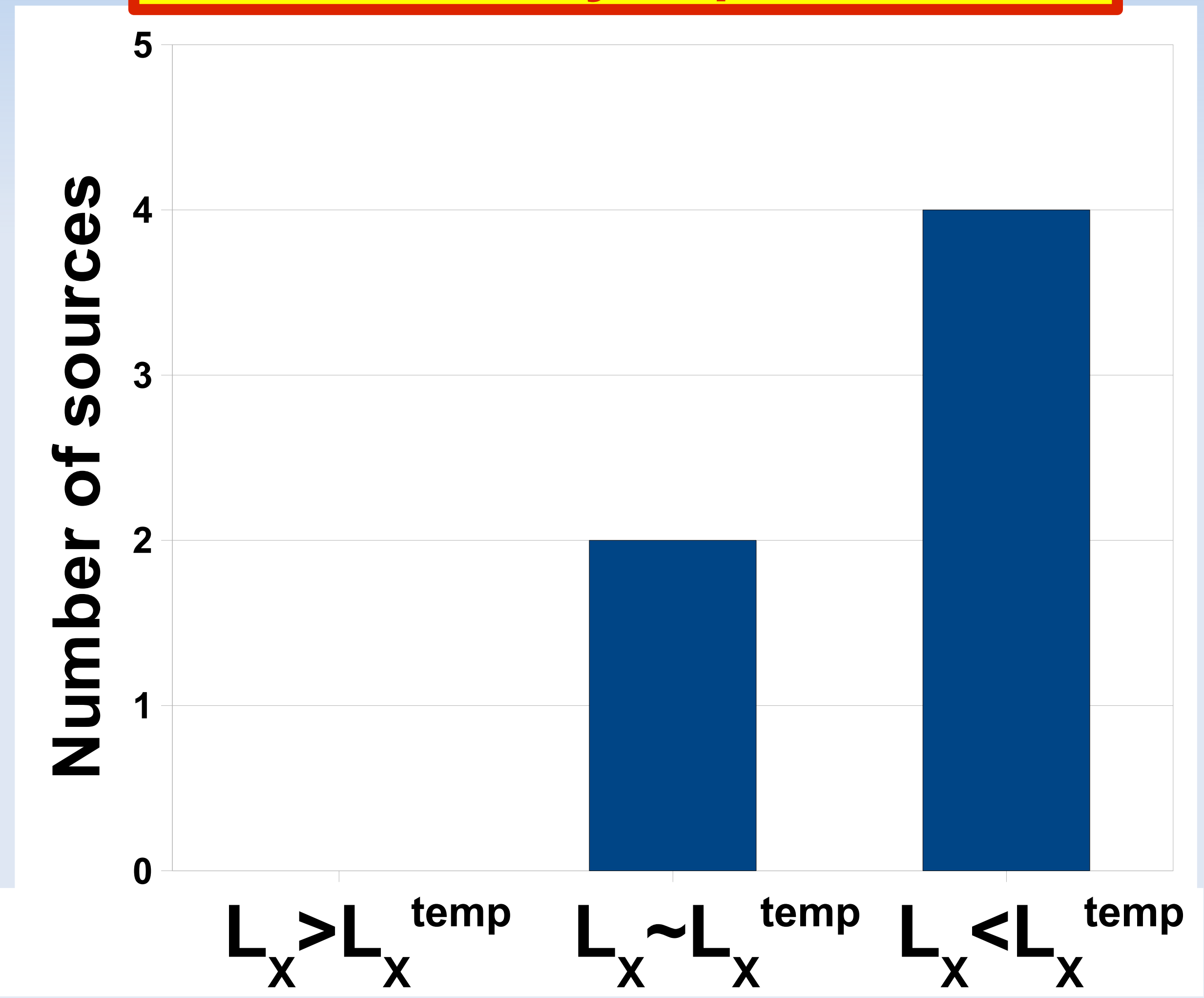




SED of HLIRGs

- ***Type 1 AGN sources (opt.)***

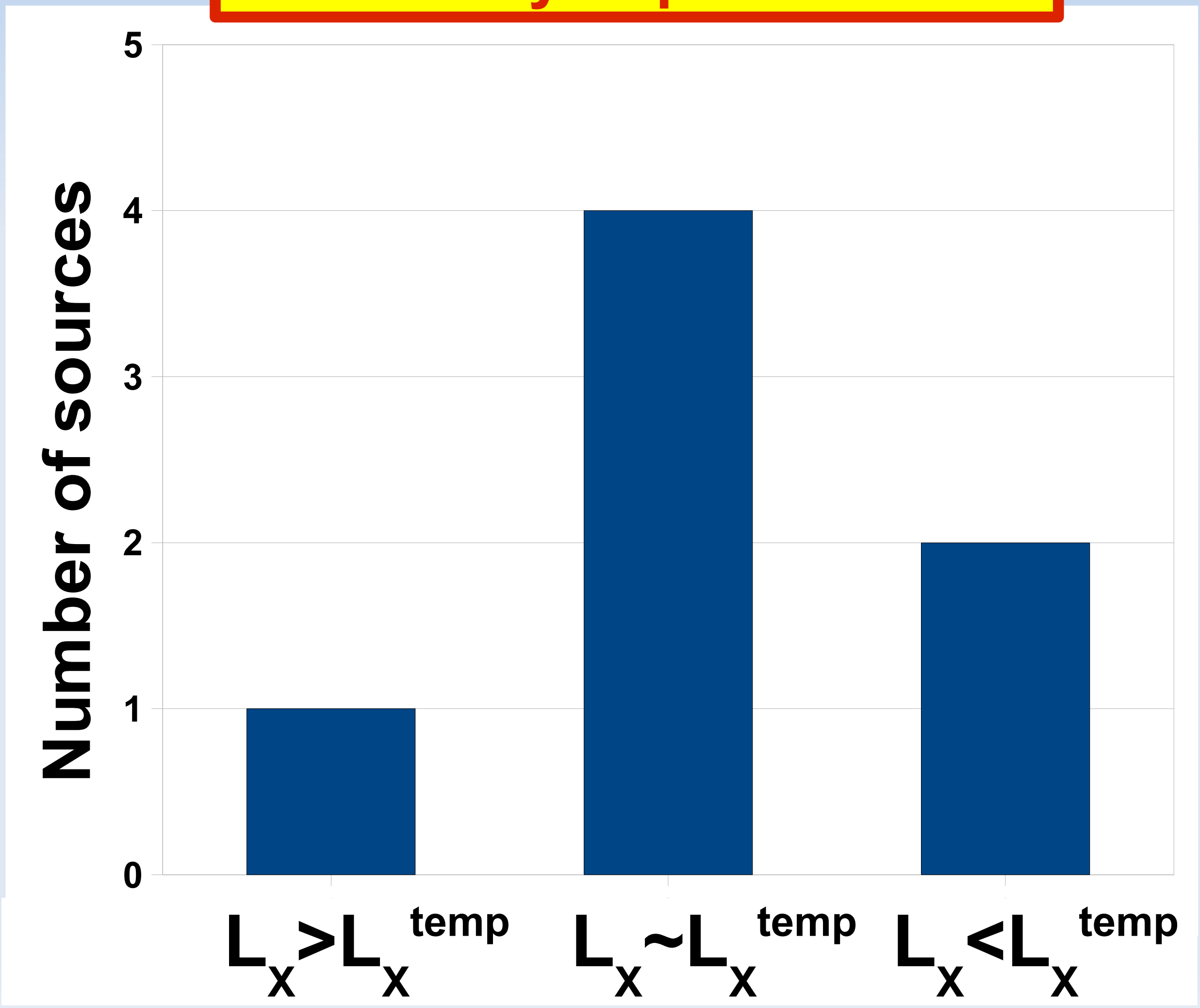
non-Luminosity-dependent SED



SED of HLIRGs

- ***Type 1 AGN sources (opt.)***

Luminosity-dependent SED



Fitting **without** X-ray data

Source	*Best fit*		log L_{BOL}	*AGN / STB*	*CT?*
IRAS F00235+1024	AGN3		46.0	1 / 0	✓
IRAS 07380-2342	AGN3		46.6	1 / 0	X
IRAS 00182-7112	AGN3		46.5	1 / 0	✓
IRAS 09104+4109	AGN3	STB4	47.0	0.9 / 0.1	✓
IRAS 12514+1027	AGN3	STB4	46.4	0.9 / 0.1	✓
IRAS F15307+3252	AGN1	STB1	47.0	0.2 / 0.8	✓
PG 1206+459	AGN1		48.4	1 / 0	X
PG 1247+267	AGN1		49.2	1 / 0	X
IRAS F12509+3122	AGN1		47.4	1 / 0	X
IRAS 14026+4341	AGN1	STB4	46.8	0.3 / 0.7	X
IRAS F14218+3845	AGN1		47.0	1 /0	X
IRAS 16347+7037	AGN1		48.9	1 / 0	X
IRAS 18216+6418	AGN1	STB1	47.4	0.8 / 0.2	X

Fitting with X-ray data

Source	*Best fit*		log L_{BOL}	*AGN / STB*	*CT?*
IRAS F00235+1024		STB4	45.6	0 / 1	✓
IRAS 07380-2342		STB1	46.2	0 / 1	X
IRAS 00182-7112		STB1	46.1	0 / 1	✓
IRAS 09104+4109	AGN3	STB1	46.9	0.6 / 0.4	✓
IRAS 12514+1027	AGN5	STB2	47.2	0.5 / 0.5	✓
IRAS F15307+3252	AGN5	STB4	47.0	0.8 / 0.2	✓
PG 1206+459	AGN1		48.4	1 / 0	X
PG 1247+267	AGN1		49.2	1 / 0	X
IRAS F12509+3122	AGN1		47.4	1 / 0	X
IRAS 14026+4341		STB4	46.8	0 / 1	X
IRAS F14218+3845	AGN1		47.0	1 /0	X
IRAS 16347+7037	AGN1		48.9	1 / 0	X
IRAS 18216+6418	AGN1	STB1	47.5	0.7 / 0.3	X

Compton Thick

Source	Best fit		log L_{BOL}	AGN / STB	CT?
IRAS F00235+1024		STB4	45.6	0 / 1	✓
IRAS 07380-2342		STB1	46.2	0 / 1	X
IRAS 00182-7112		STB1	46.1	0 / 1	✓
IRAS 09104+4109	AGN3	STB1	46.9	0.6 / 0.4	✓
IRAS 12514+1027	AGN5	STB2	47.2	0.5 / 0.5	✓
IRAS F15307+3252	AGN5	STB4	47.0	0.8 / 0.2	✓
PG 1206+459	AGN1		48.4	1 / 0	X
PG 1247+267	AGN1		49.2	1 / 0	X
IRAS F12509+3122	AGN1		47.4	1 / 0	X
IRAS 14026+4341		STB4	46.8	0 / 1	X
IRAS F14218+3845	AGN1		47.0	1 /0	X
IRAS 16347+7037	AGN1		48.9	1 / 0	X
IRAS 18216+6418	AGN1	STB1	47.5	0.7 / 0.3	X

Source	*Best fit*		log L_{BOL}	*AGN / STB*	*CT?*
IRAS F00235+1024		STB4	45.6	0 / 1	✓
IRAS 07380-2342		STB1	46.2	0 / 1	X
IRAS 00182-7112		STB1	46.1	0 / 1	✓
IRAS 09104+4109	AGN3	STB1	46.9	0.6 / 0.4	✓
IRAS 12514+1027	AGN5	STB2	47.2	0.5 / 0.5	✓
IRAS F15307+3252	AGN5	STB4	47.0	0.8 / 0.2	✓
PG 1206+459	AGN1		48.4	1 / 0	X
PG 1247+267	AGN1		49.2	1 / 0	X
IRAS F12509+3122	AGN1		47.4	1 / 0	X
IRAS 14026+4341		STB4	46.8	0 / 1	X
IRAS F14218+3845	AGN1		47.0	1 /0	X
IRAS 16347+7037	AGN1		48.9	1 / 0	X
IRAS 18216+6418	AGN1	STB1	47.5	0.7 / 0.3	X

AGN only: 5 sources

Source	Best fit		log L_{BOL}	AGN / STB	CT?
IRAS F00235+1024		STB4	45.6	0 / 1	✓
IRAS 07380-2342		STB1	46.2	0 / 1	X
IRAS 00182-7112		STB1	46.1	0 / 1	✓
IRAS 09104+4109	AGN3	STB1	46.9	0.6 / 0.4	✓
IRAS 12514+1027	AGN5	STB2	47.2	0.5 / 0.5	✓
IRAS F15307+3252	AGN5	STB4	47.0	0.8 / 0.2	✓
PG 1206+459	AGN1		48.4	1 / 0	X
PG 1247+267	AGN1		49.2	1 / 0	X
IRAS F12509+3122	AGN1		47.4	1 / 0	X
IRAS 14026+4341		STB4	46.8	0 / 1	X
IRAS F14218+3845	AGN1		47.0	1 /0	X
IRAS 16347+7037	AGN1		48.9	1 / 0	X
IRAS 18216+6418	AGN1	STB1	47.5	0.7 / 0.3	X

SB only: 4 sources

Composite: 4 sources

Source	Best fit		log L_{BOL}	AGN / STB	CT?
IRAS F00235+1024		STB4	45.6	0 / 1	✓
IRAS 07380-2342		STB1	46.2	0 / 1	X
IRAS 00182-7112		STB1	46.1	0 / 1	✓
IRAS 09104+4109	AGN3	STB1	46.9	0.6 / 0.4	✓
IRAS 12514+1027	AGN5	STB2	47.2	0.5 / 0.5	✓
IRAS F15307+3252	AGN5	STB4	47.0	0.8 / 0.2	✓
PG 1206+459	AGN1		48.4	1 / 0	X
PG 1247+267	AGN1		49.2	1 / 0	X
IRAS F12509+3122	AGN1		47.4	1 / 0	X
IRAS 14026+4341		STB4	46.8	0 / 1	X
IRAS F14218+3845	AGN1		47.0	1 /0	X
IRAS 16347+7037	AGN1		48.9	1 / 0	X
IRAS 18216+6418	AGN1	STB1	47.5	0.7 / 0.3	X

Source	Best fit		log L_{BOL}	AGN / STB	CT?
IRAS F00235+1024		STB4	45.6	0 / 1	✓
IRAS 07380-2342		STB1	46.2	0 / 1	X
IRAS 00182-7112		STB1	46.1	0 / 1	✓
IRAS 09104+4109	AGN3	STB1	46.9	0.6 / 0.4	✓
IRAS 12514+1027	AGN5	STB2	47.2	0.5 / 0.5	✓
IRAS F15307+3252	AGN5	STB4	47.0	0.8 / 0.2	✓
			48.4	1 / 0	X
			49.2	1 / 0	X
IRAS F12509+3122	AGN1		47.4	1 / 0	X
IRAS 14026+4341		STB4	46.8	0 / 1	X
IRAS F14218+3845	AGN1		47.0	1 /0	X
IRAS 16347+7037	AGN1		48.9	1 / 0	X
IRAS 18216+6418	AGN1	STB1	47.5	0.7 / 0.3	X

Bolometric output dominated by AGN emission

Thanks to ESA & ESA Education Office for financial support

Conclusions

- XMM-Newton-selected sample of **13 HLIRGs:**
  - 10/13 detected and **AGN-dominated in X-rays**:
  - Under luminous in X-rays with respect to mean SED of local QSO
- Modelling multi-λ SED (from radio to X-rays):
  - SED fitting **consistent** with the **optical classification**
  - **9/13 need an AGN component**:
    - 5 pure AGN, 4 composite
    - STB templates preferred: NGC 1482 (**aged bursts**)
  - **AGN** component **dominates** the bolometric **output**
- **X-ray data are mandatory** for an accurate estimation of the relative AGN / STB contribution
- SED of **type 1** AGN are consistent with a **luminosity dependent SED**