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# Target Selection of the General Program of SVOM

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*In coll. with*

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- **Sample selection**

  correlation with the RASS-BSC
- **The AGN science**

  the extremes of AGN variability

# Sample Selection

**Why ROSAT?**

**MXT** 0.2-6 keV

**ROSAT** 0.1-2.4 keV

**Why the ROSAT all-sky survey bright source catalog?**

**RASS-BSC:** contains 18,811 sources (Voges et al. 1999)

- down to a limiting ROSAT PSPC count-rate of 0.05 cts $s^{-1}$ in 0.1−2.4 keV
- with a detection likelihood of at least 15
- at least 15 source counts

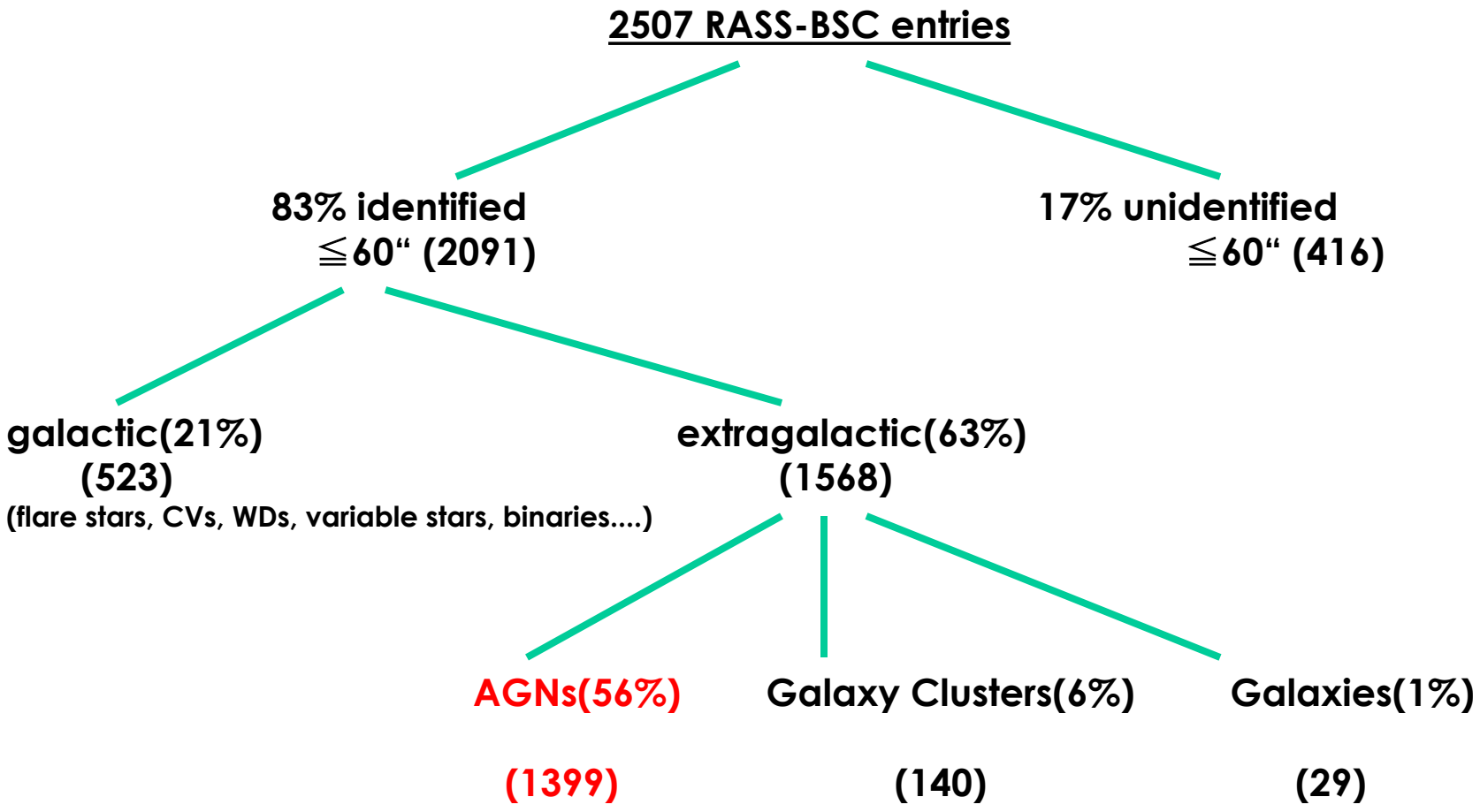
# Sample Selection

- **2,507 ROSAT-BSC sources close (i.e., within 10° ) to the B1 law.**

- **Correlation with exisiting data bases:**

➢ We have performed a cross-correlation of these sources with various cataloges. These cataloges include public data bases like the NED or SIMBAD and the latest versions of published cataoges or cataloges in print.

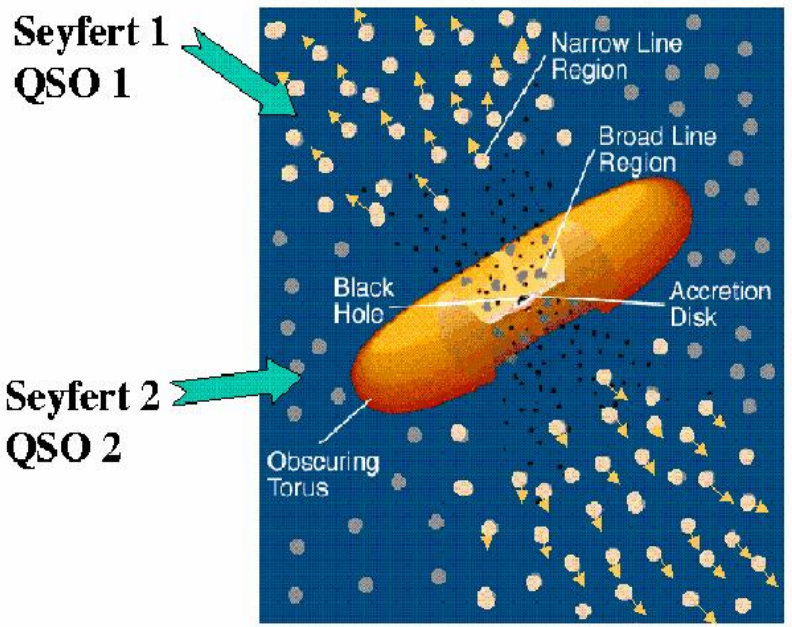
# Sample Selection

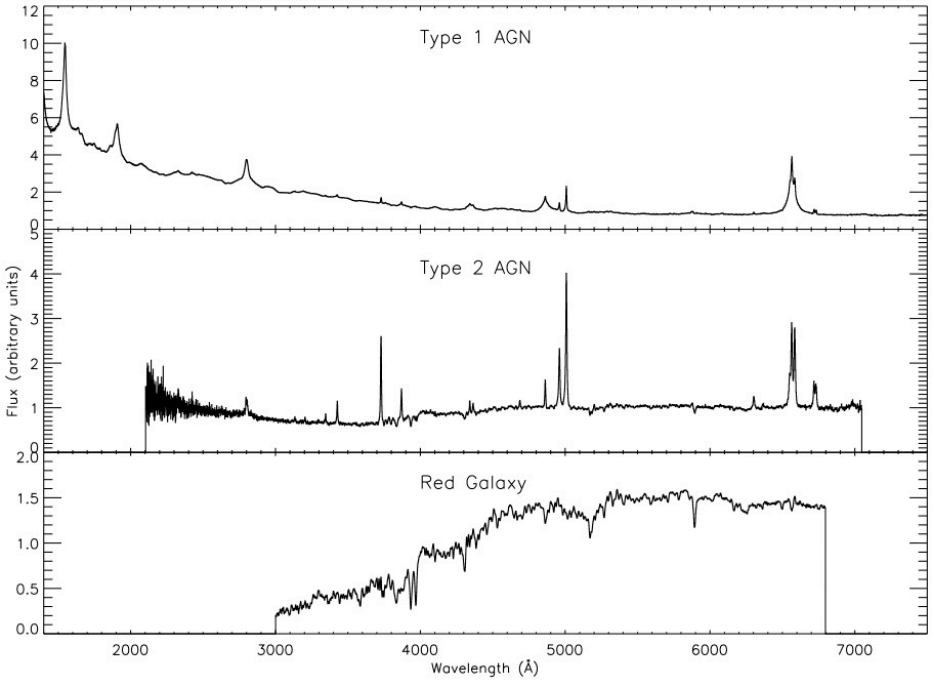


# AGN Paradigm

- Unified model (Antonucci 93 & Urry & Padovani 95)
  - Obscured vs. unobscured AGNs (opt & X-ray)

**AGNs** are super-massive black-holes accreting gas from a disk in the center of a galaxy.



# The extremes of AGN variability

- **Deep X-ray low-flux states in (NL)S1 galaxies (factor 10)**
- **AGNs at the highest amplitudes: giant drops & outbursts (>factor 100)**
- **"Changing-look" AGNs: multi-λ view of extreme Sy-type changes**

extreme flux and spectral states: -- can reveal the nature of the inner accretion disk, -- the physics of matter under strong gravity, -- offer a way of measuring BH spin, -- provide insight on the material expelled by the SMBH incl. strong outflows, feedback; -- route to discovery of rare new transients, TDEs, changing-look AGNs, SMBBHs, ...

Komossa+16,17

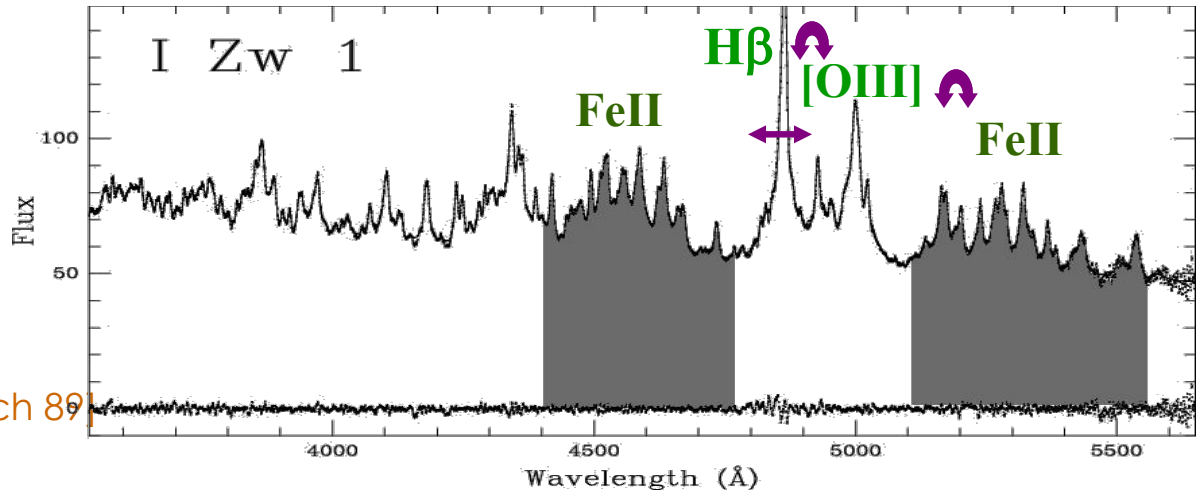
# Intro: Narrow-Line Seyfert 1 galaxies

- **defi:** via optical spectral properties

**$FWHM_{H\beta}$ < 2000 km/s**
**FeII/Hβ > 0.5**

**[OIII]/Hβ < 3**

[e.g.,Osterbrock & Pogge 85, Goodrich 89]




- **NLS1s locate at "extreme end" of correlations (`EV1´) between line/continuum properties of AGNs**

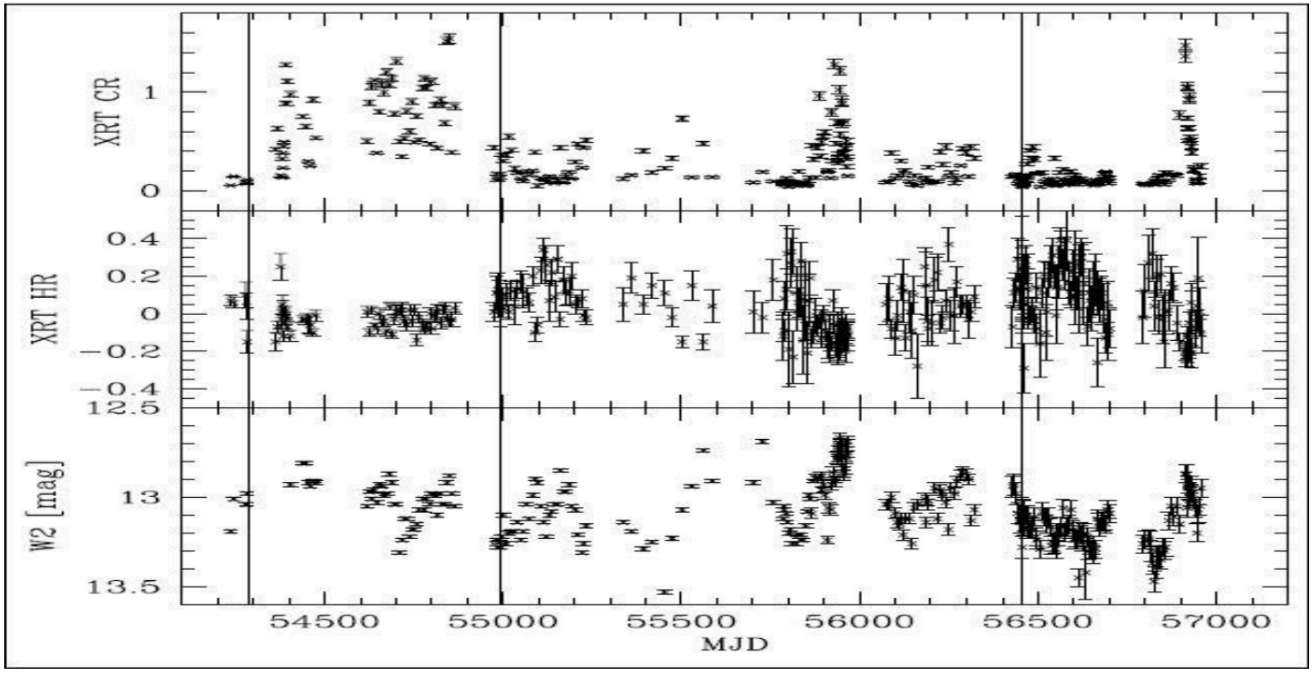
  - small $FWHM_{H\beta}$ , strong FeII/Hβ, weak [OIII/Hβ, strong CIV blueshifts, Hβ asym.
  - sometimes: steep X-spectra; some samples show $\Gamma_X$-$FWHM_{H\beta}$ corr., others not at all

- **low-mass BHs and high accretion rates**

- **important targets when addressing questions related to black hole growth, galaxy evolution and accretion physics.**

# Deep X-ray low-flux states: the NLS1 Mrk 335

- nearby, highly variable NLS1 galaxy
- has traditionally been a bright X-ray source
- deep X-ray low-state (factor >10 drop) seen with Swift in 2007
- since then:
  - deep low-state in 2013: XMM, Suzaku & NuStar follow-ups
  - rapid UV decline in 2015/16: HST & XMM-RGS follow-up




[Grupe + 07, 08, 12, Komossa+14,17, Gallo+15,18….]

# Deep X-ray low-flux states: the NLS1 Mrk 335

## deep low-state scenarios:

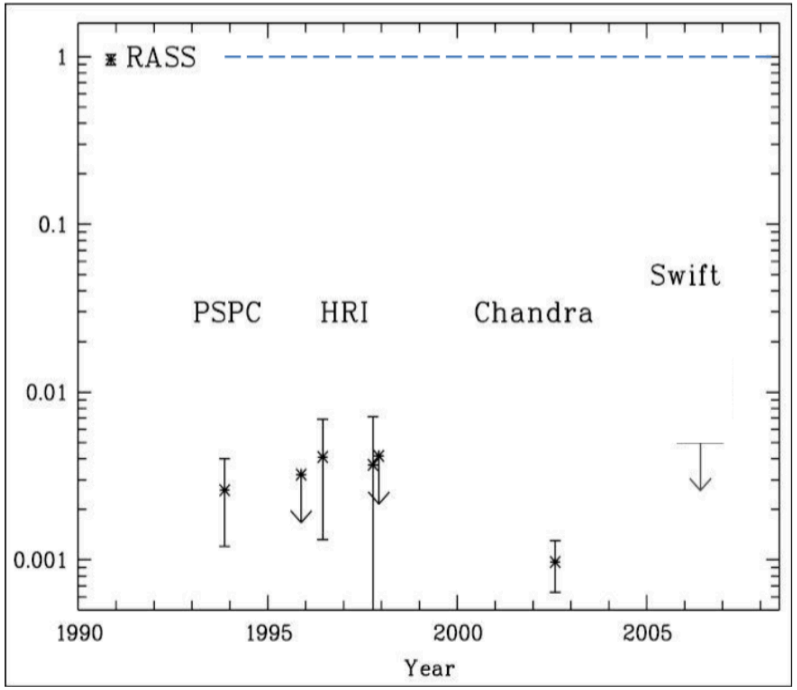
- **reflection-dominated spectrum**: low coronal height, above inner disk → strong light bending and blurring best-fit models require: most of the reflection originates from within a few $r_g$ & high spin (+ additional warm absorption)

- **partial covering absorption, unobscured at high-state, strongly absorbed at low-state** (cf ~0.95, log N ~ 23.3)

[Grupe + 07, 08, 12, Komossa+14,17, Gallo+15,18…]

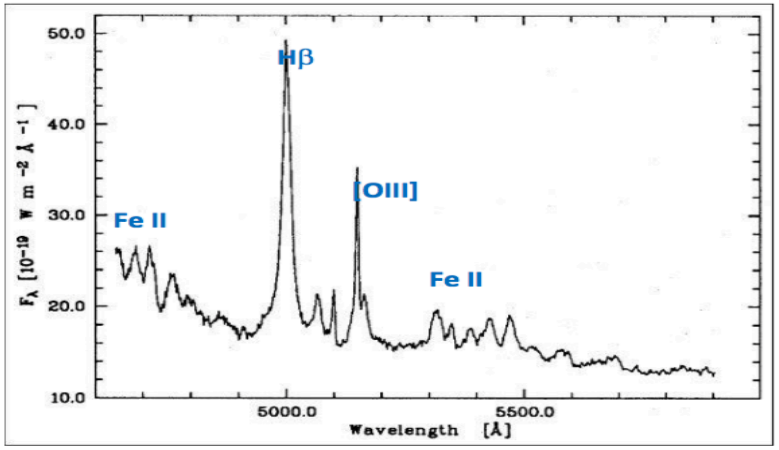
# Giant X-ray drop: the NLS1 WPVS007

- **unique, giant-amplitude drop in its X-ray emission (factor ~400)**
- its optical spectrum showed little/no changes from 1993-2012
- recent strong change in UV, into very low state: triggered HST observation




- **Scenario: l.o.s. grazes edge of clumpy, dusty torus**

  - clumps produce occultation event(s)
  - else: view through wind launched from edge of torus, r ~ 0.1-1pc

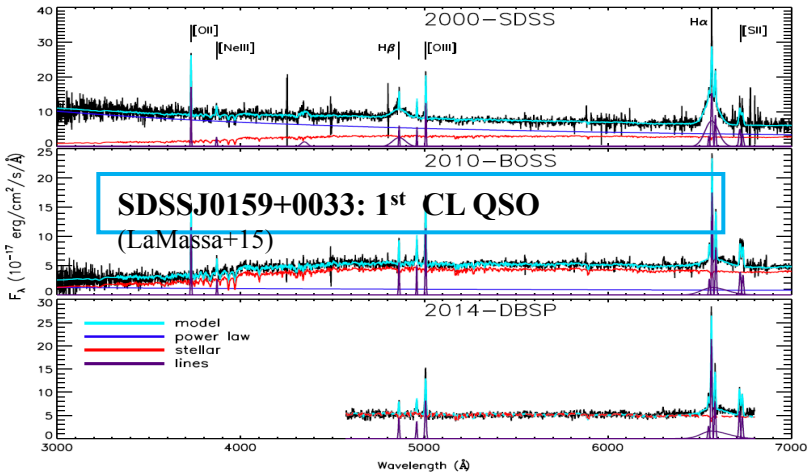


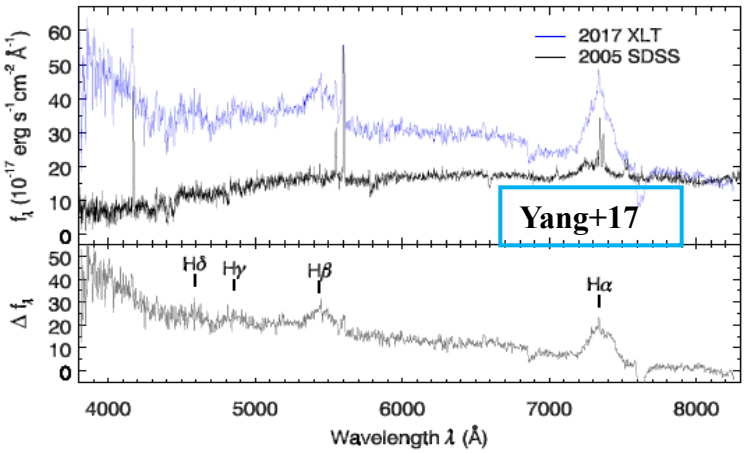

[Grupe+ 95, 07, 08, 13, Leighly+09, 15, Komossa+17]

# Changing-look AGNs

- "Changing-look" (CL) phenomenon
  - rare cases, with the (opt) spectral type change within years.
  - Type 2 ⟺ Type 1.8/1.9 ⟺ Type 1.5 ⟺ Type 1 (turn-on & off)

- Cases in previous
  - e.g, Mark 1018, Mark 590, 3C390.3, NGC2617, NGC4151, SDSS J015957.64+003310.5, SDSSJ101152.98+544206.4, SDSS J155440.25+362952.0, HE1136-2304 (e.g, McElroy+16; Shappee+14; Shapovalova+10; LaMass+15; Parker+ 16; Runnoe+16; Gezari+2017)
  - 21 new CL AGNs from LAMOST (Yang+17)
  - Studies in Ruan+15 and Macleod+16

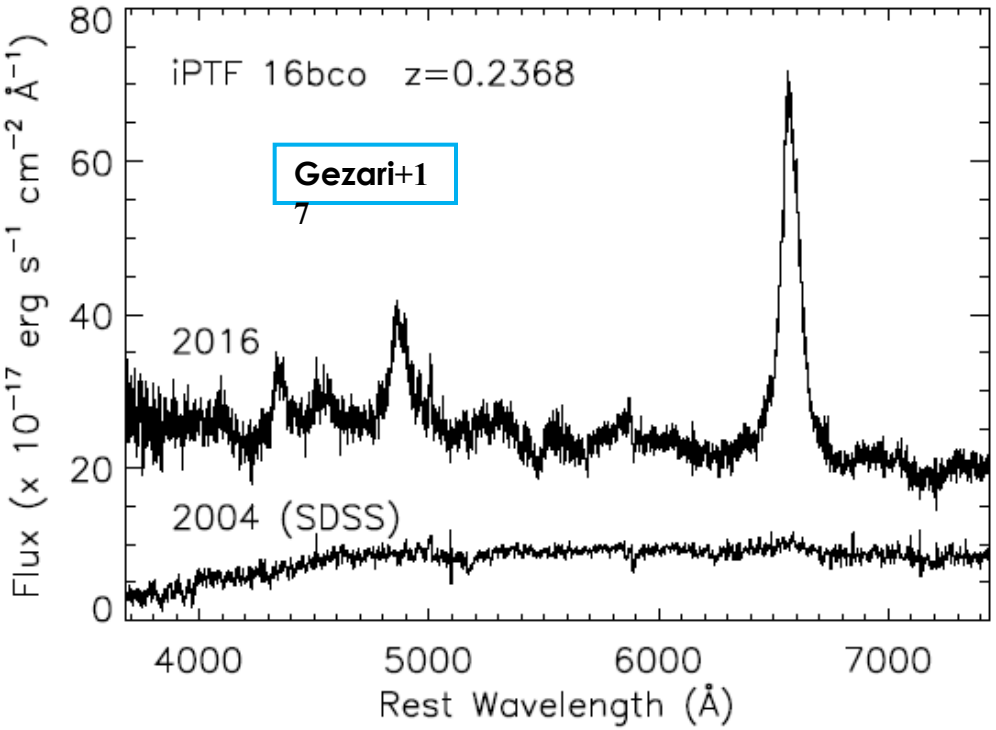


# Changing-look AGNs

- **Why do we study CL AGNs?**
  - **a challenge of the unified model**
  - **host galaxies of luminous AGNs: essential for studying the co-evolution of SMBH & its host**

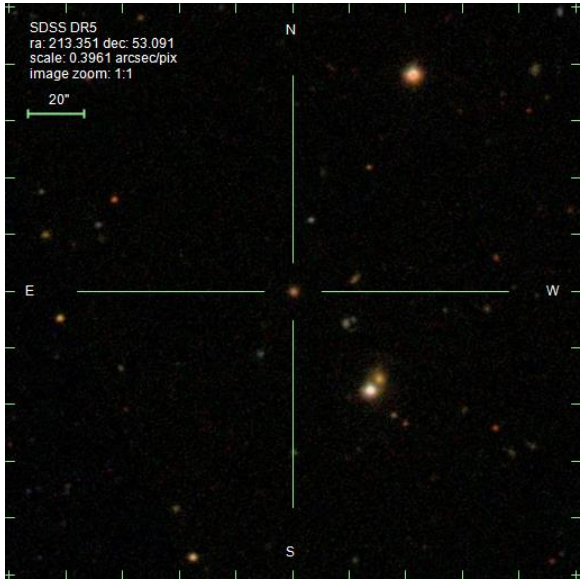
- **Potential drivers**
- **variation of obscuration**
- **accelerating outflow**
- **TDE**
- **change in accretion rate**



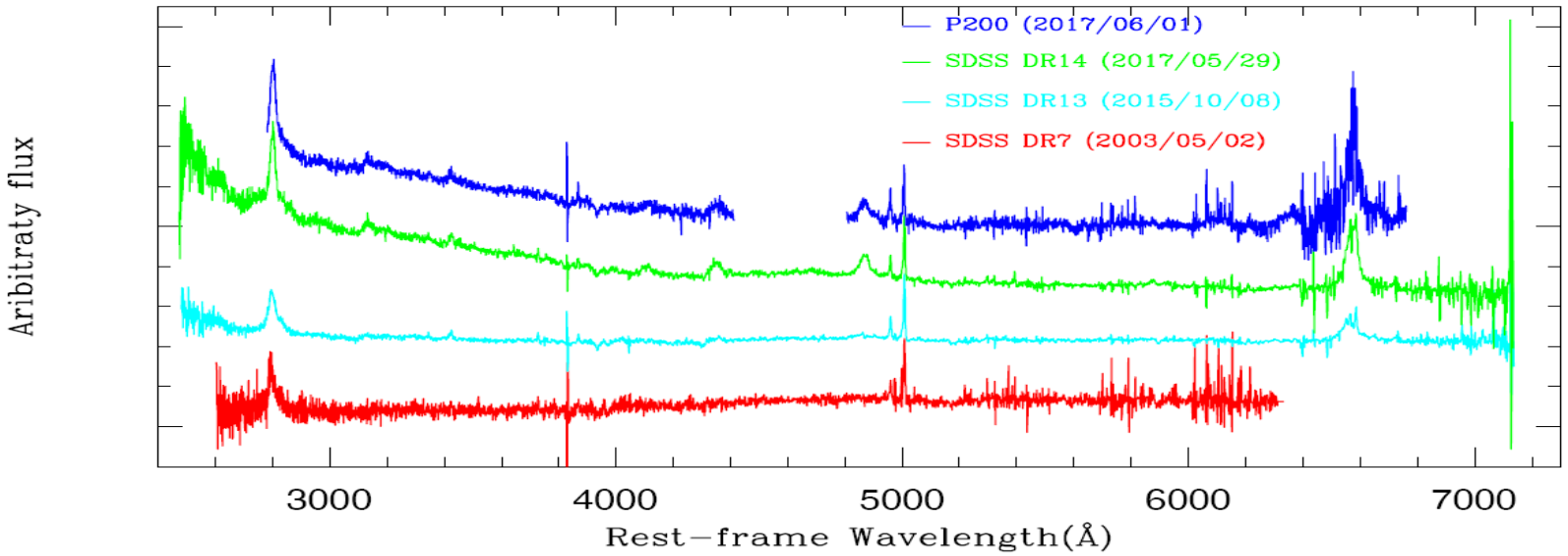
# SDSS J141324.27+530527.0 (SBS 1411+533)

- Identified as a “Turn-on” QSO at Palomar Obs.
  - z~0.46
  - r=19.40 mag

- Spectroscopic obs
- P200/DBSP
- 2017/06/01
- 7×1200 s Exp

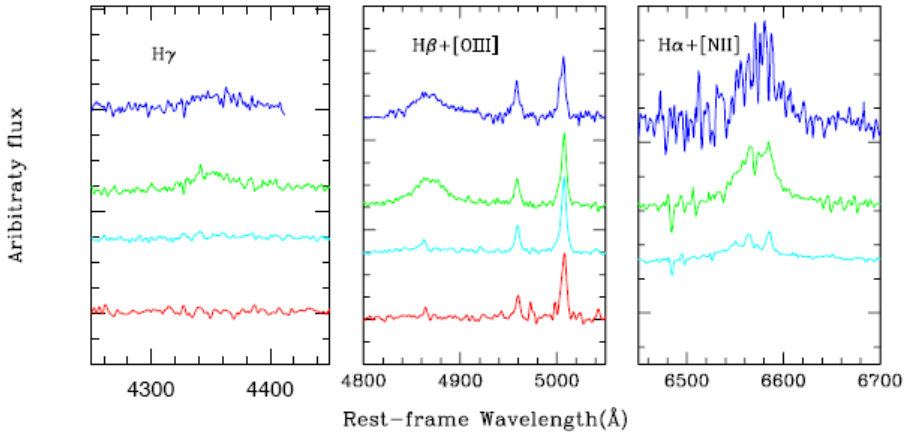



# Type 2/1.9 ➡ Type 1.8 ➡ Type 1 (turn-on)




- **A new CL quasar (z = 0.456344 and $M_{BH}$ ~5-9×$10^7 M_\odot$) with a "turn-on" type transition from Type-2/1.9 into Type-1 within a rest frame time scale of 1-10 years.**
- **Plausible driver: viscous radial inflow → change in accretion rate**

✓ Inflow time scale Δt~1-5 yr
✓ thermal instability time scale Δt~3-4 yr
✓ mid-infrared brighten (Sheng+17; Yang+18)




**Wang, Xu, & Wei, 2018**

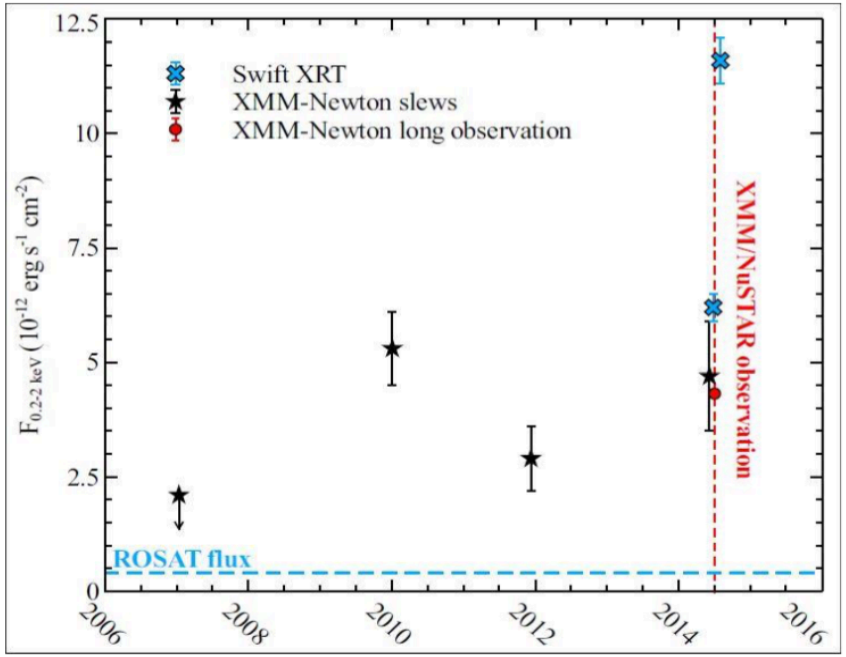
# HE1136-2304

- discovered in high-state in XMM-slew → XMM, NuSTAR, Swift & SALT quasi-sim. within 3d

- change of Sy1.9 into Sy1 ($\Delta t$ =11yr)

- high amplitude of X-ray increase (x 30) accompanied by strong broad- line increase (x >4)
  -- unlikely changes in large-scale extinction/torus

- **potential driver: change in accretion rate ?**
  - either BLR sees more photons
  - or cloud-formation conditions change (Nicastro+00, Elitzur+14)




Parker+16, Komossa+17

# Future Work

- **importance of triggered observations, to catch the extreme states**
  - deep X-ray low/high states
  - highest-amplitude outbursts and drops in AGNs
  - changing look AGNs
- **multi-wavelength approach**
- **searches for new AGNs in extreme flux & spectral states, and rapid follow-ups at multiple wavebands**
- **science on galactic sources (Huali)**


Thank you for your attention!