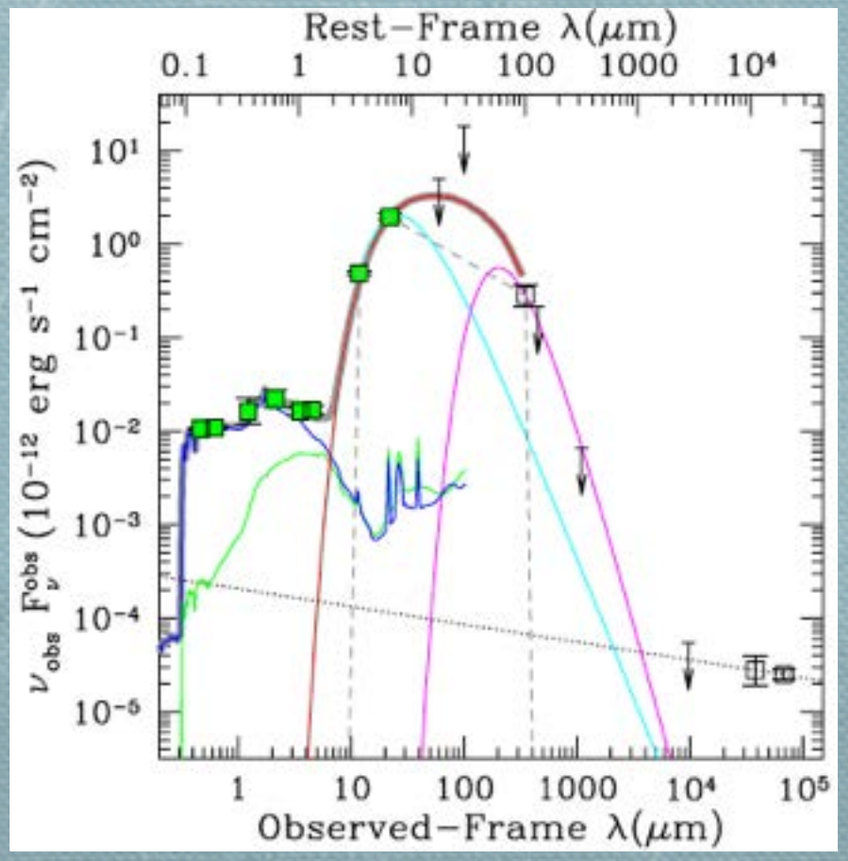
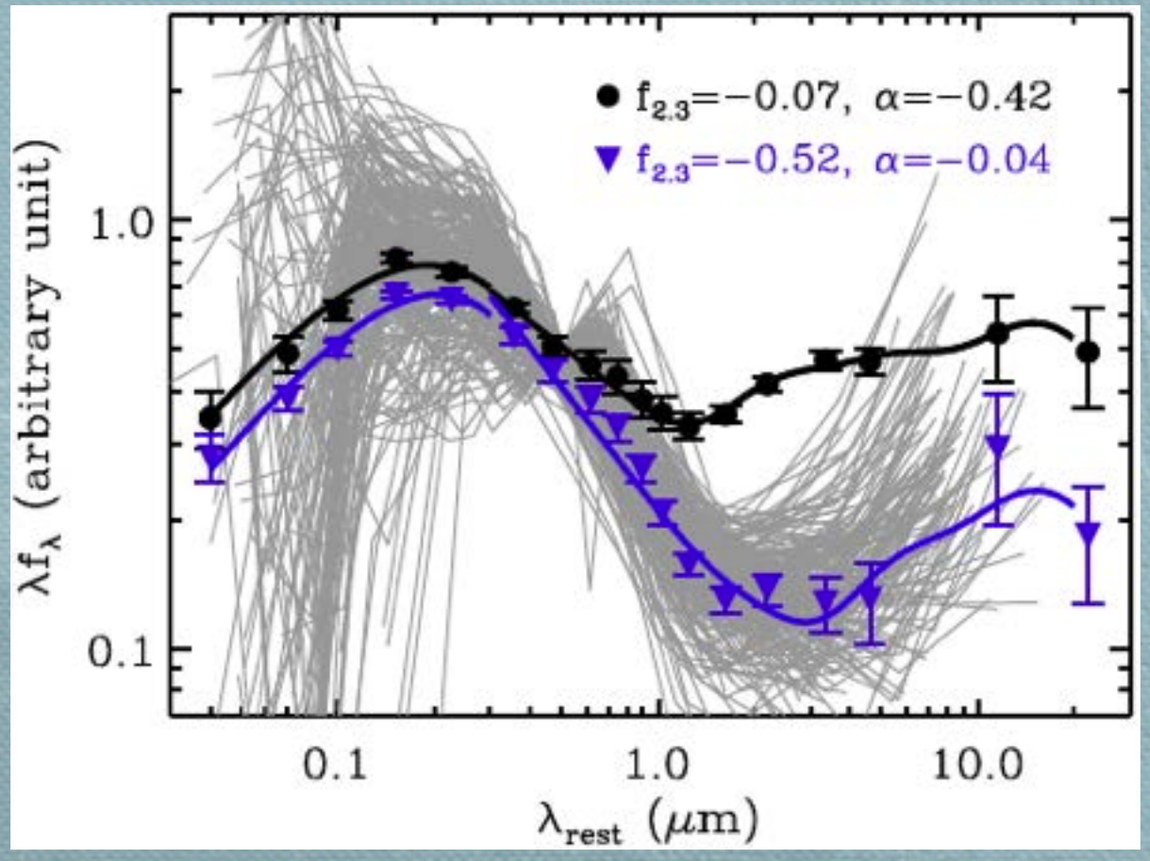


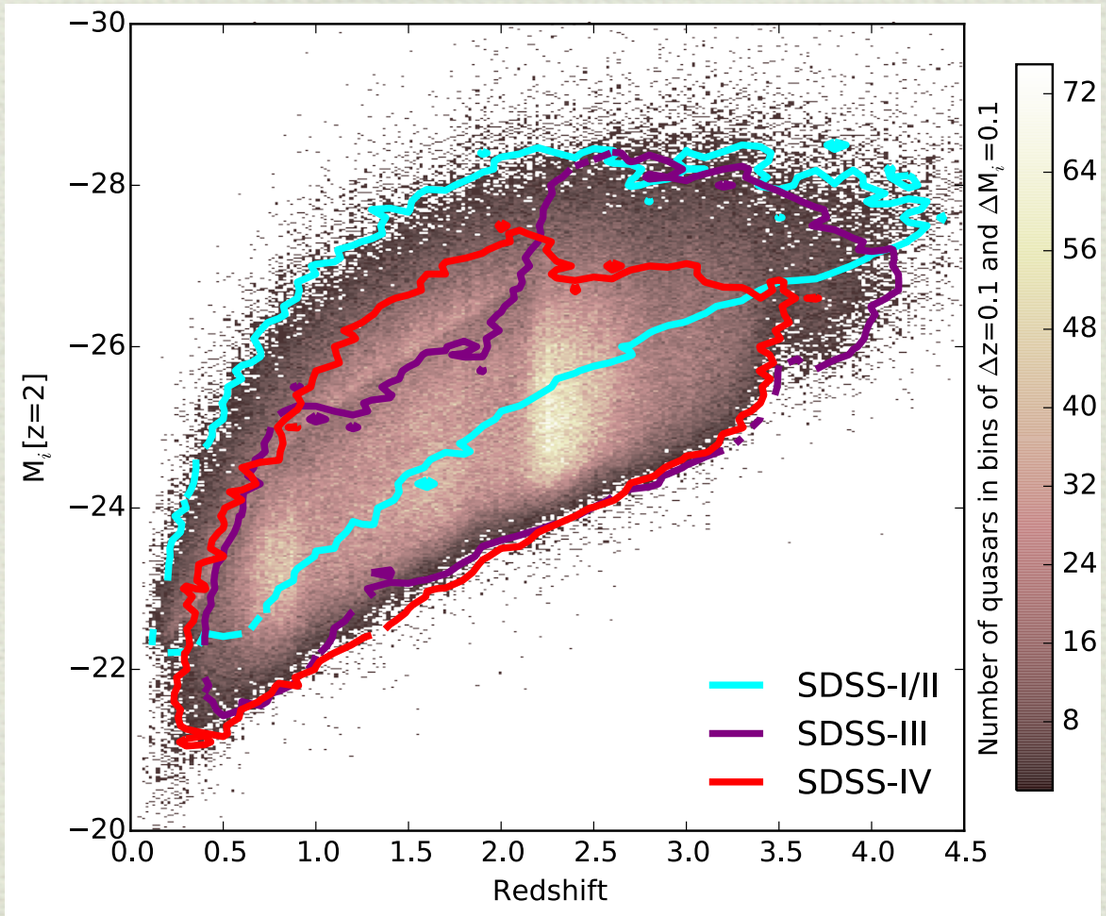


The most obscured and unobscured quasars

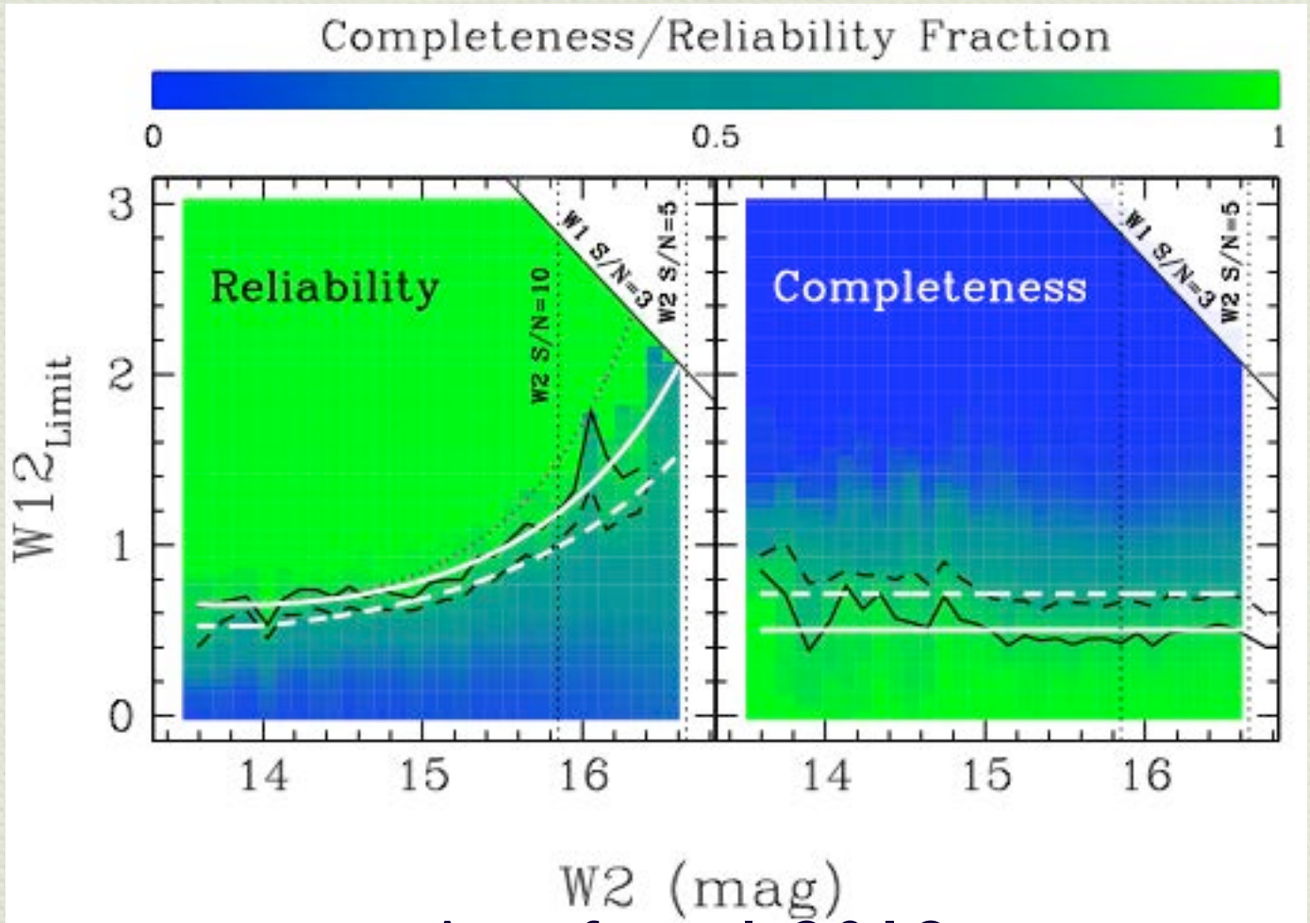
Hyunsung Jun (KIAS)

AGN science using surveys

- N=526,356 spectroscopically confirmed quasars in SDSS (DR14, Pâris et al. 2017), N=4,543,530 (R90), 20,907,127 (C75) WISE 3.4-4.6um color selected (Assef et al. 2018)



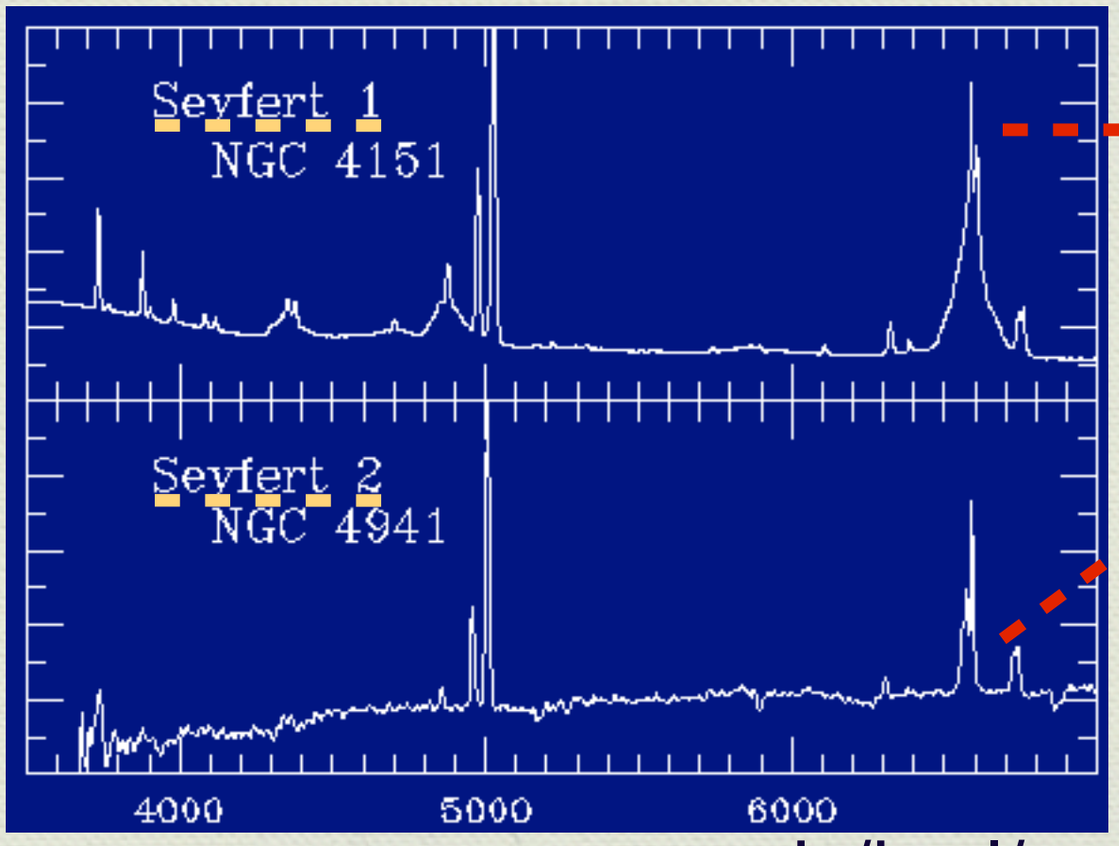
Pâris et al. 2017



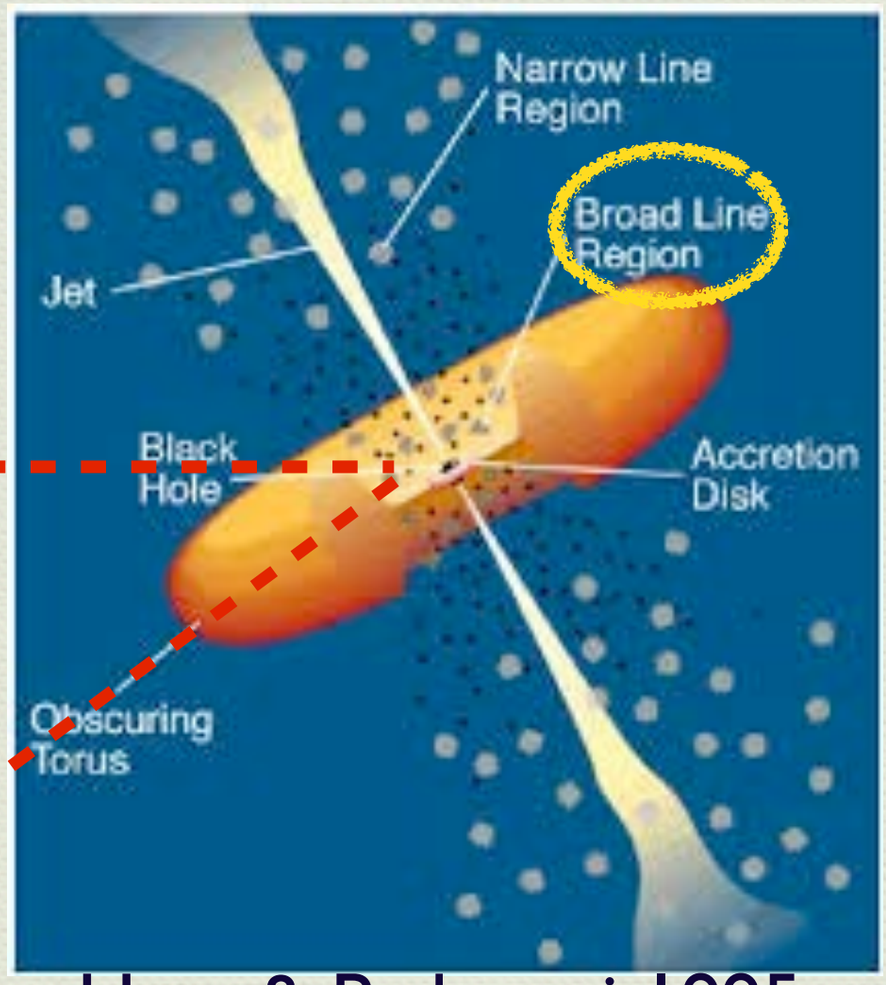
Assef et al. 2018

Geometry: AGN unification

- Type 1/2 AGN could be divided upon different orientation of the observer to the obscuring torus



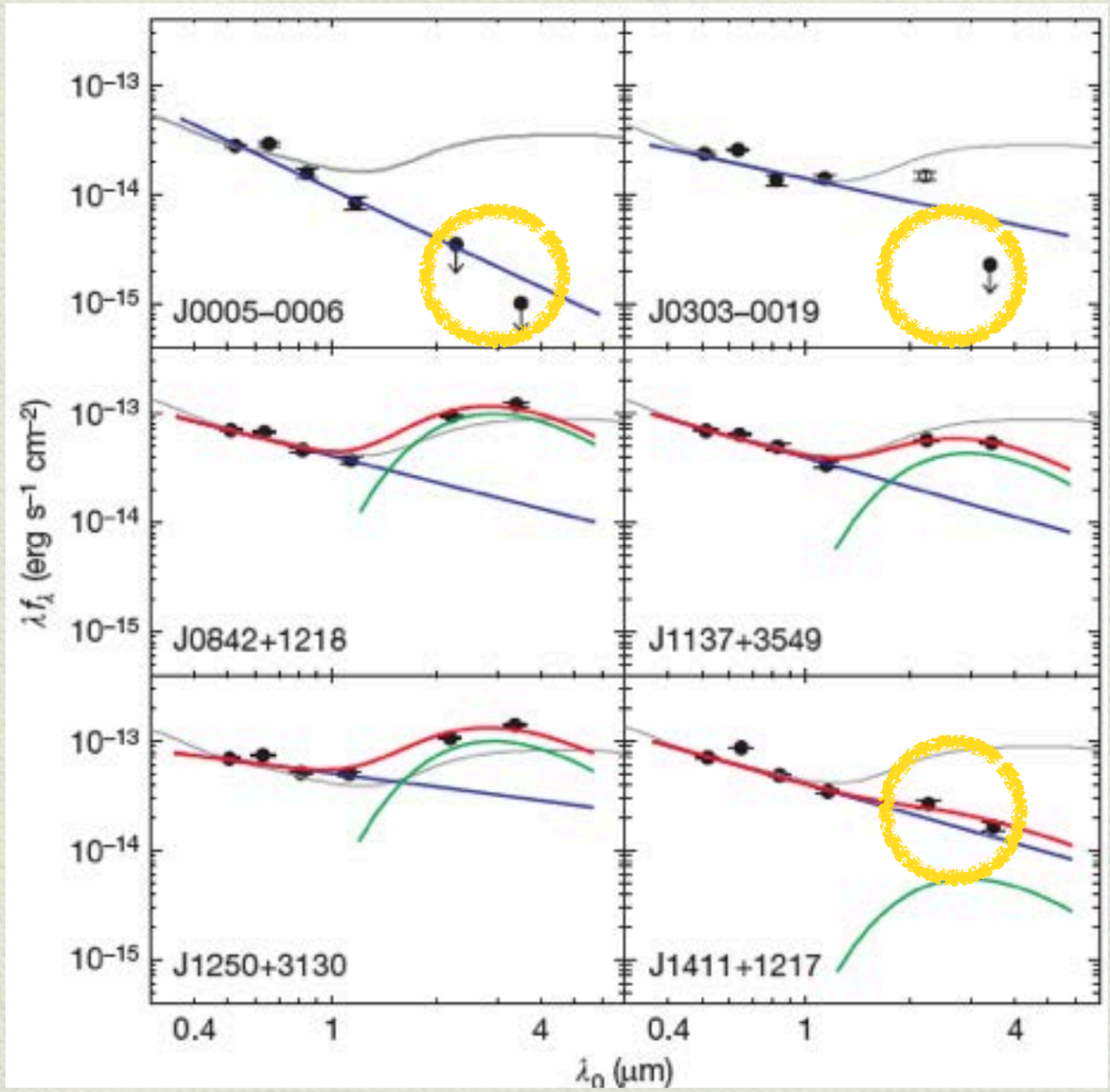
pages.astronomy.ua.edu/keel/



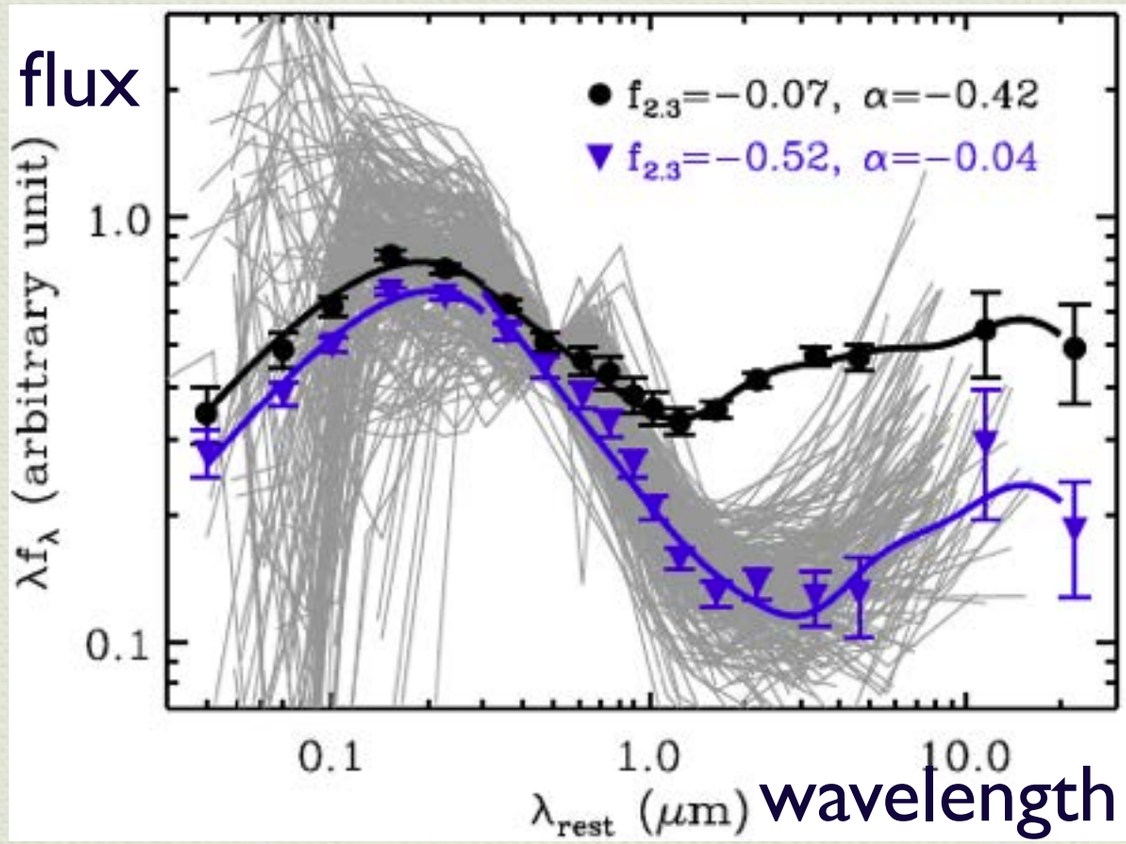
Urry & Padovani 1995 : Unified model of AGN

Challenges: dust-poor AGN

- 3/21 (15%) z~6 quasars found to be hot dust-poor
- 233/40805 (0.6%) z=0-5



Jiang et al. 2010

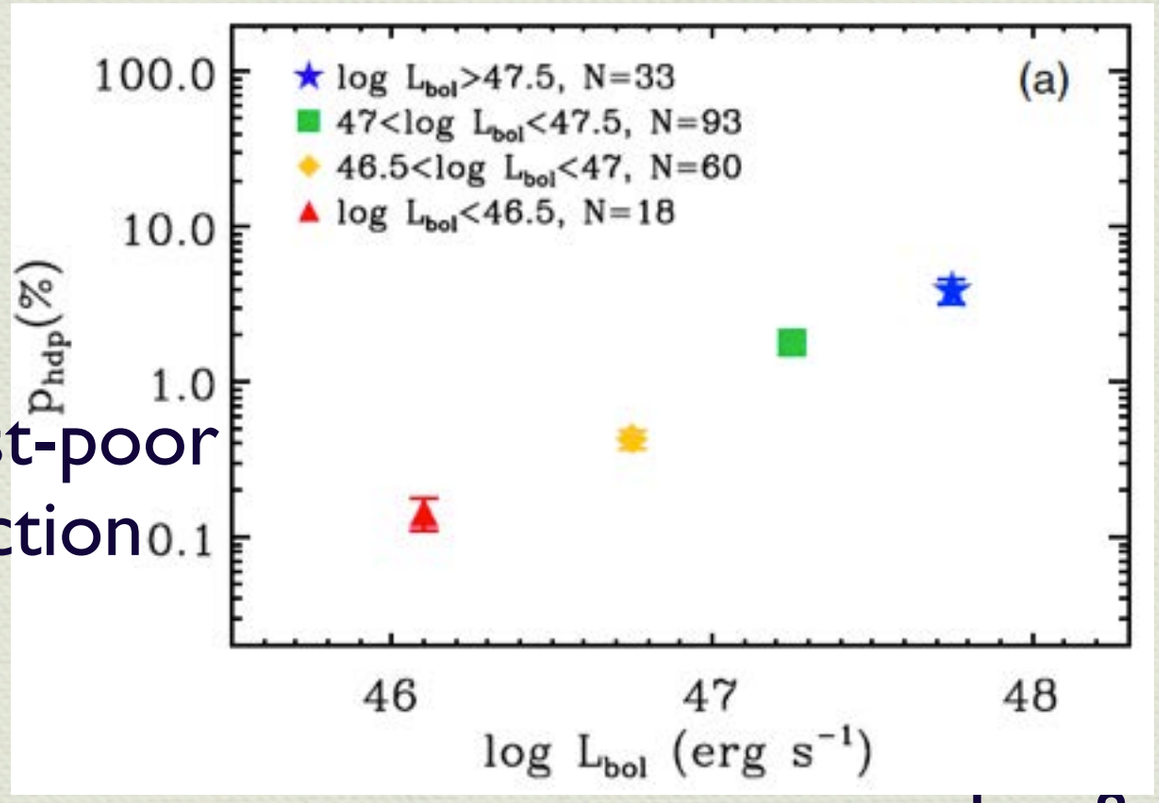


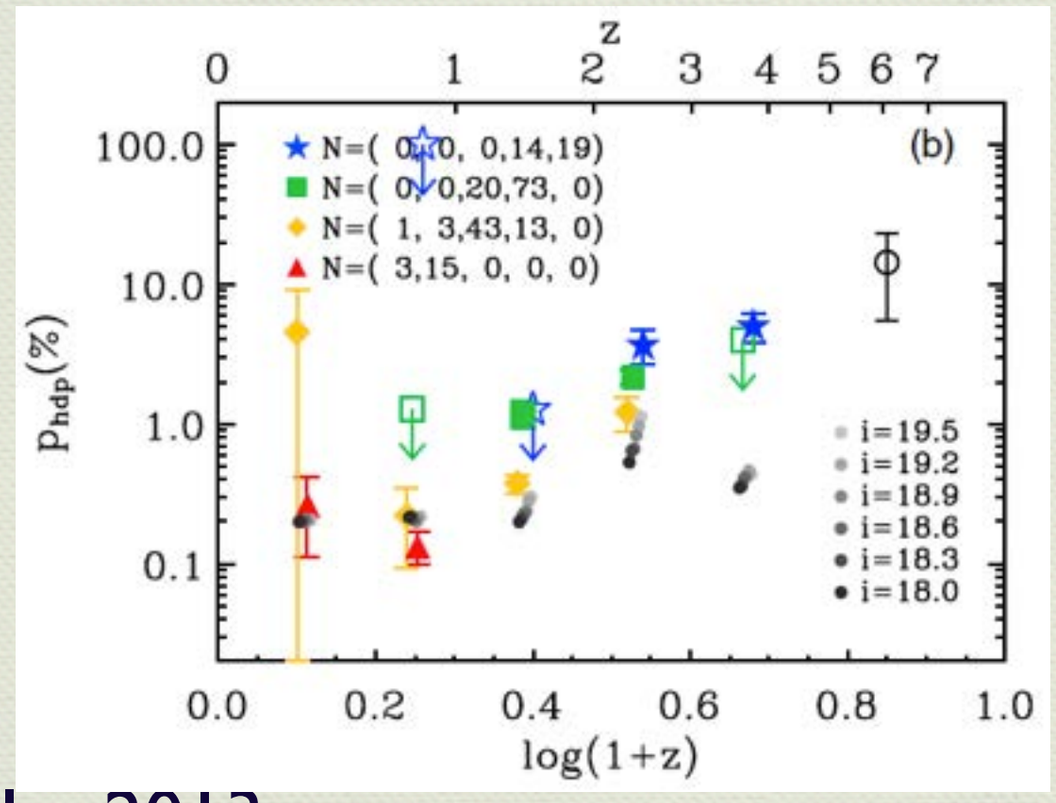
Jun & Im 2013

Challenges: dust-poor AGN

- More dust-poor AGN at higher luminosity : geometry (receding dust torus, Lawrence 1991)
- More dust-poor AGN at higher redshift : evolution (less dust in host galaxy, or merger driven mechanism)

dust-poor fraction

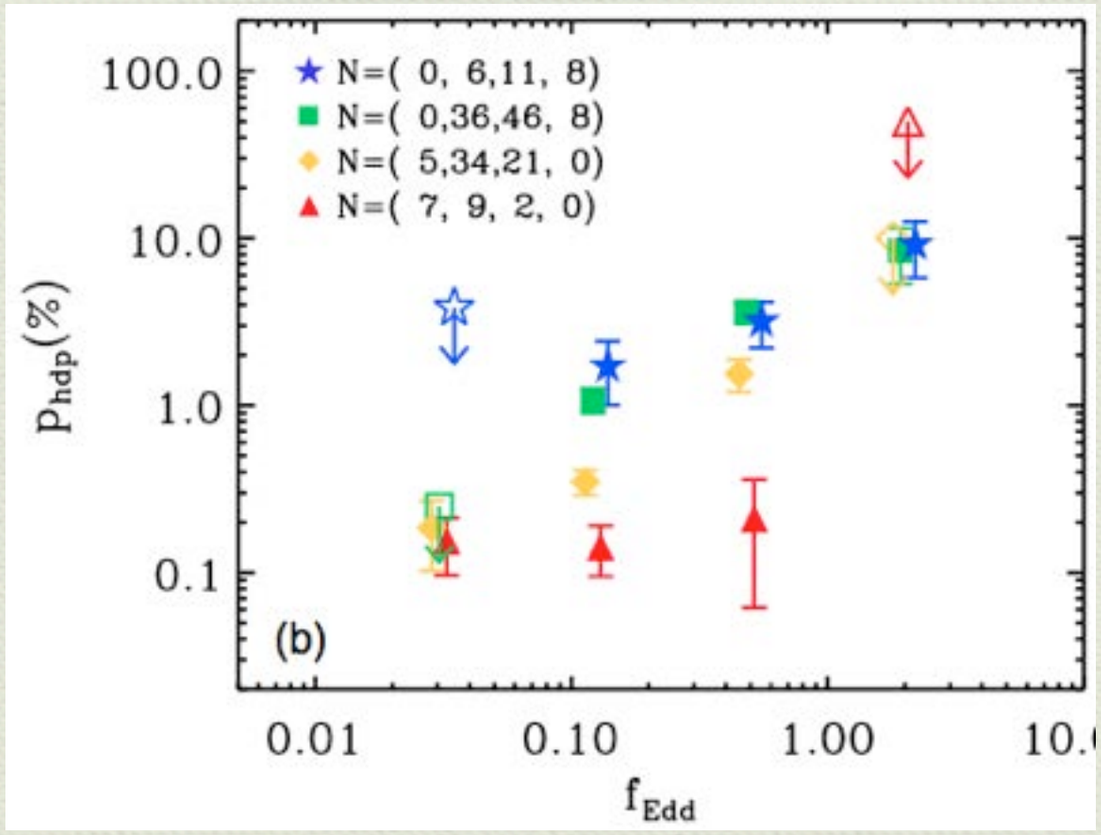




Jun & Im 2013

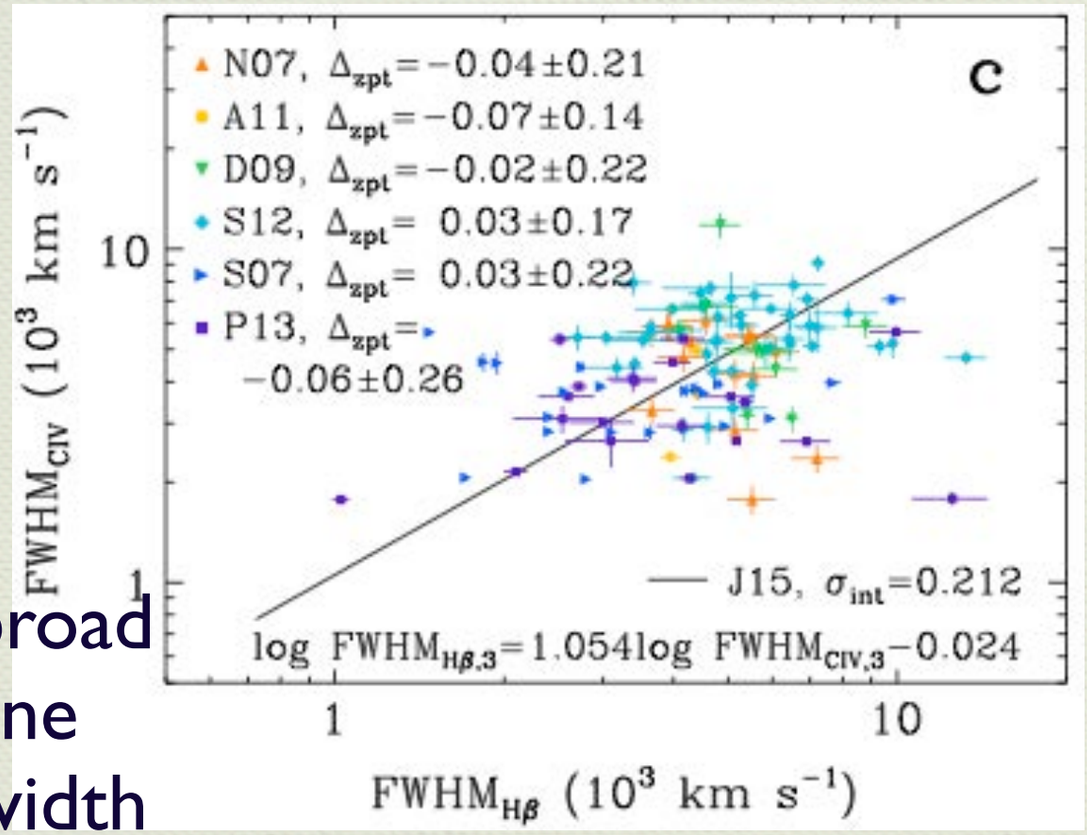
Challenges: dust-poor AGN

- More dust-poor AGN at higher accretion rate : could be explained by either face-on geometry, or intrinsically narrower broad line widths (from rest-UV observations)



Jun & Im 2013

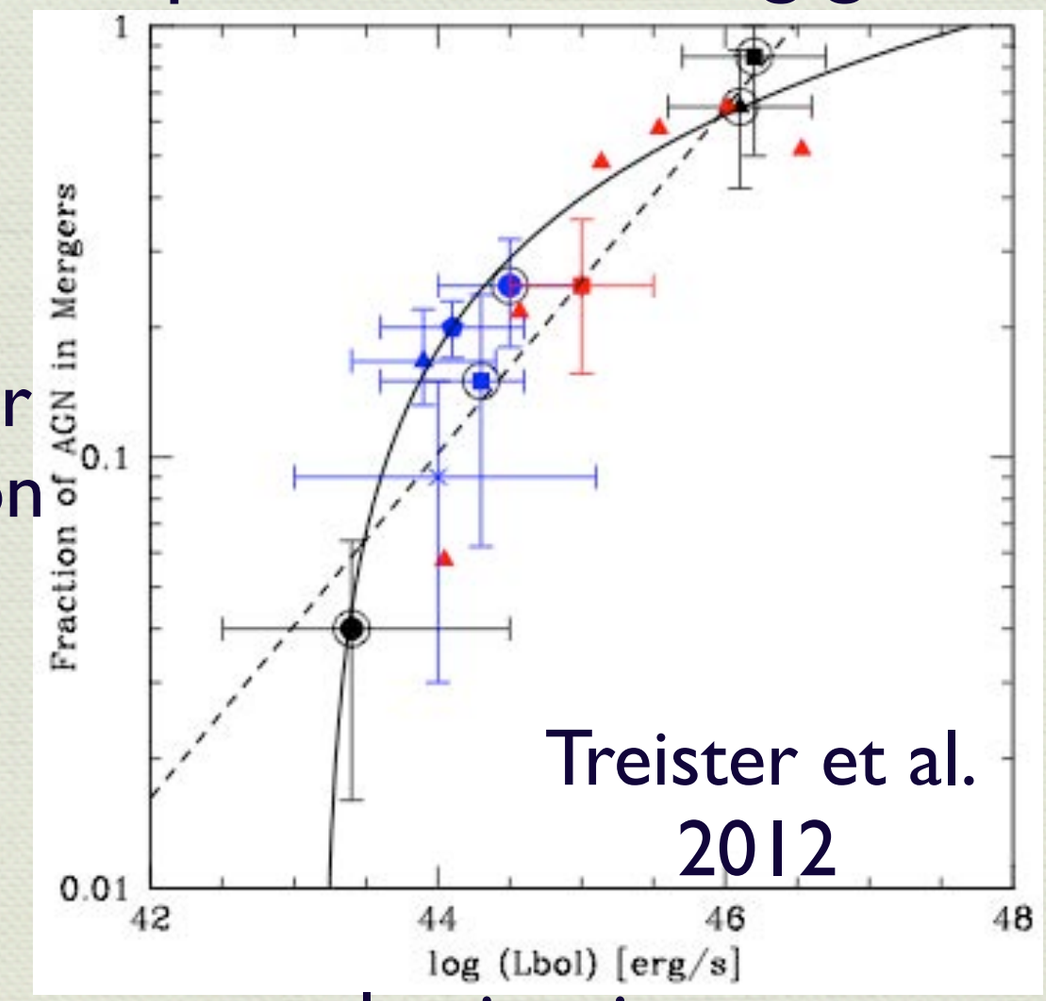
broad line width



Jun et al. 2015

Evolution: AGN feeding/feedback

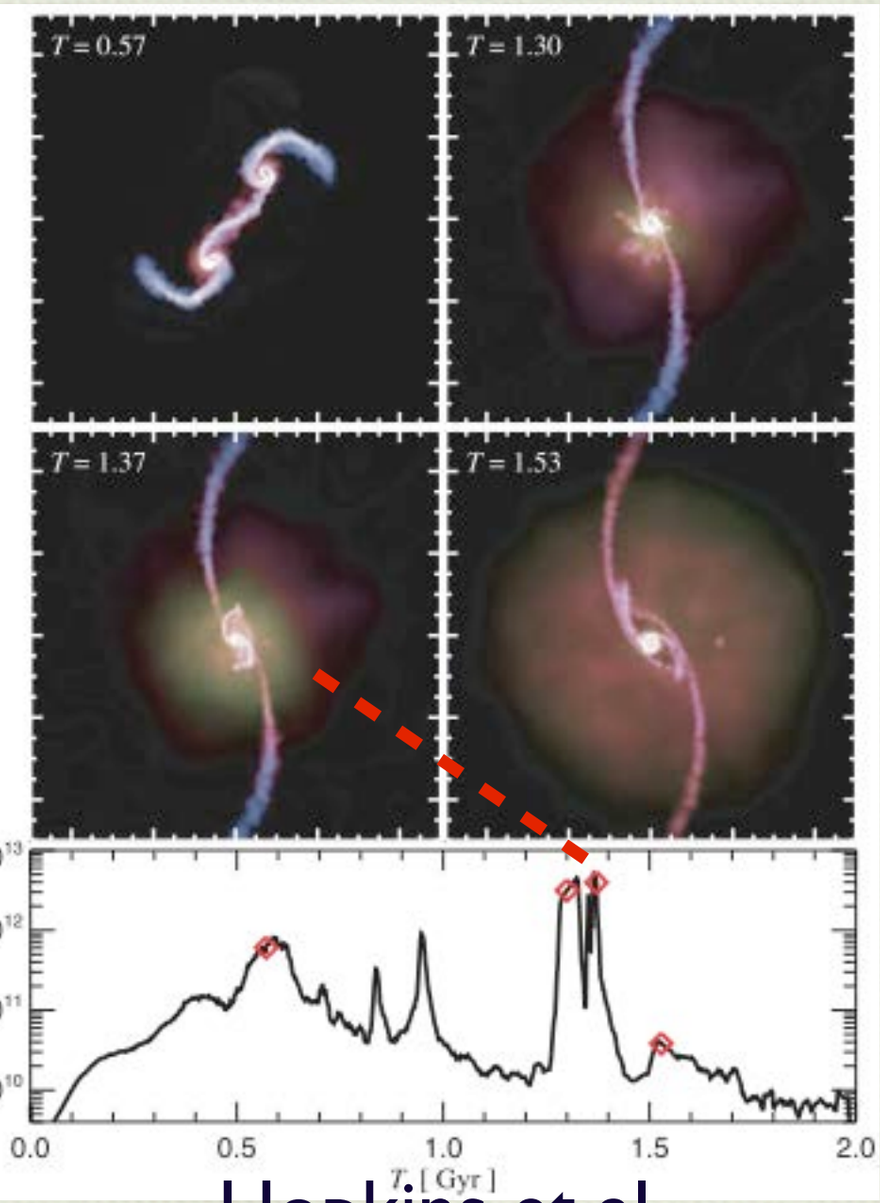
- Merger driven AGN activity will power luminous, obscured quasars, when they will heat/push surrounding gas/dust



merger fraction

Treister et al. 2012

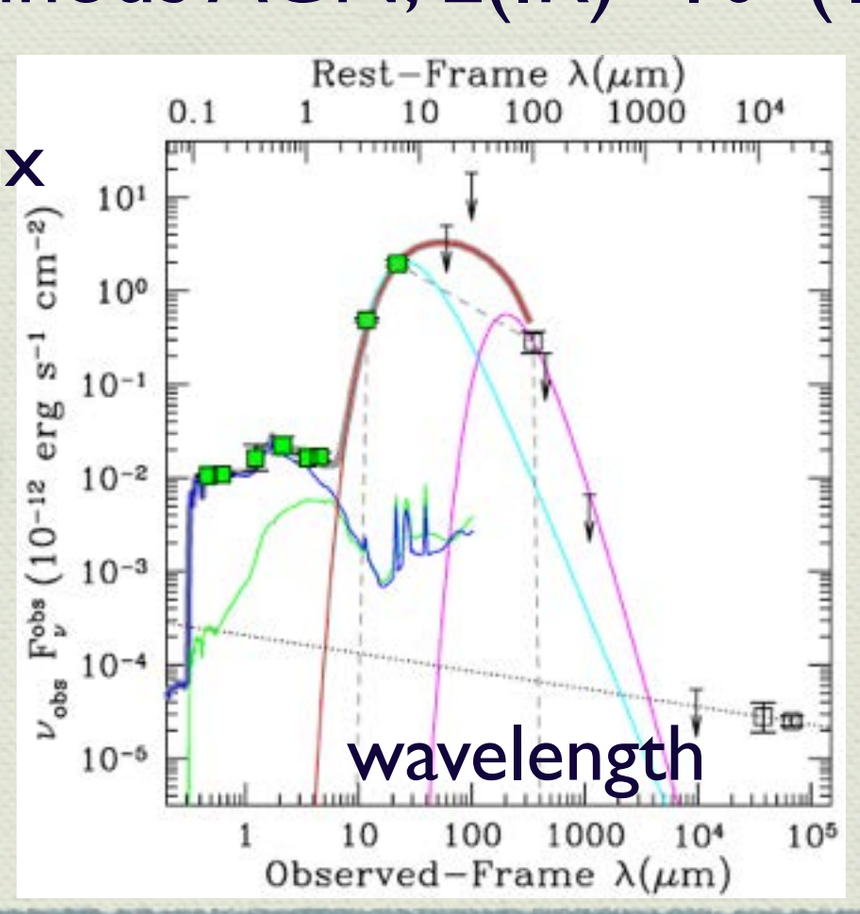
luminosity



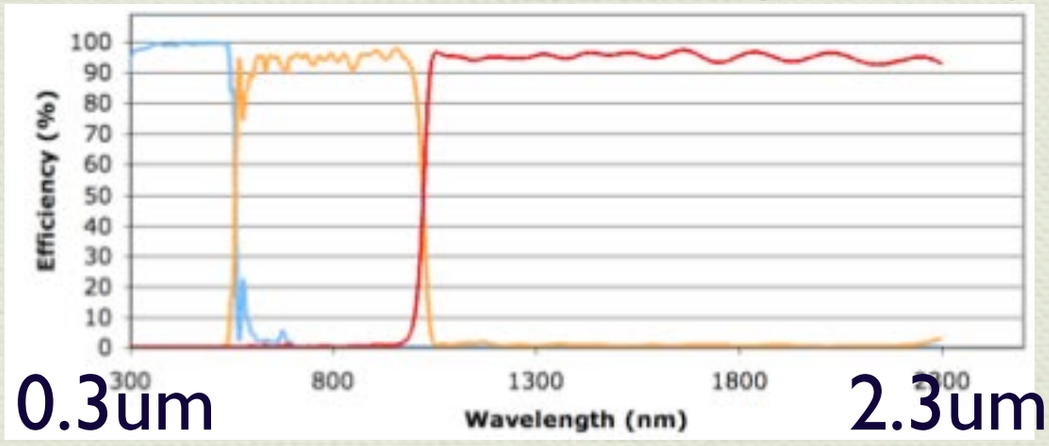
Hopkins et al. 2005

Hot Dust-Obscured galaxies

- W1W2 dropouts (Eisenhardt+2012), or Hot dust-obscured galaxies (Hot DOGs): z~2-3, extremely red, luminous AGN, L(IR)~10^(13-14) L⊙



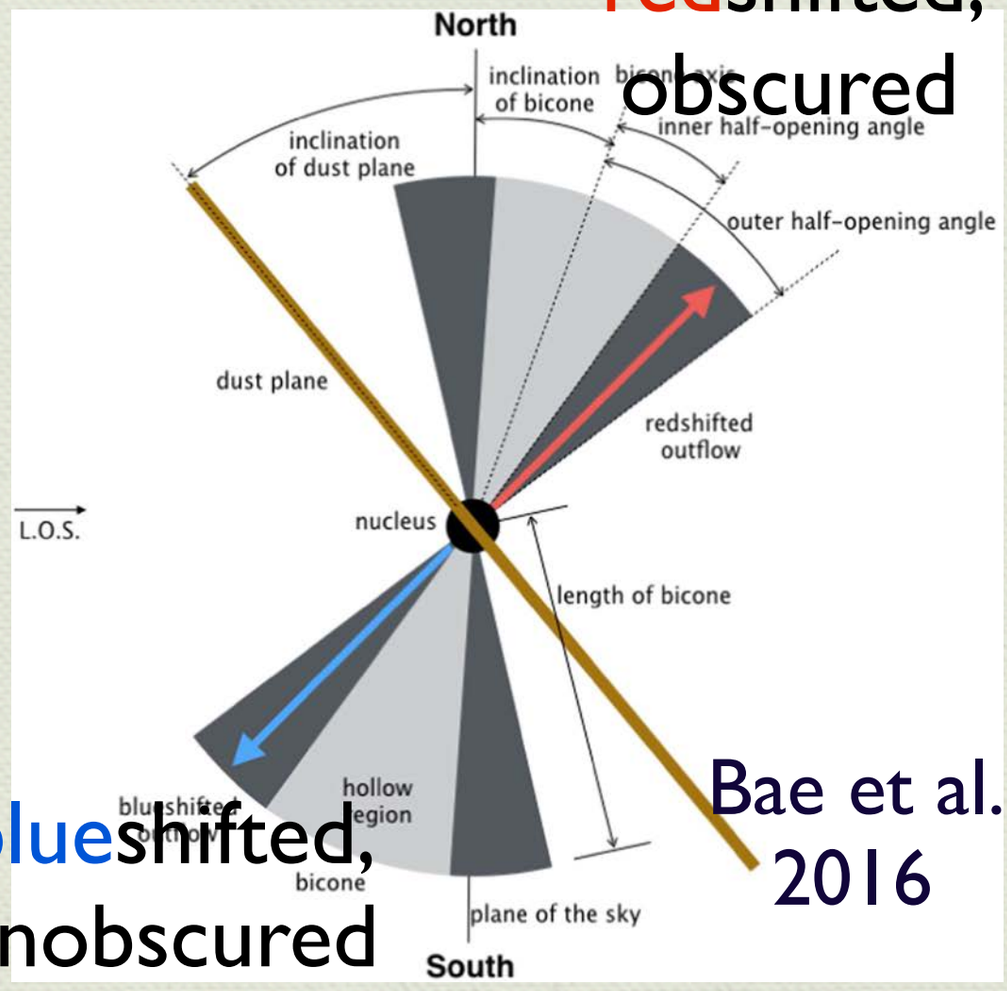
- VLT X-shooter observations (2015A)



Vernet et al. 2011

Ionized gas outflows

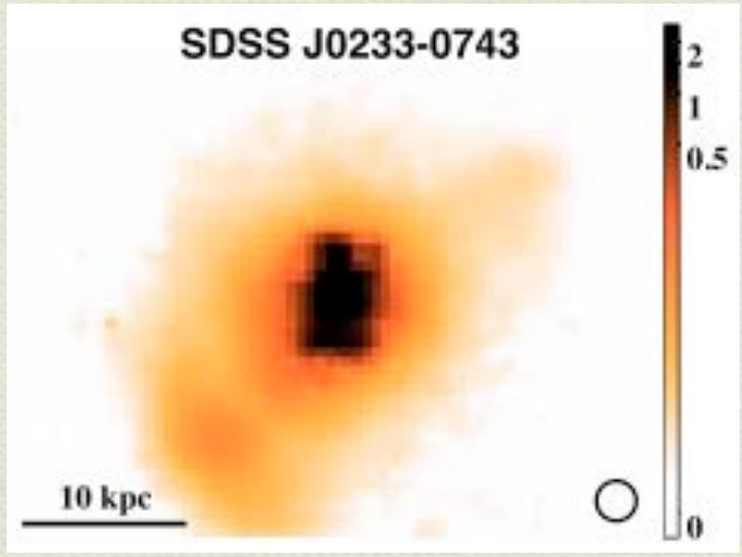
redshifted, obscured



blueshifted, unobscured

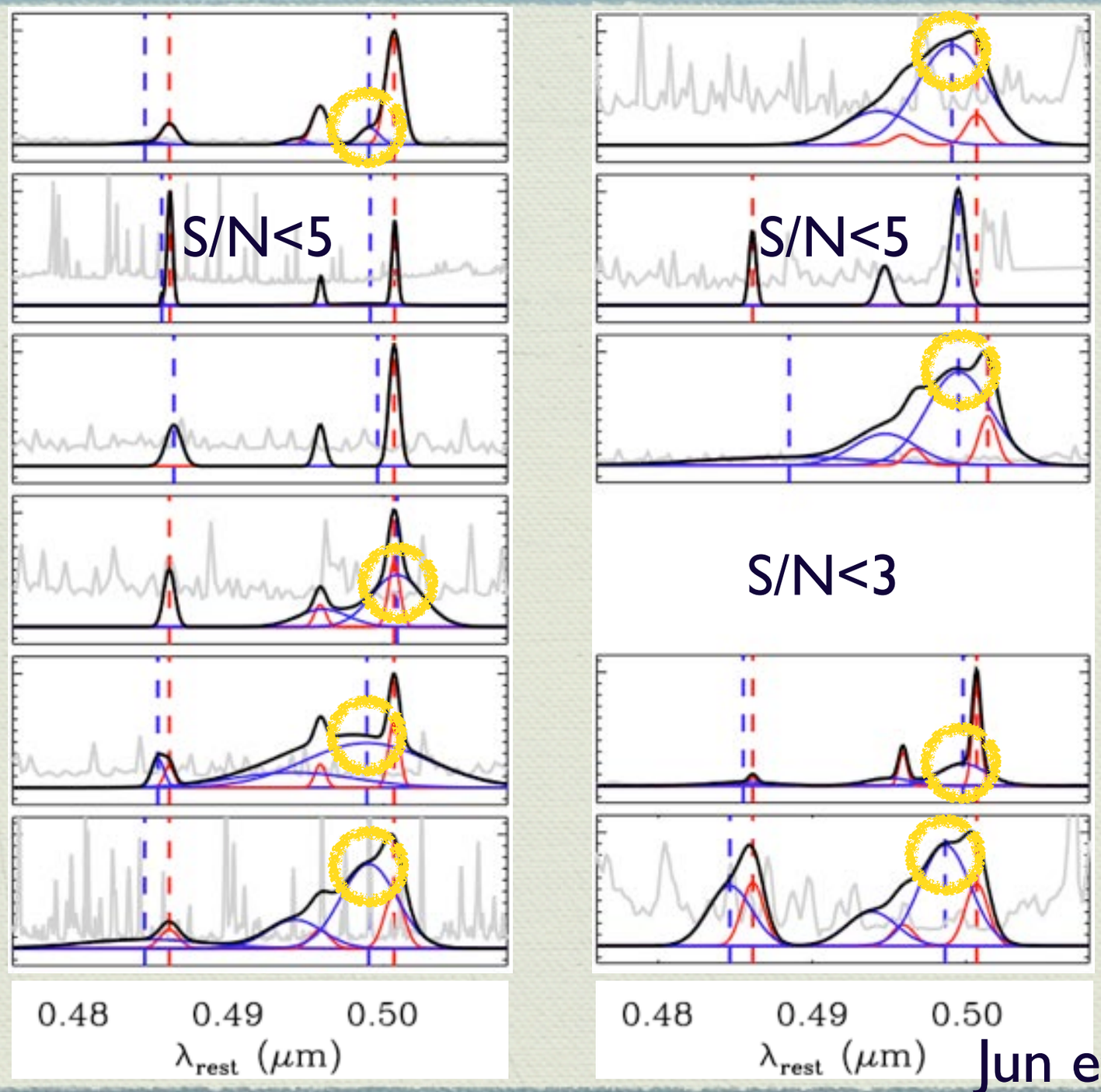
Bae et al. 2016

- Broad and blueshifted [OIII] λ5007 profiles, modeled as biconical outward motions
- Often extends over kpc scales, sign of radiative feedback from the AGN



Liu et al. 2014

Ionized gas outflows

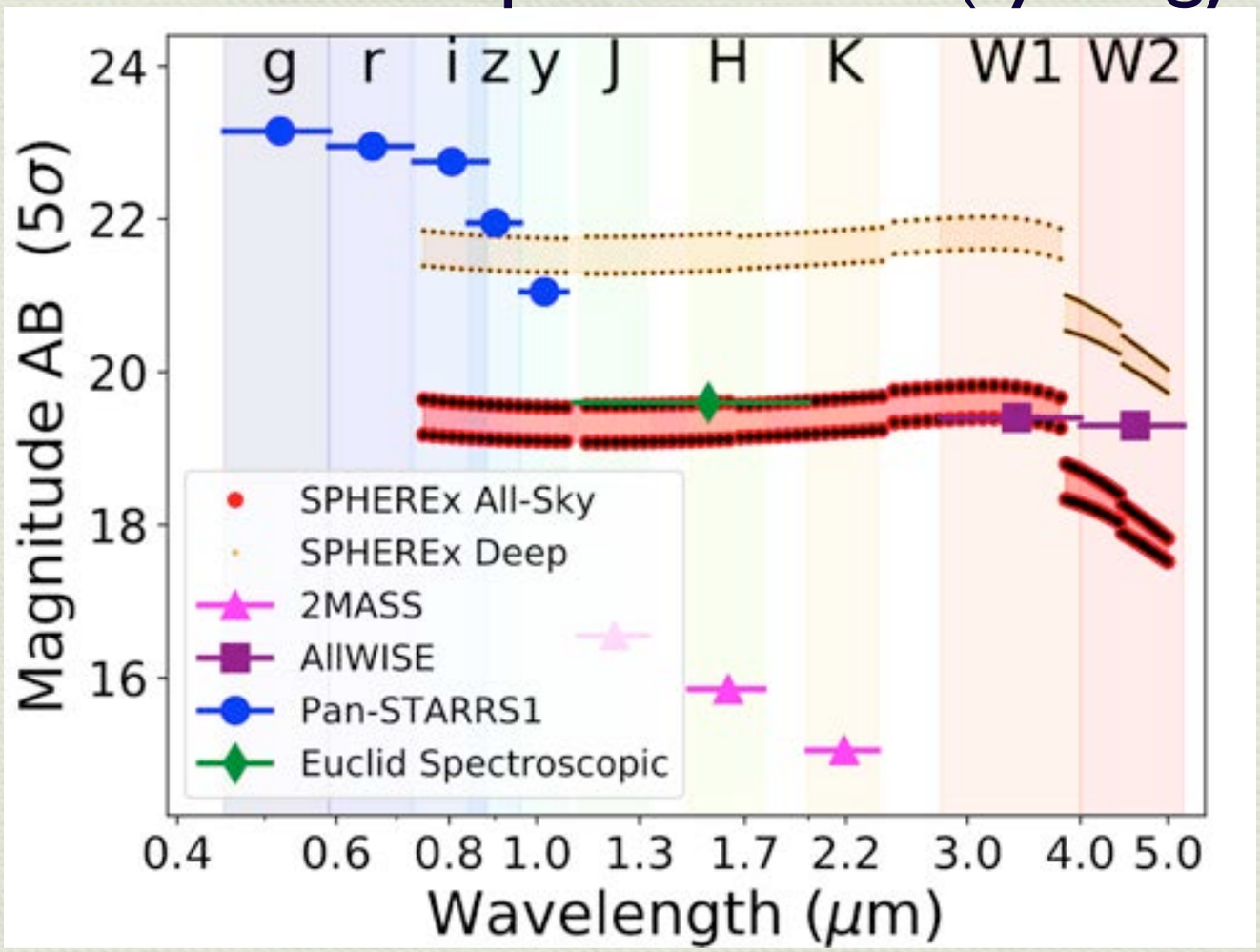


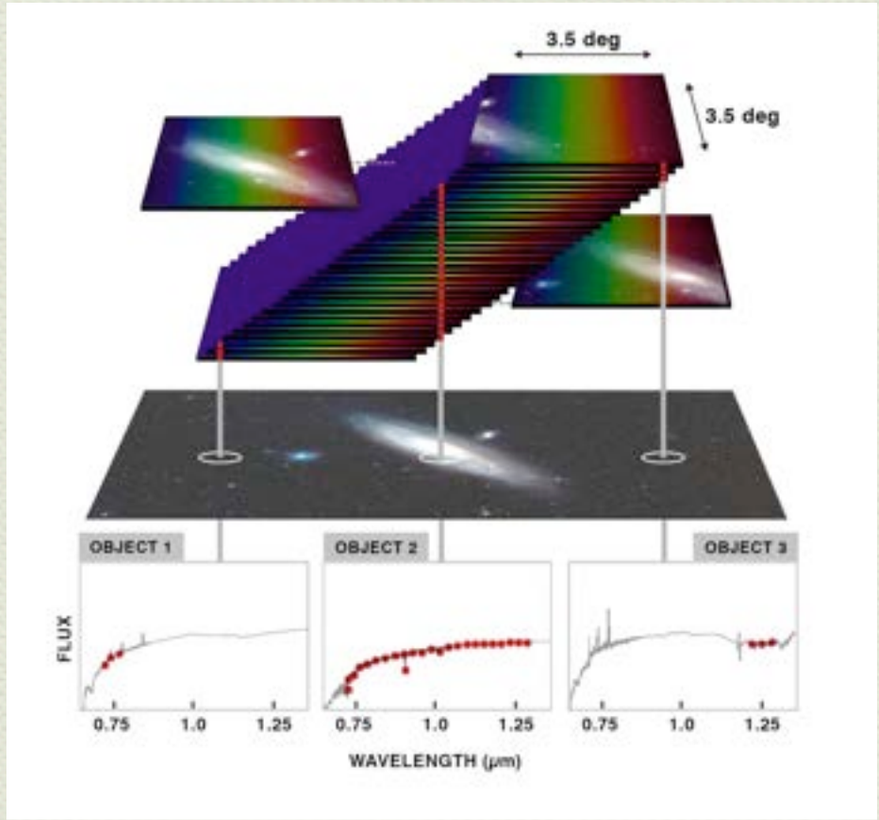
- Model fits reveal 8/9 [OIII]λ5007 profiles with σ>400km/s
- Consistent with higher outflow fraction at high-L AGN (e.g, Rakshit et al. 2018)
- Mass outflow rate greater than star formation rate

Jun et al. in prep

AGN science from upcoming surveys

- SPHEREx: R~40 spectroscopy of millions of AGN (big data)
- Selection of dust-poor/obscured AGN, feeding environment, feedback in quasar mode (synergy with simulations)

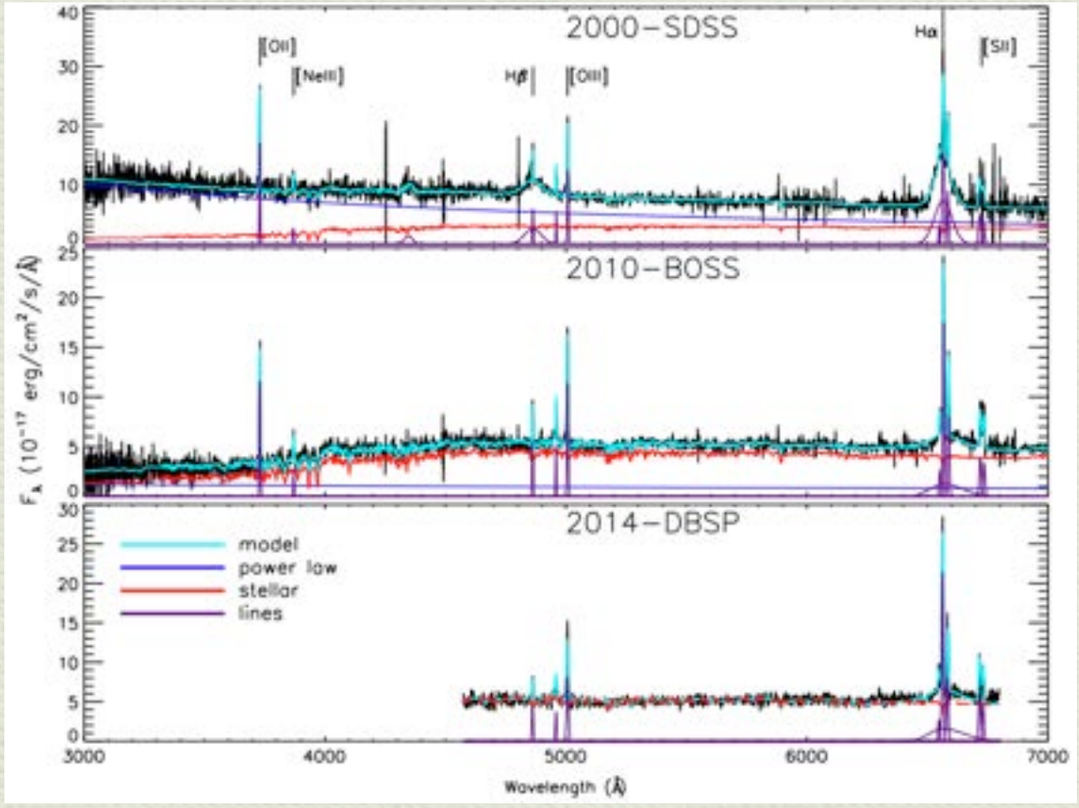




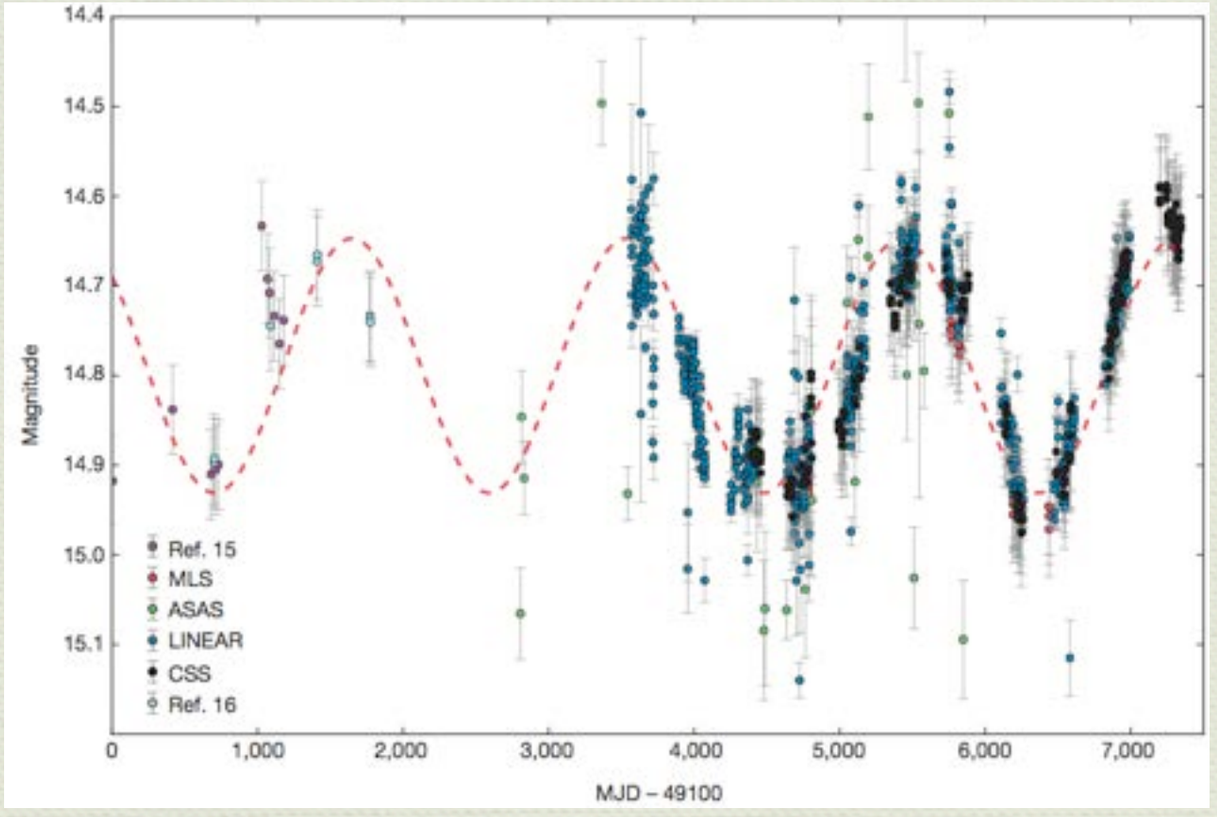
spherex.caltech.edu

AGN science from upcoming surveys

- LSST: Long term, faint changes in spectroscopic appearance (e.g., changing look quasars), unusual light curves (e.g., periodic quasars, flaring AGN, tidal disruption events)



LaMassa et al. 2015



Graham et al. 2015

Summary

- With large area, multi-wavelength surveys we can select the most obscured and unobscured AGN - placing evolutionary constraints in addition to the simplest geometric explanation
- Upcoming surveys will provide large number of infrared, time-domain information (observation) and mock galaxies with gas physics (simulation)