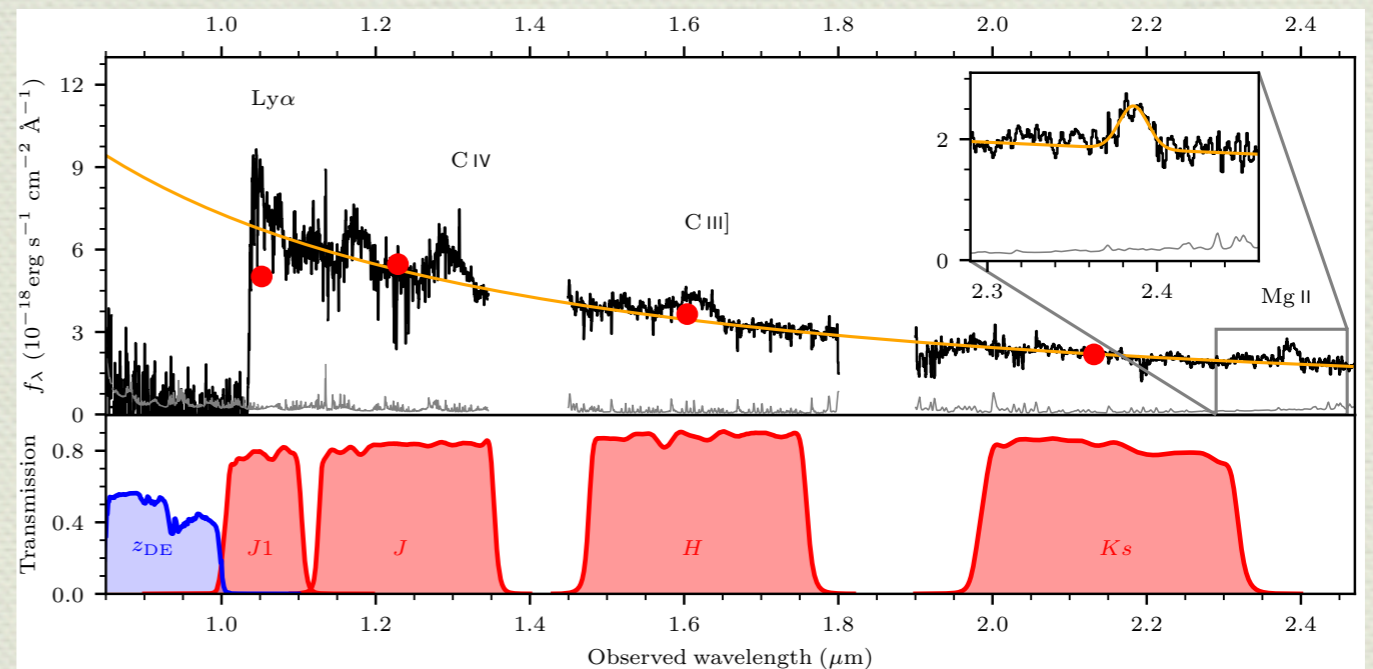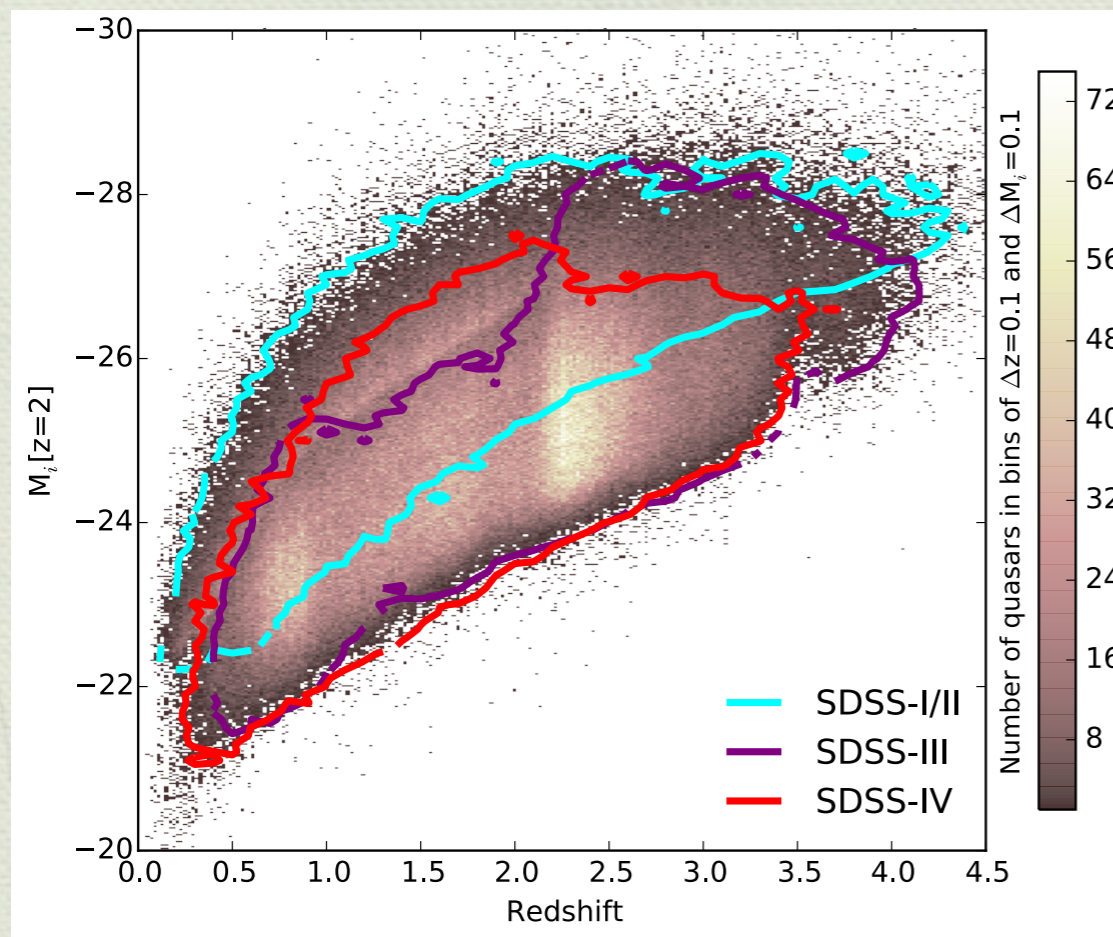# Reverberation Mapping of AGN at less explored luminosities

Hyunsung Jun (KIAS)
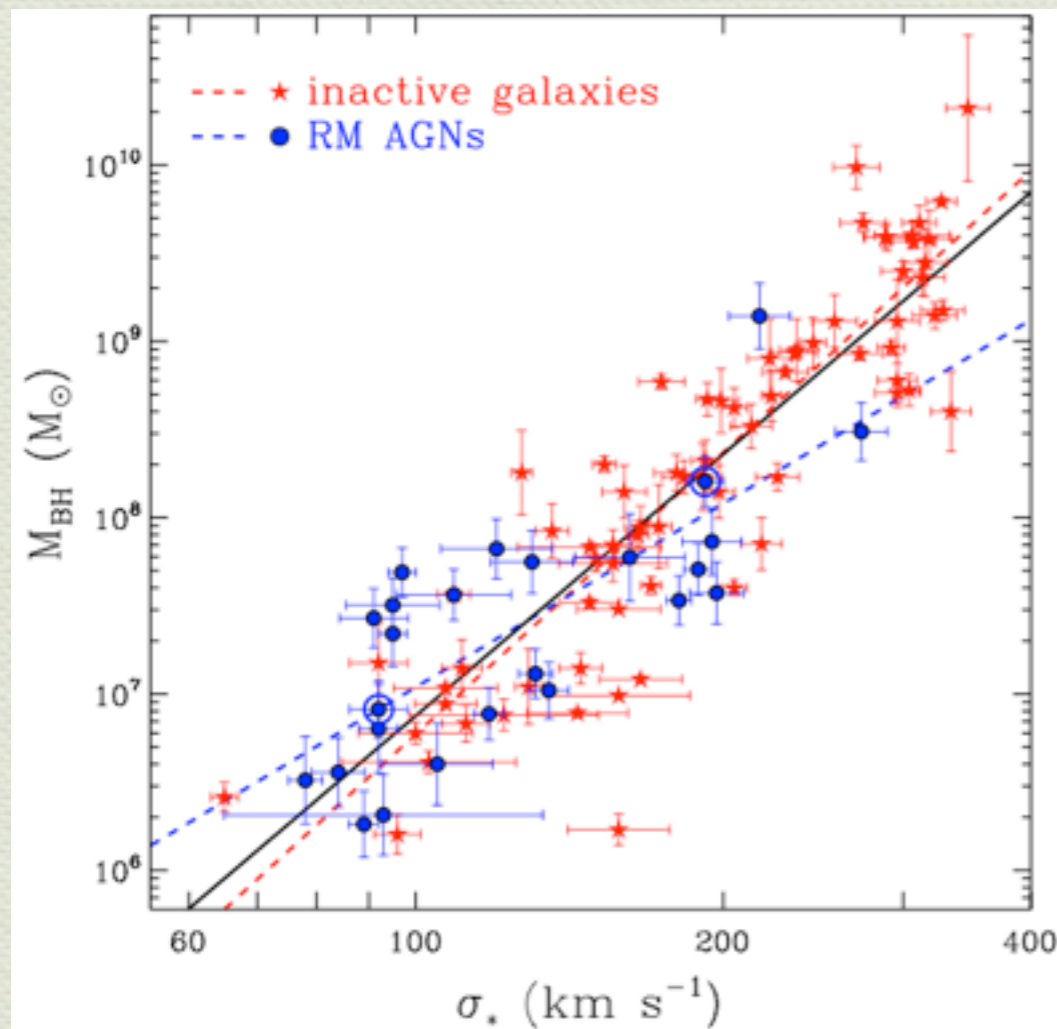
AGN science using surveys

- Discovery of quasars : N=526,356 in SDSS DR14 (Pâris et al. 2017), z=7.5 quasar (Banados et al. 2017)
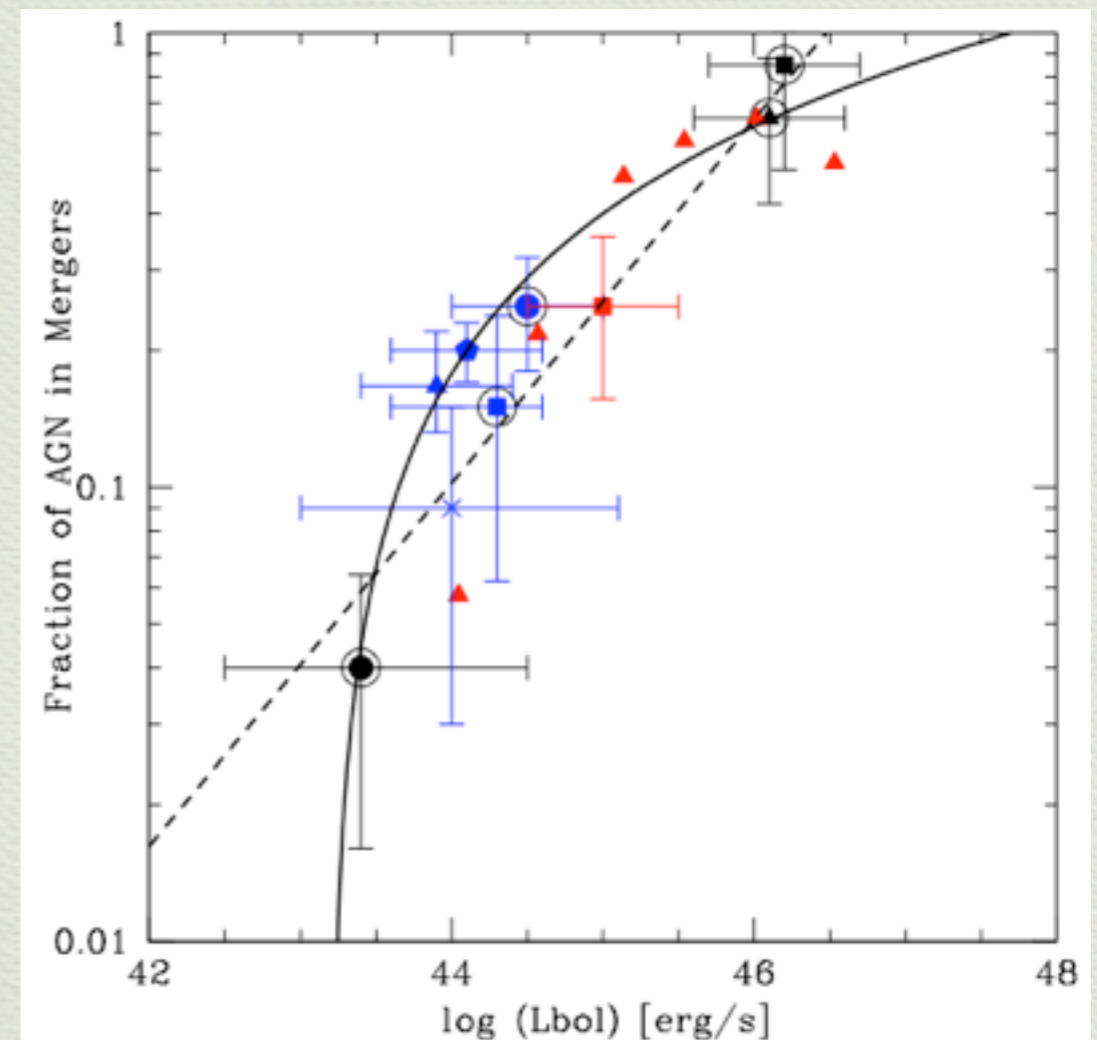
AGN science using surveys

- AGN properties : BH properties (mass, luminosity,..), AGN structure (spectral type, SED,..), coevolution (M-sigma, feeding/feedback,..)
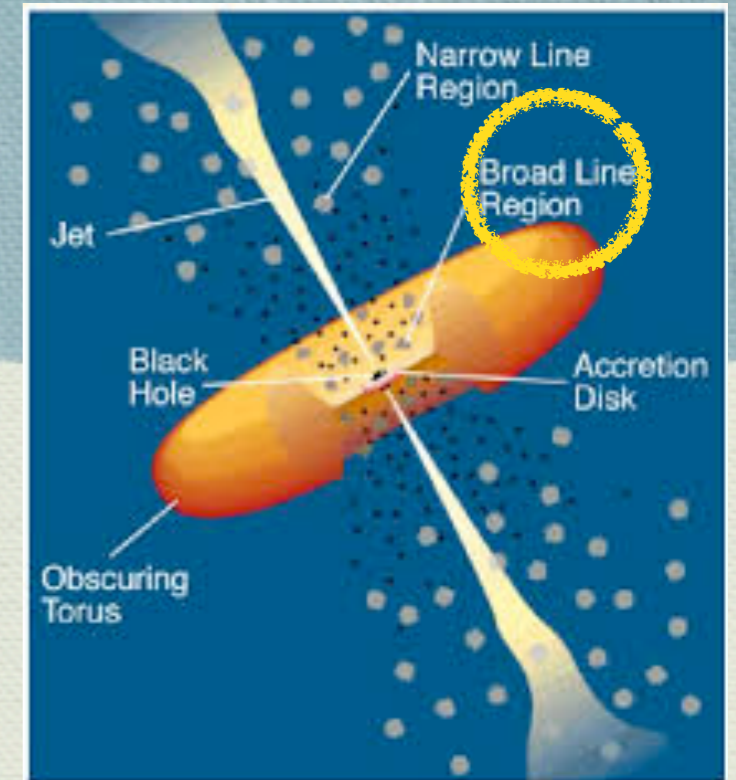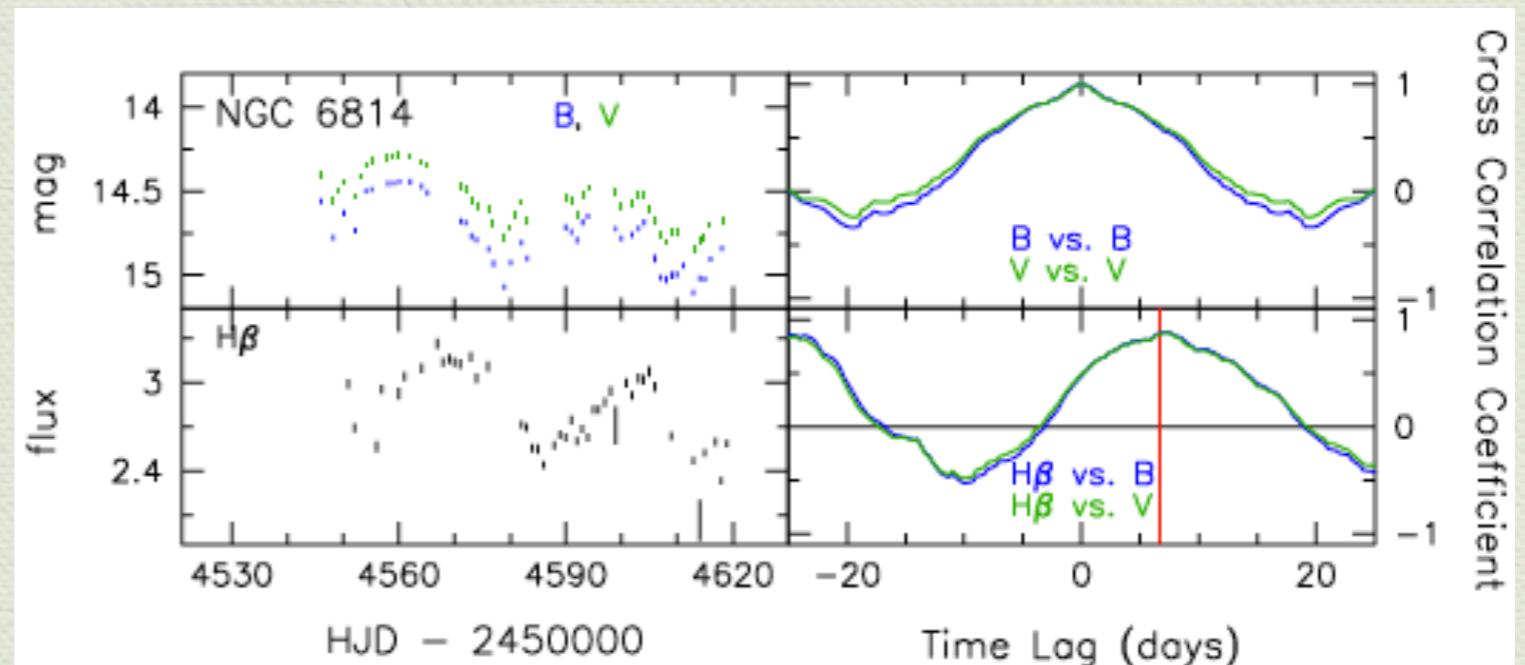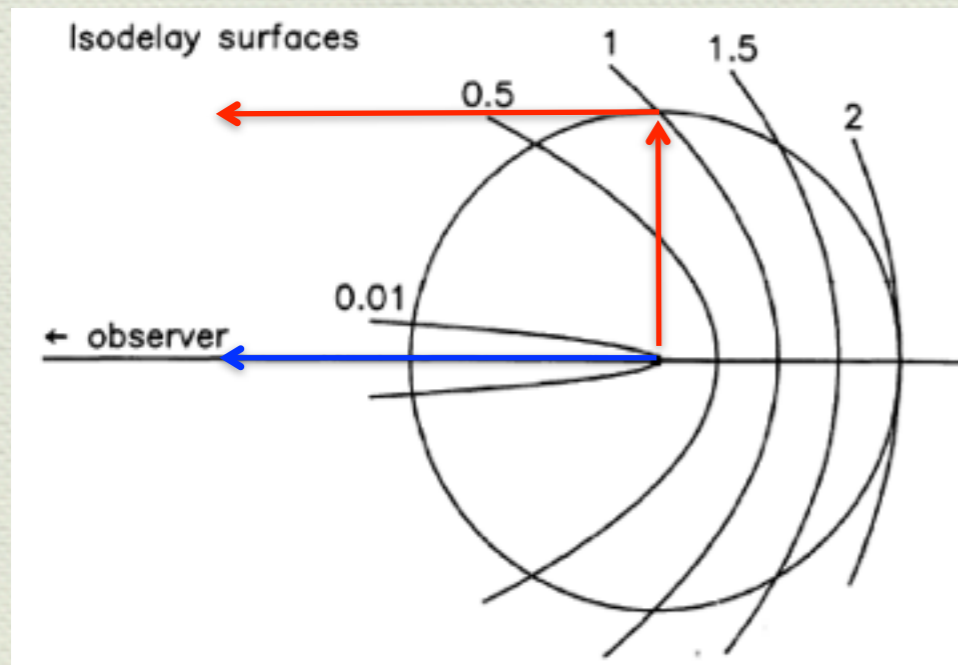

Woo et al. 2013

Treister et al. 2012

BH mass for AGN

- Reverberation mapping : time-lag btw UV/optical continuum and broad line emission
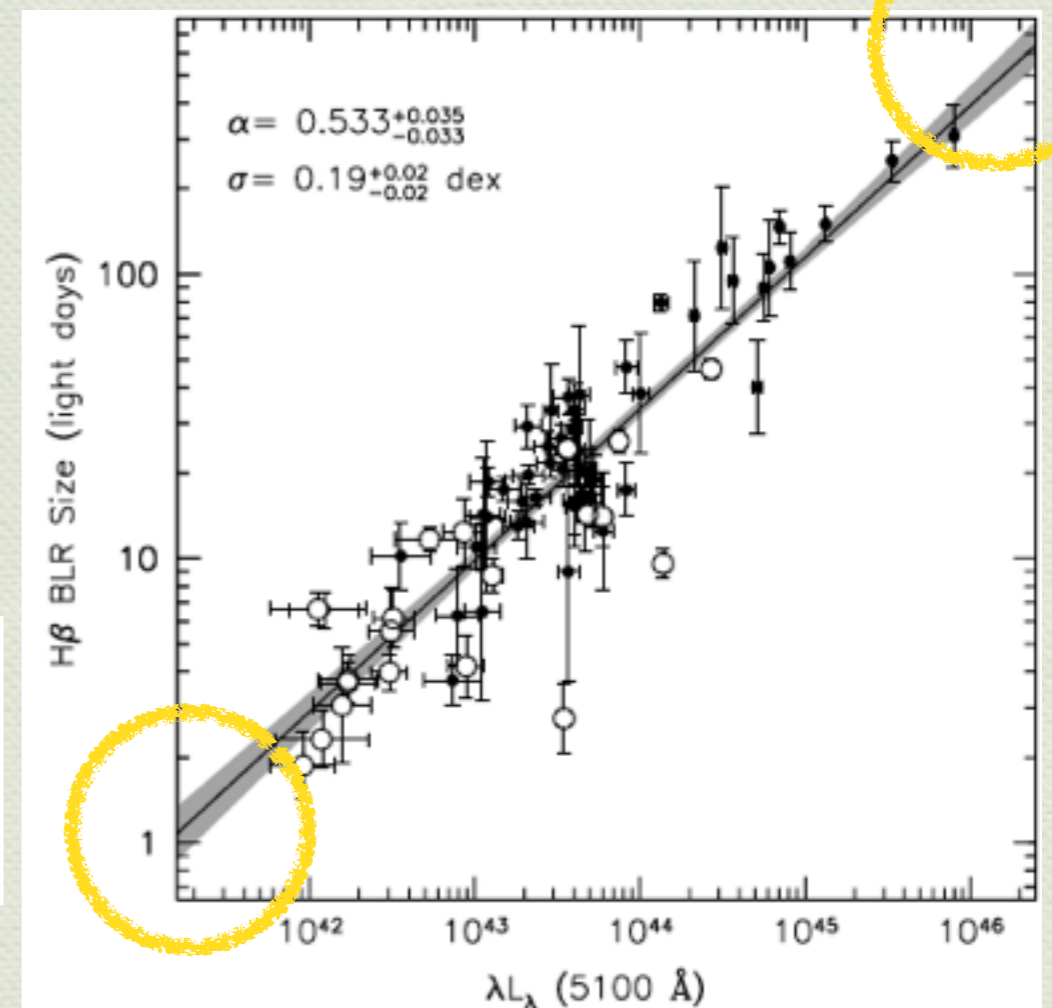

Peterson 1993

Bentz et al. 2009

BH mass for AGN

- Single epoch M_{BH} of AGNs

  reverberation
  mapping, r-L relation

  $r=r(L_{5100})$
  $\sigma=\sigma(H\beta)$

$$M_{BH} = (4.4 \pm 0.2)$$
$$\times 10^6 \left(\frac{L_{5100}}{10^{44} \text{ ergs s}^{-1}} \right)^{0.64 \pm 0.02} \left(\frac{\text{FWHM}_{H\beta}}{10^3 \text{ km s}^{-1}} \right)^2 M_\odot$$

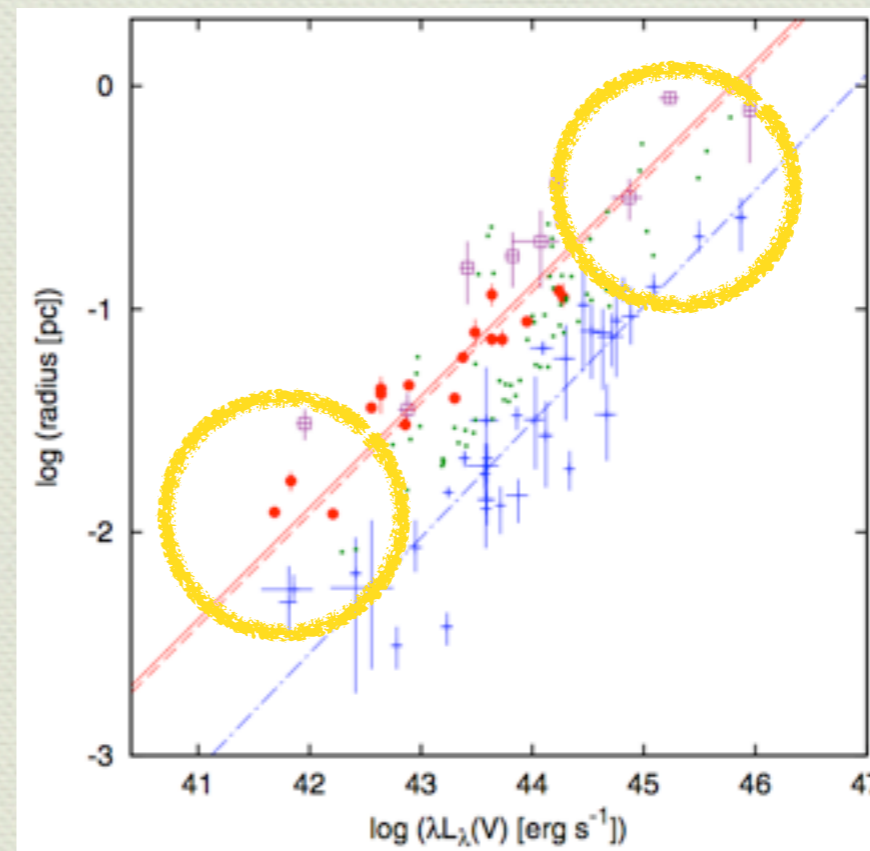Greene & Ho 2005

$\alpha = 0.533^{+0.035}_{-0.033}$
$\sigma = 0.19^{+0.02}_{-0.02}$ dex

Hβ BLR Size (light days)

λL_λ (5100 Å)
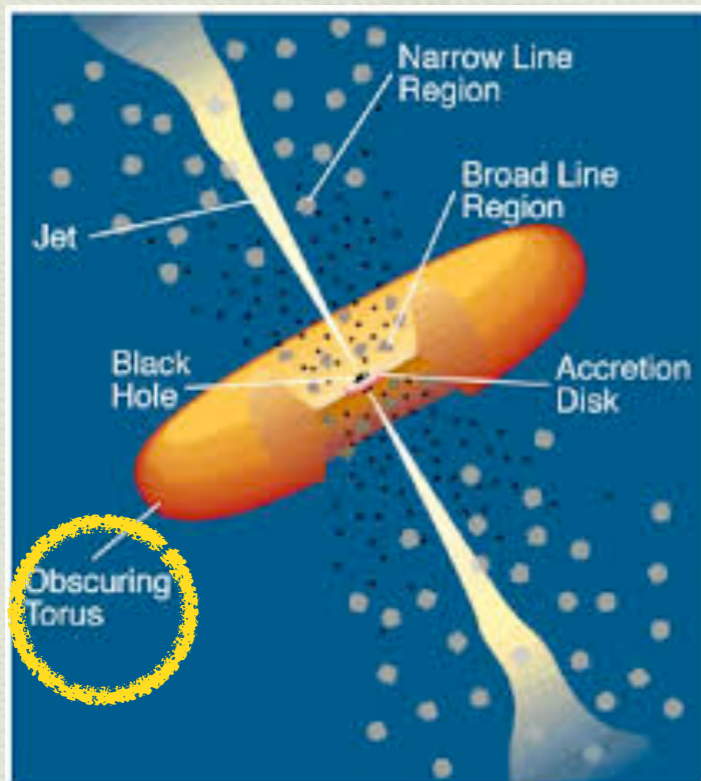
Bentz et al. 2013

Obscuring structure

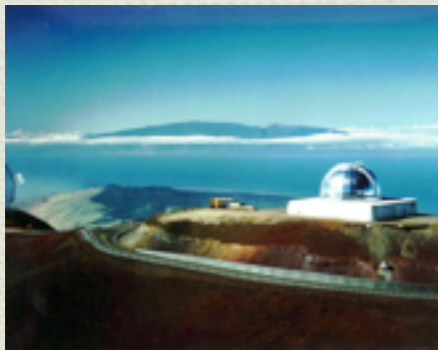- Dust reverberation mapping : time-lag btw UV/optical continuum and near-IR continuum

Koshida et al. 2014

Network telescopes

CTIO 0.6m imaging

DOAO, LOAO 1m imaging

UKIRT 4m Hawaii, IR imaging

Haleakala 2m, Spectroscopy

Siding Spring 2m, Spectroscopy

*several 2m, 1m, 0.4m LCOGT imaging

a global telescope network

Objectives

- N~5-10, ~5yr continuum (B, V-band)/broad-line (H-beta) monitoring of luminous AGN : broad-line region size estimates for big BHs, better **mass** estimation

- N~5-10, 1~5yr continuum (B, V-band)/dust heated emission (K-band) monitoring of bright/faint AGN : dusty structure size estimates for big/small BHs, better understanding of AGN torus **geometry**

- Collaborations btw institutes (KIAS, SNU, KASI, ..)

Other time-domain topics

- Change in spectral appearance : changing look quasar

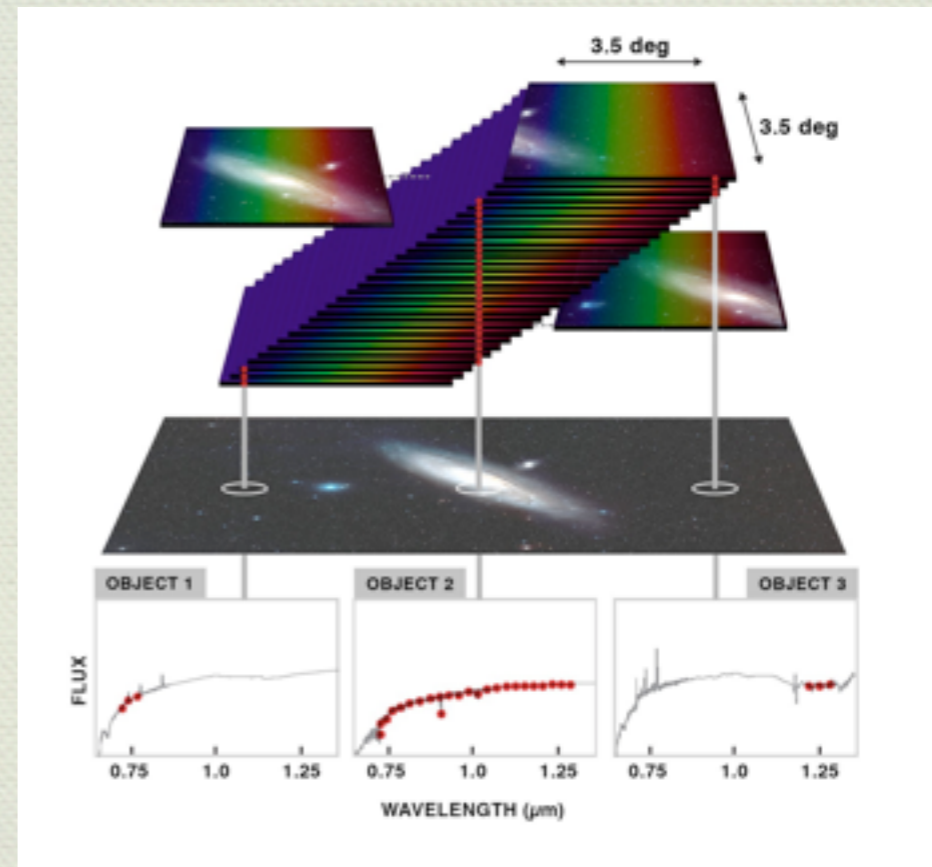- Unusual light curves : periodic quasar
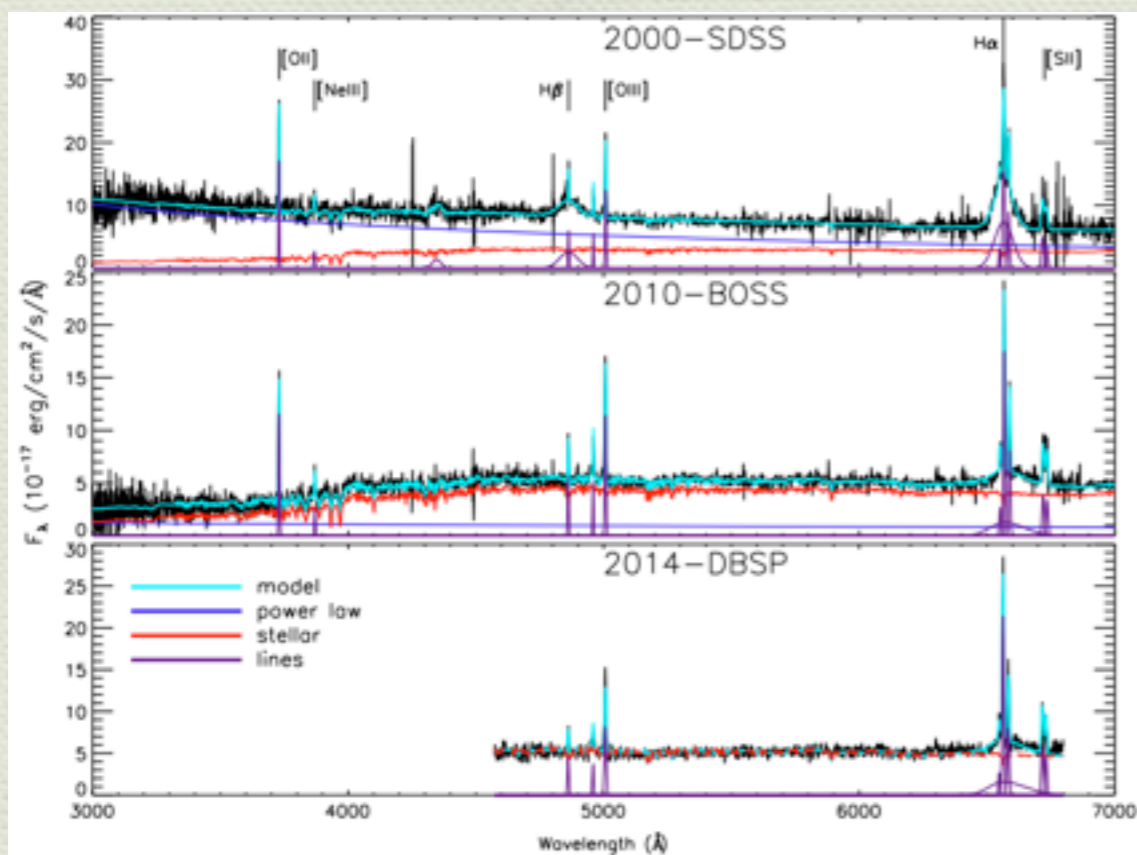
LaMassa et al. 2015
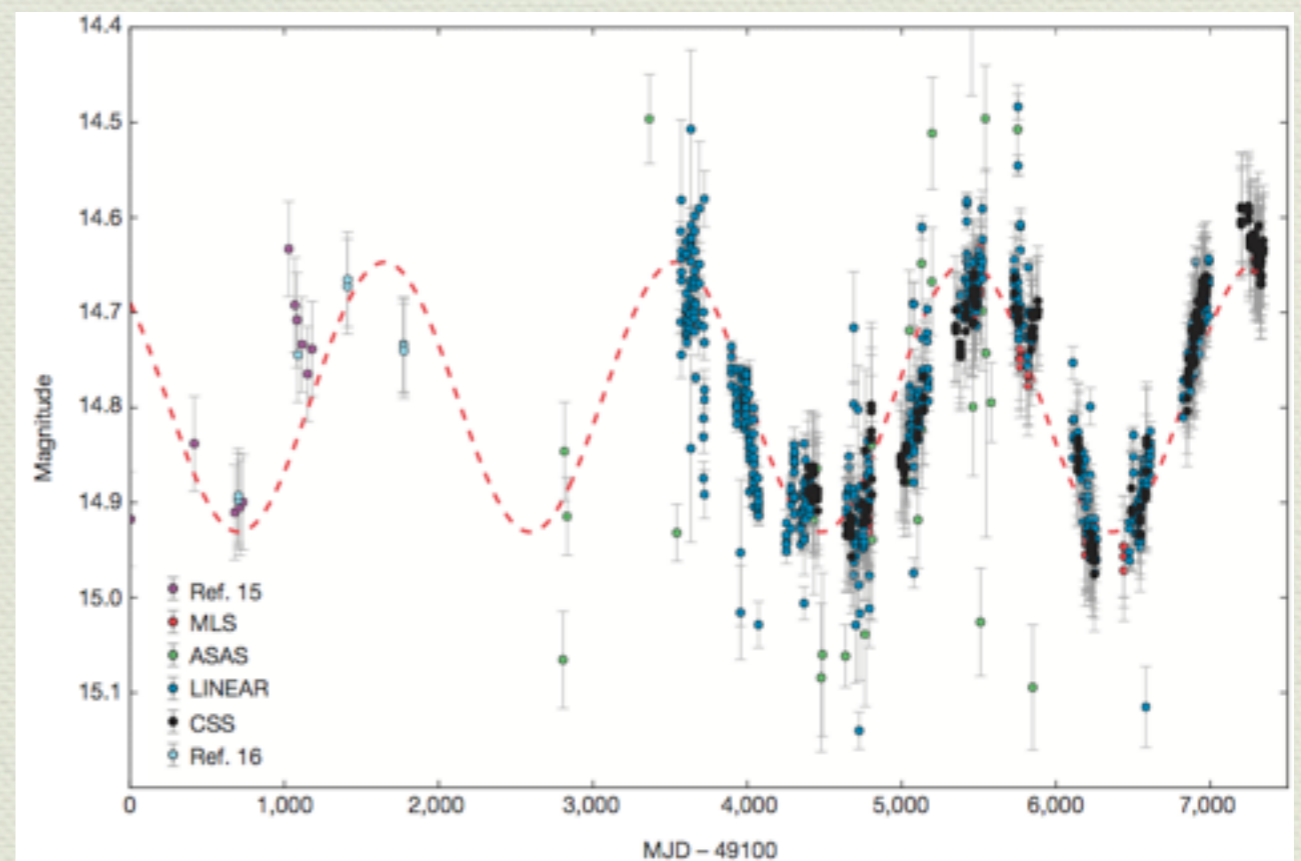
Graham et al. 2015

Survey synergies

- Large area, short-cadence imaging (e.g., LSST)

- near-IR wavelengths (e.g., SPHEREx)

Summary

- AGN reverberation mapping as a survey - targeted science - survey synergy case

- Utilizing shorter cadence, better accessibility to dig into variability, time-domain sciences