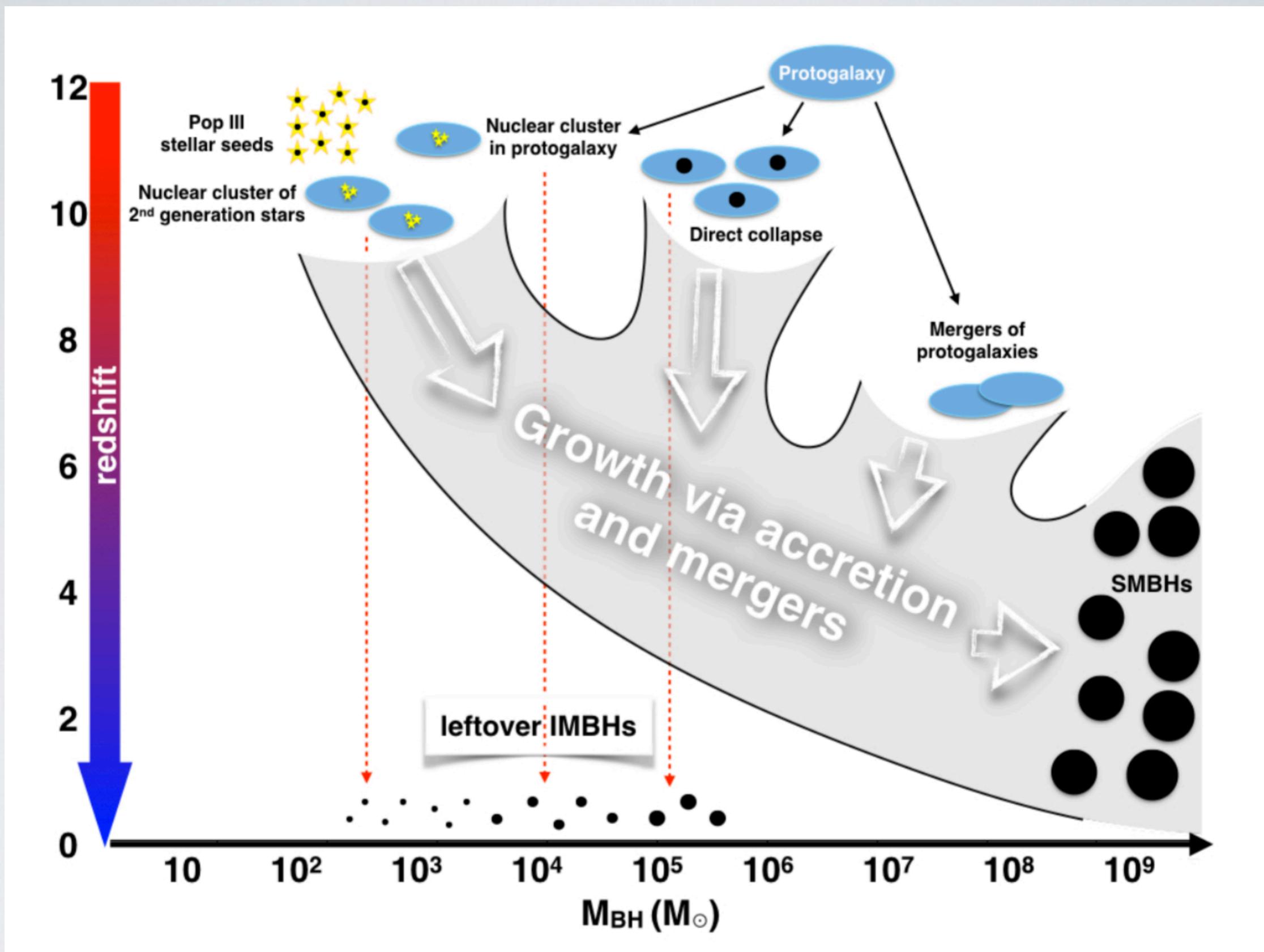


# Search for Intermediate-mass **BL**ack-holes **In** **N**earby **G**alaxies: The **SIBLING** Survey

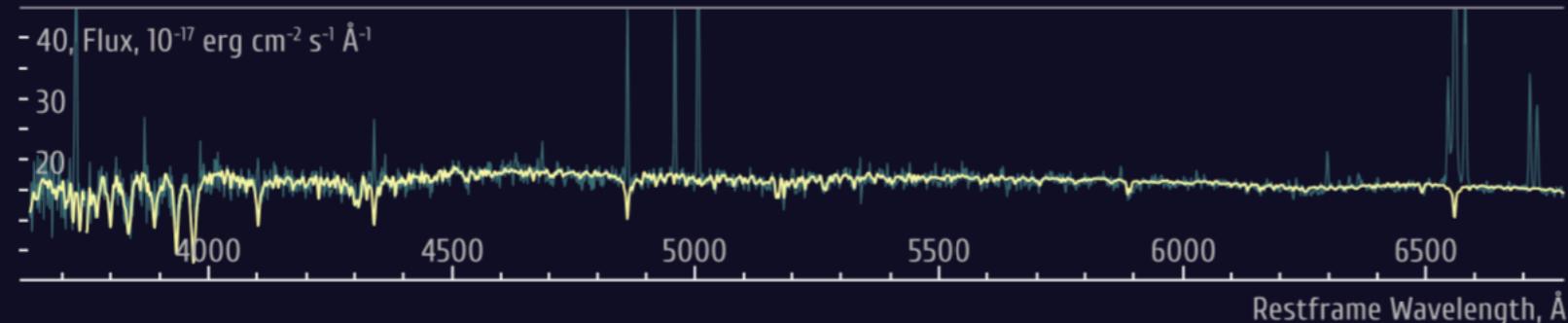
**Paulina Lira**  
**University of Chile**

J. Martínez-Palomera (Berkeley), I. Bhalla-Ladd (Yale), R. Plotkin (Nevada),  
L. Ho (KIAA), M. Graham (Caltech), F. Forster (UChile)

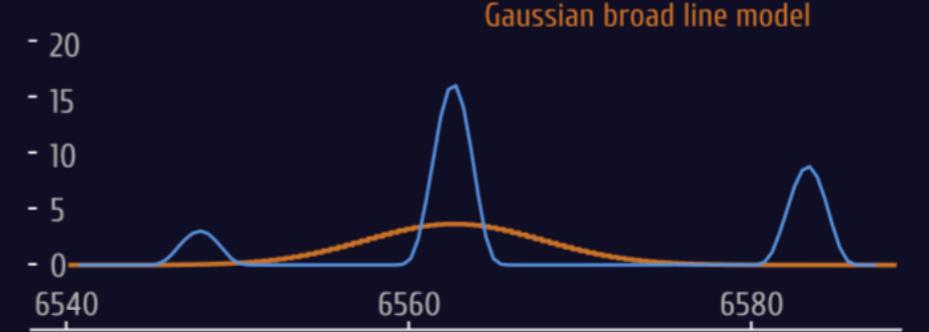


Mezcua 2017

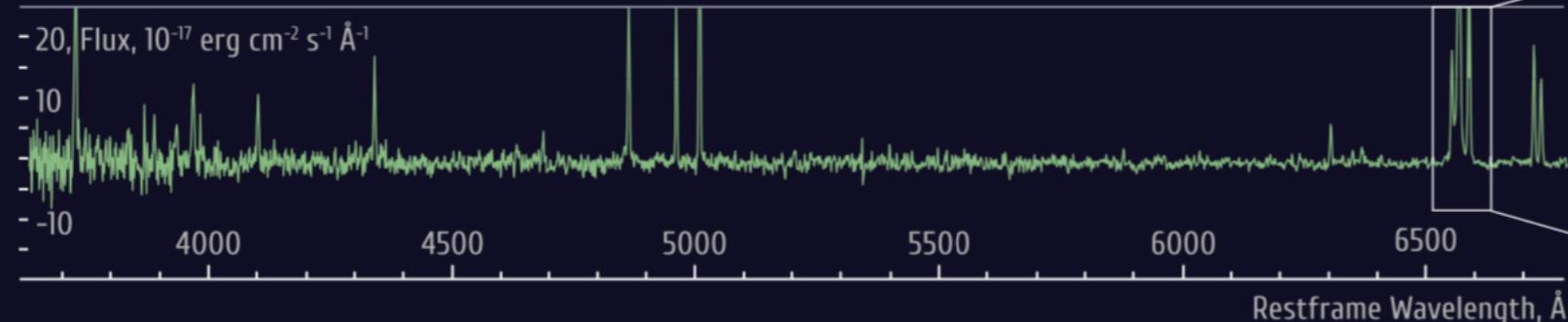
An optical spectrum of the galaxy centre and the galaxy starlight model



$\text{H}_\alpha + [\text{NII}]$  emission lines

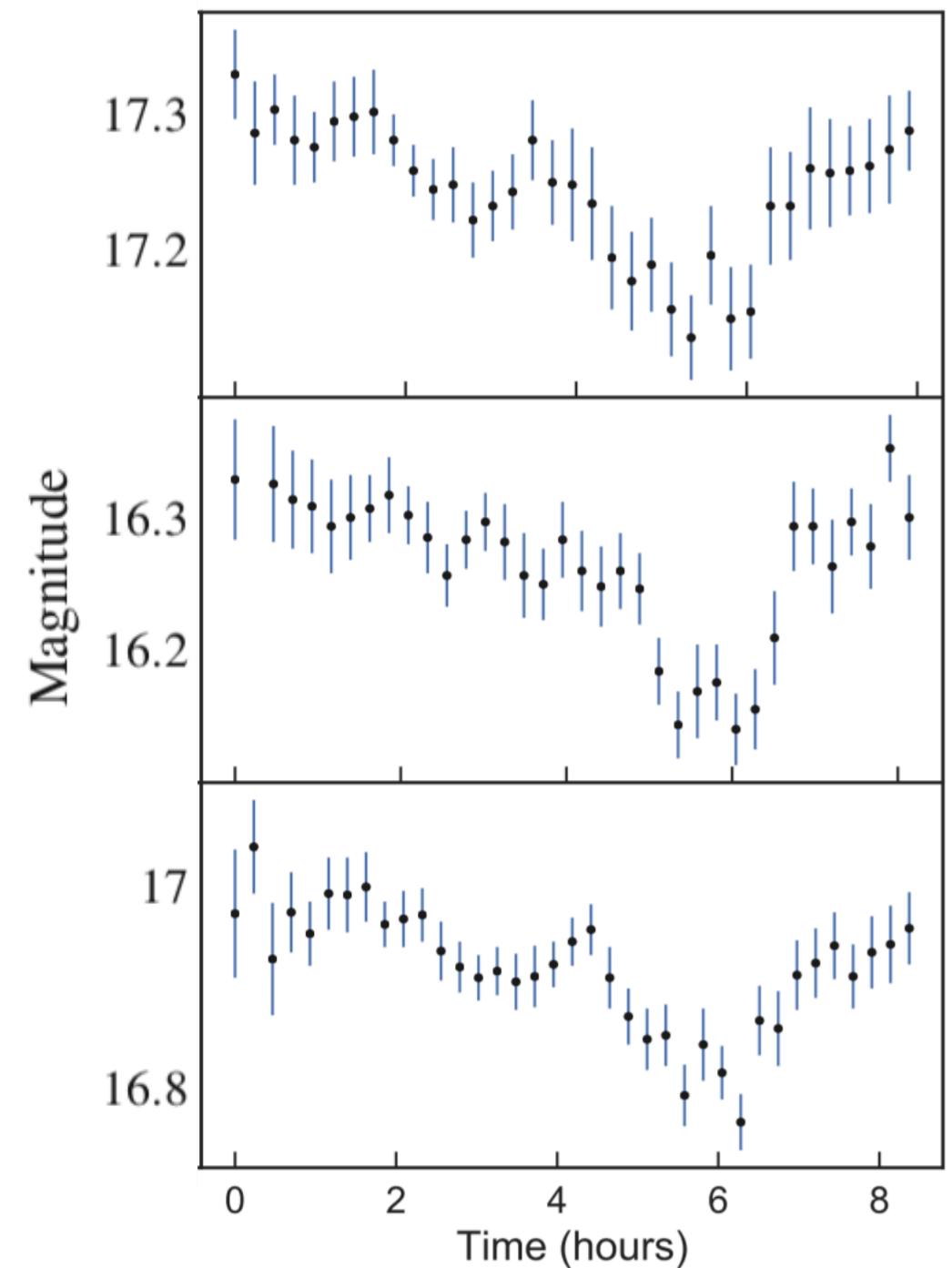


An optical spectrum of the galaxy centre with the galaxy starlight model subtracted

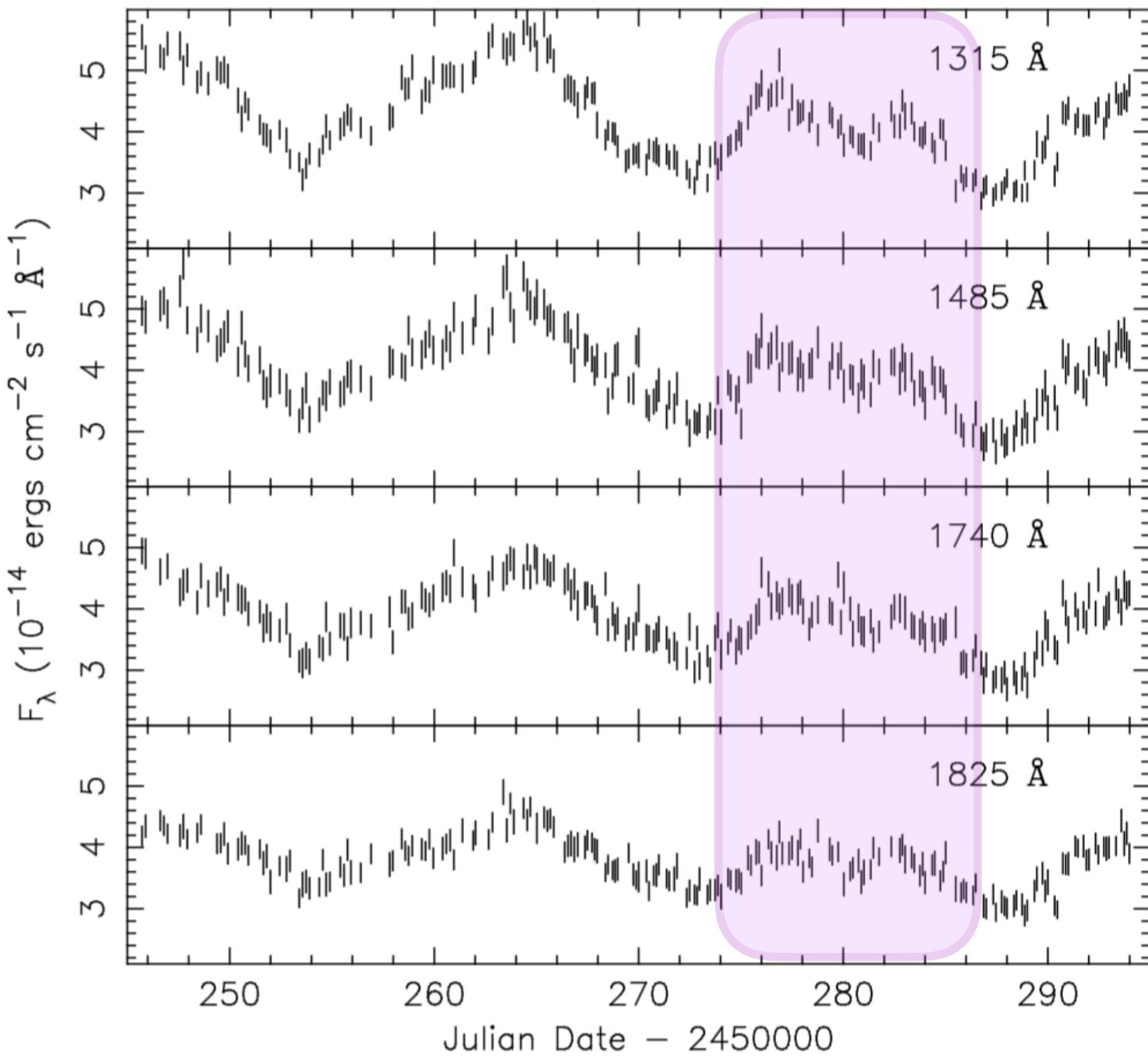


Liu et al. 2018  
Chilingarian et al. 2018

# NGC 4395

 $M_{\bullet} \sim 10^5 M_{\odot}$ 

# NGC 7469

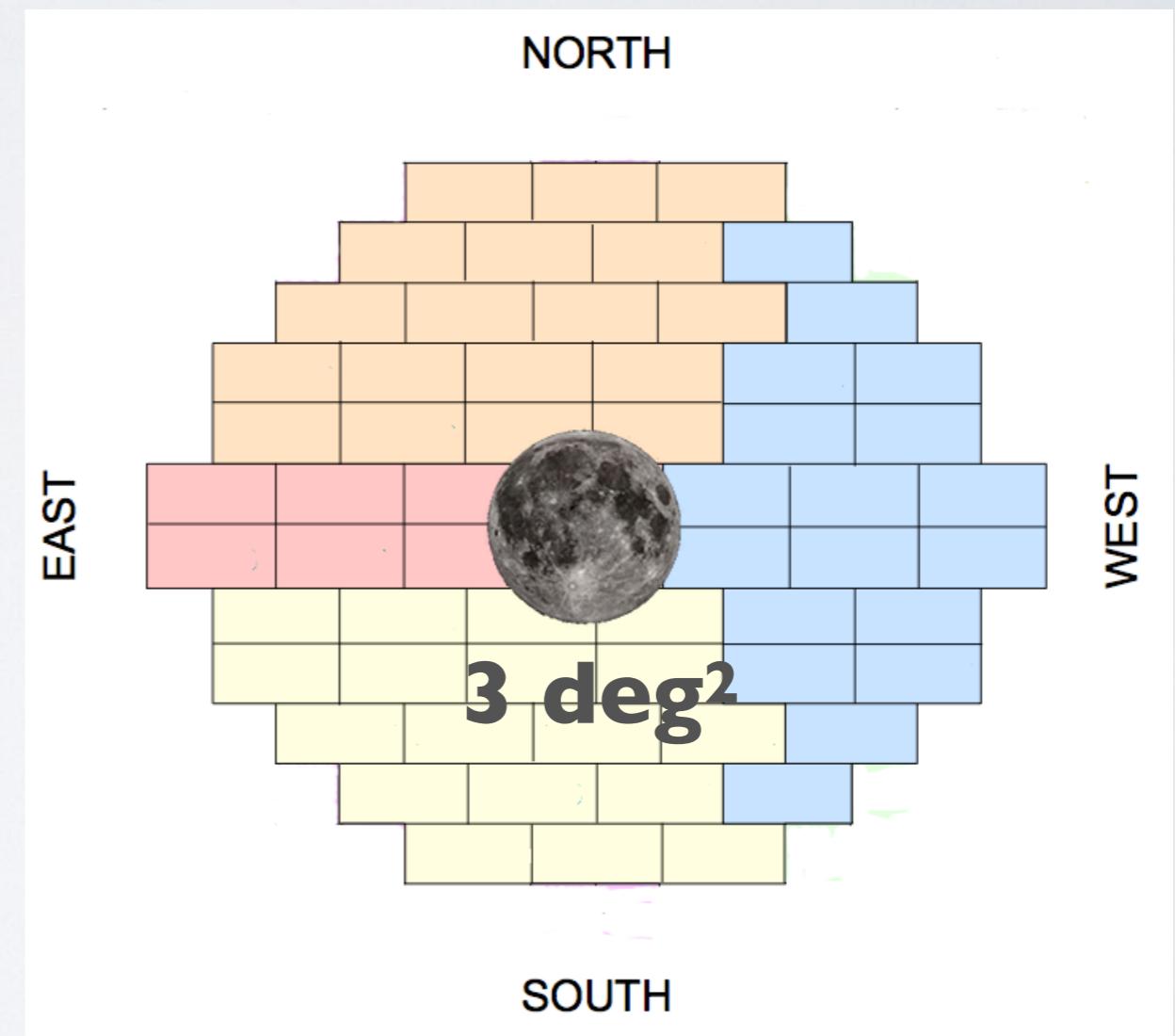
 $M_{\bullet} \sim 10^7 M_{\odot}$ 

# Cadence, depth, area.....

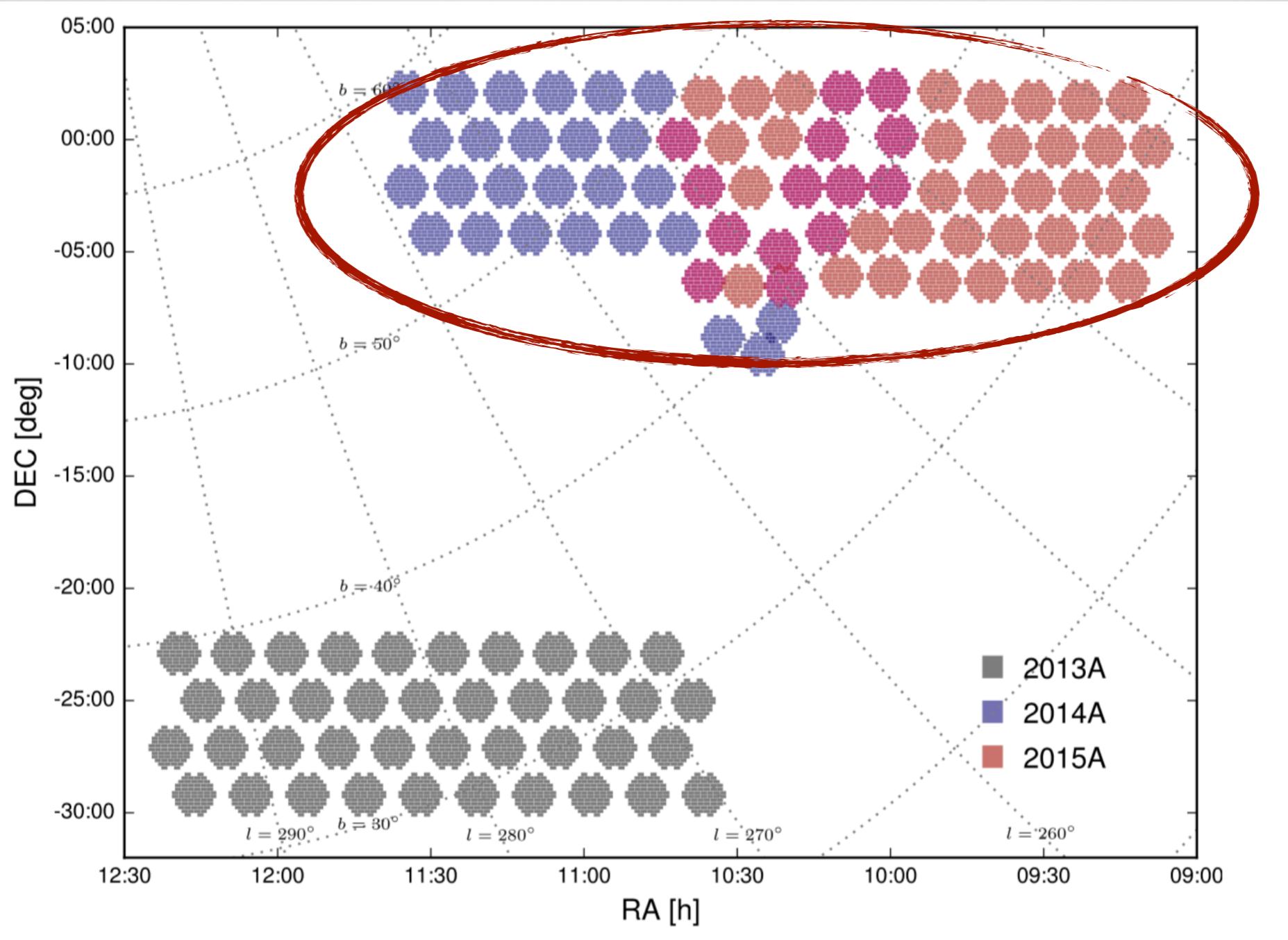
## The High Cadence Transient Survey (HiTS) PI: Francisco Forster



Blanco 4m Telescope

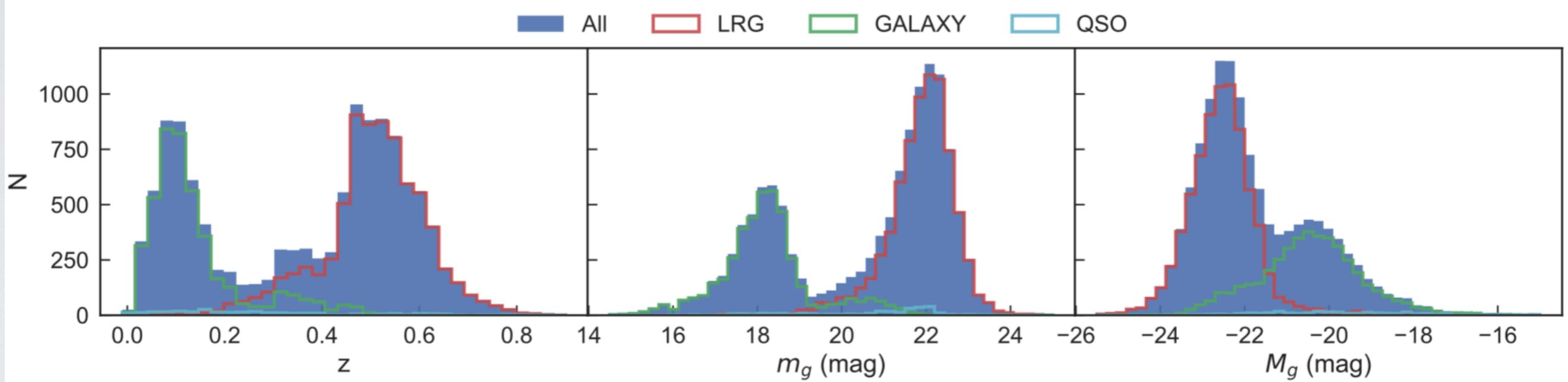


Dark Energy Camera

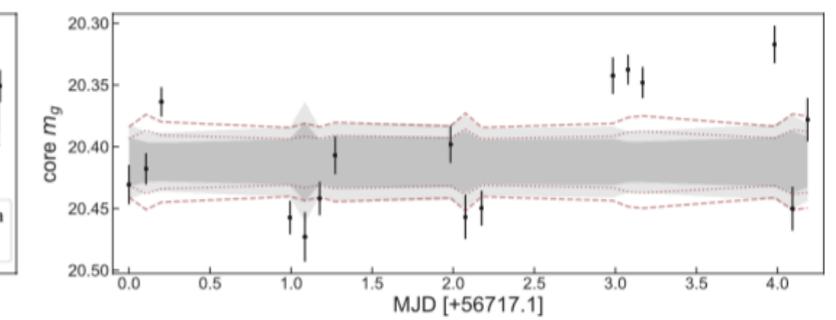
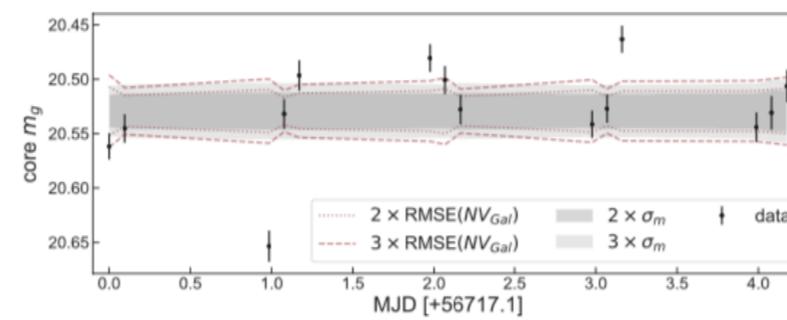
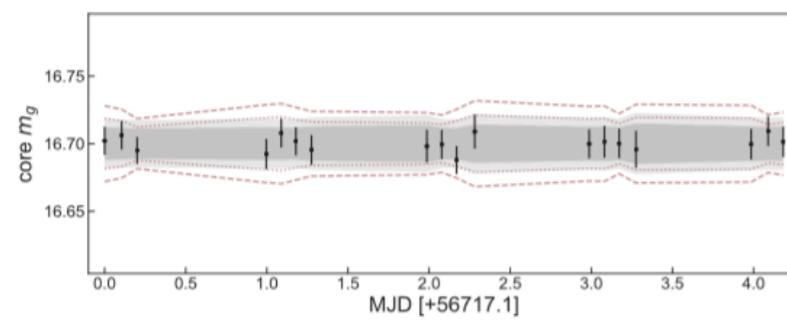
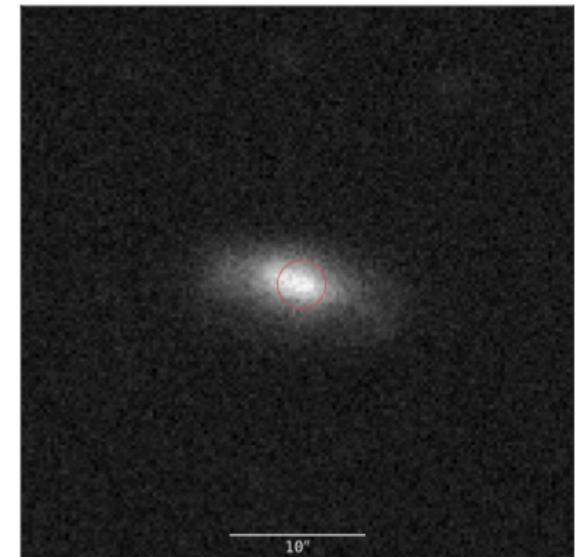
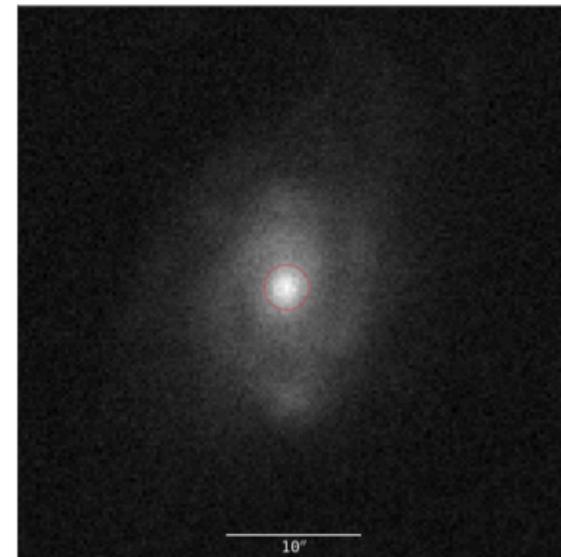
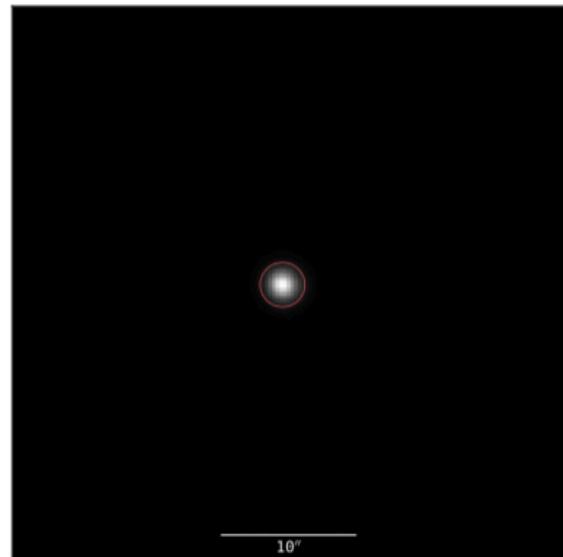


- Cross-match with SDSS Main Galaxy Catalog (**2014+2015**)
- Take all epochs to the same PSF
- Light-curve production from aperture photometry of nuclei

Total of 12 306 unique galaxies across 140 deg<sup>2</sup>

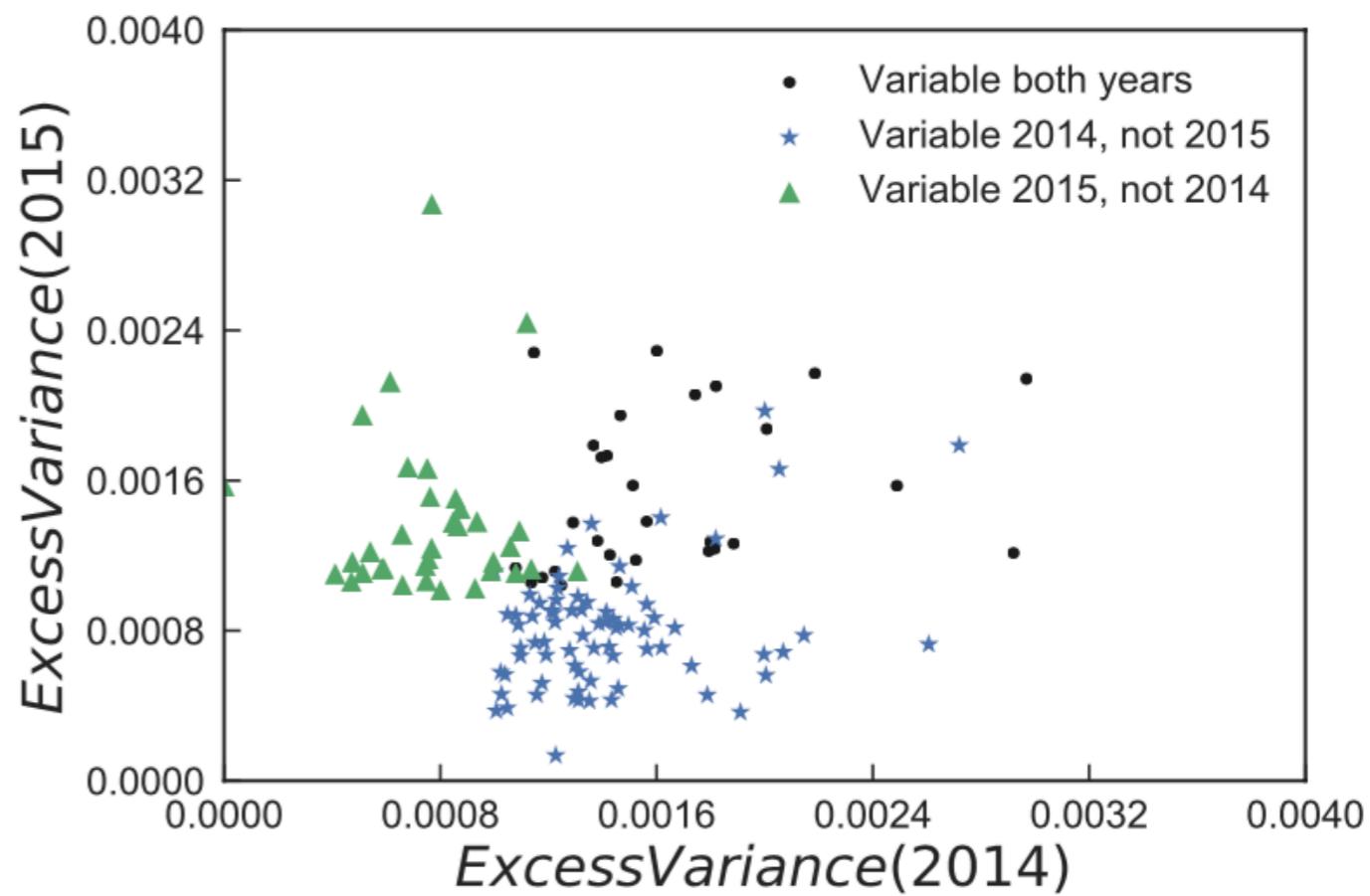
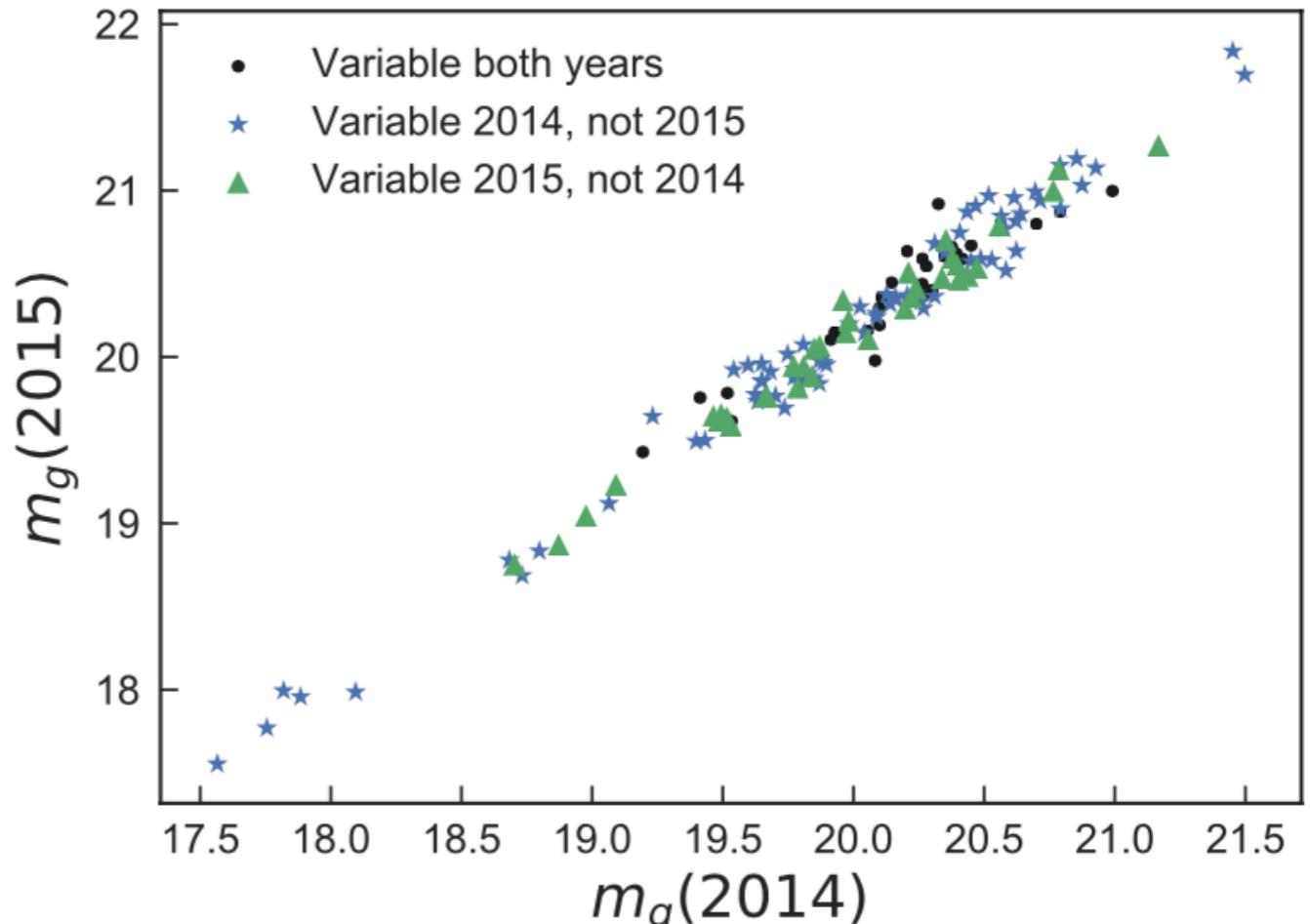


# Short time-scale variable galaxy nuclei



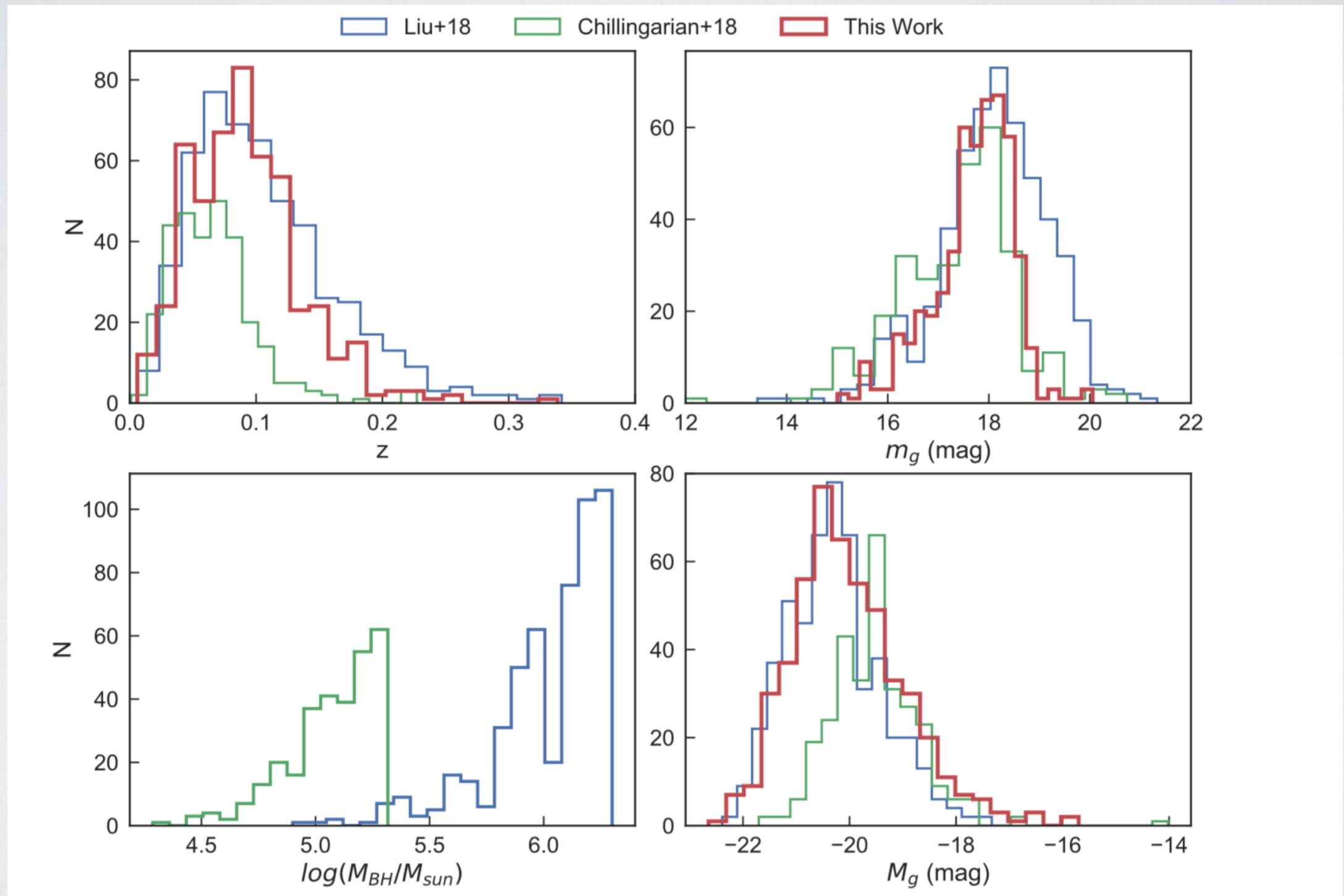
During 2014 we detected **~75%** of “available” sources

During 2015 we detected **~50%** of “available” sources



Other works searching for IMBH measuring broad H $\alpha$  emission lines:  
**Liu+18 & Chilingarian+18**

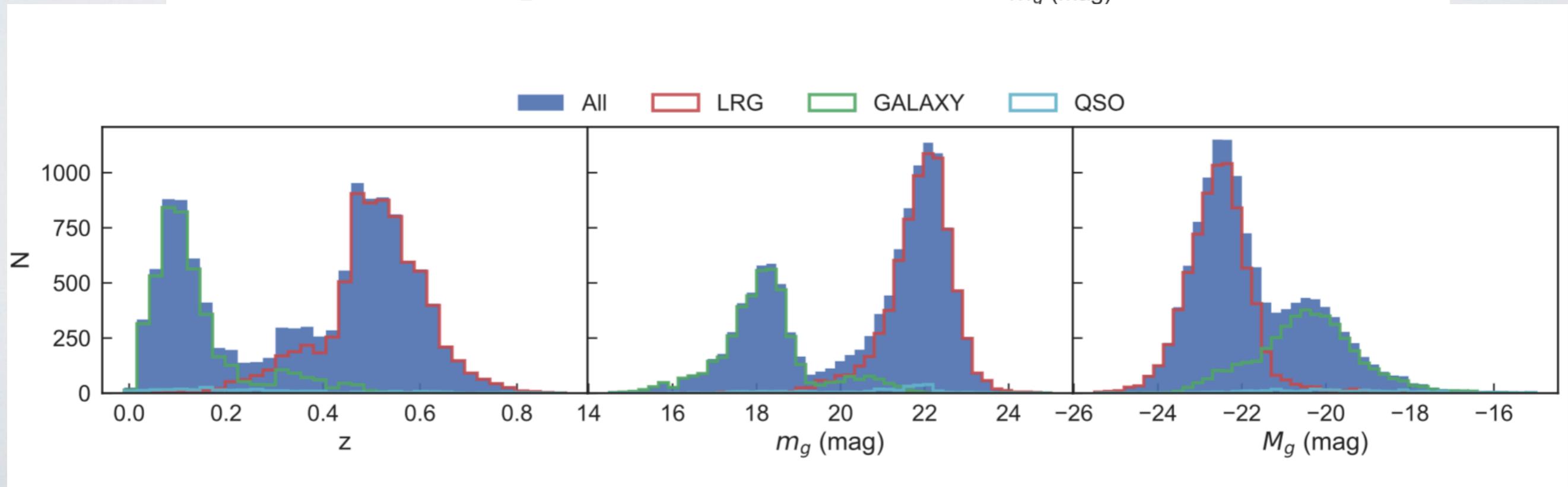
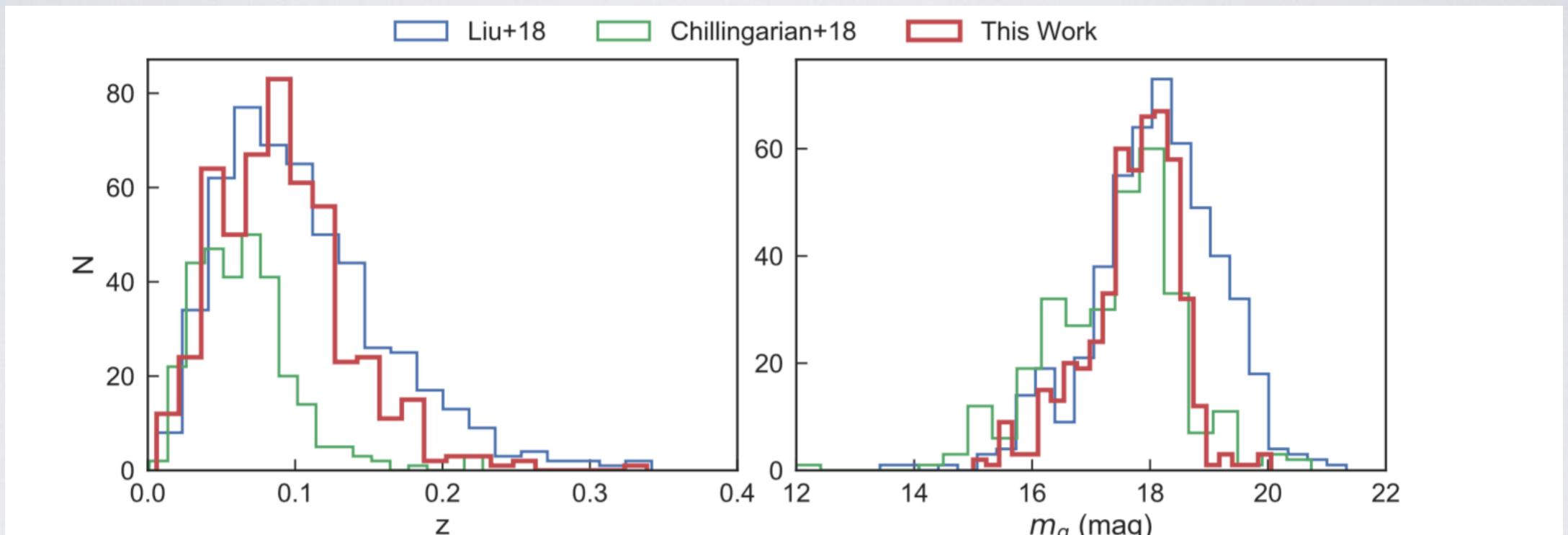
with ~500+300 candidates each from full SDSS searches



Other works searching for IMBH measuring broad H $\alpha$  emission lines:

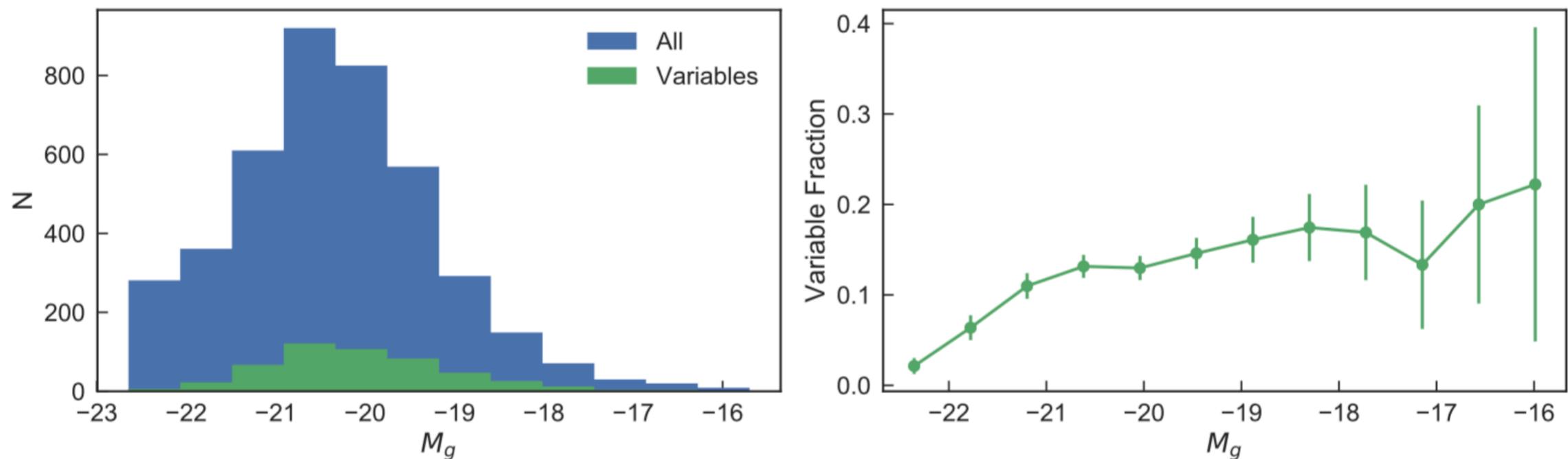
**Liu+18 & Chilingarian+18**

with ~500+300 candidates each from full SDSS searches



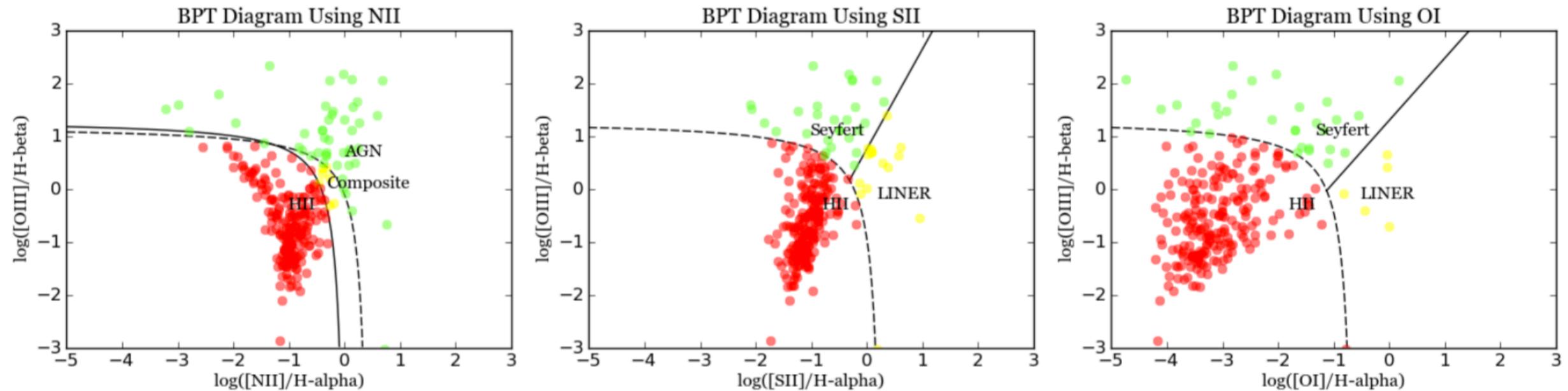
# IMBH Candidates

- IMBH occupancy fraction is ~ 4% and the surface density is 3.1 deg<sup>-2</sup>



GZ Type	Visual Inspection				
	Spiral	Elliptical	Irregular	Merger	Uncertain
Spiral	213	1	2	0	0
Elliptical	1	15	0	0	0
Uncertain	167	49	27	4	3
No Data	10	3	1	2	1
Total	391	68	30	6	4

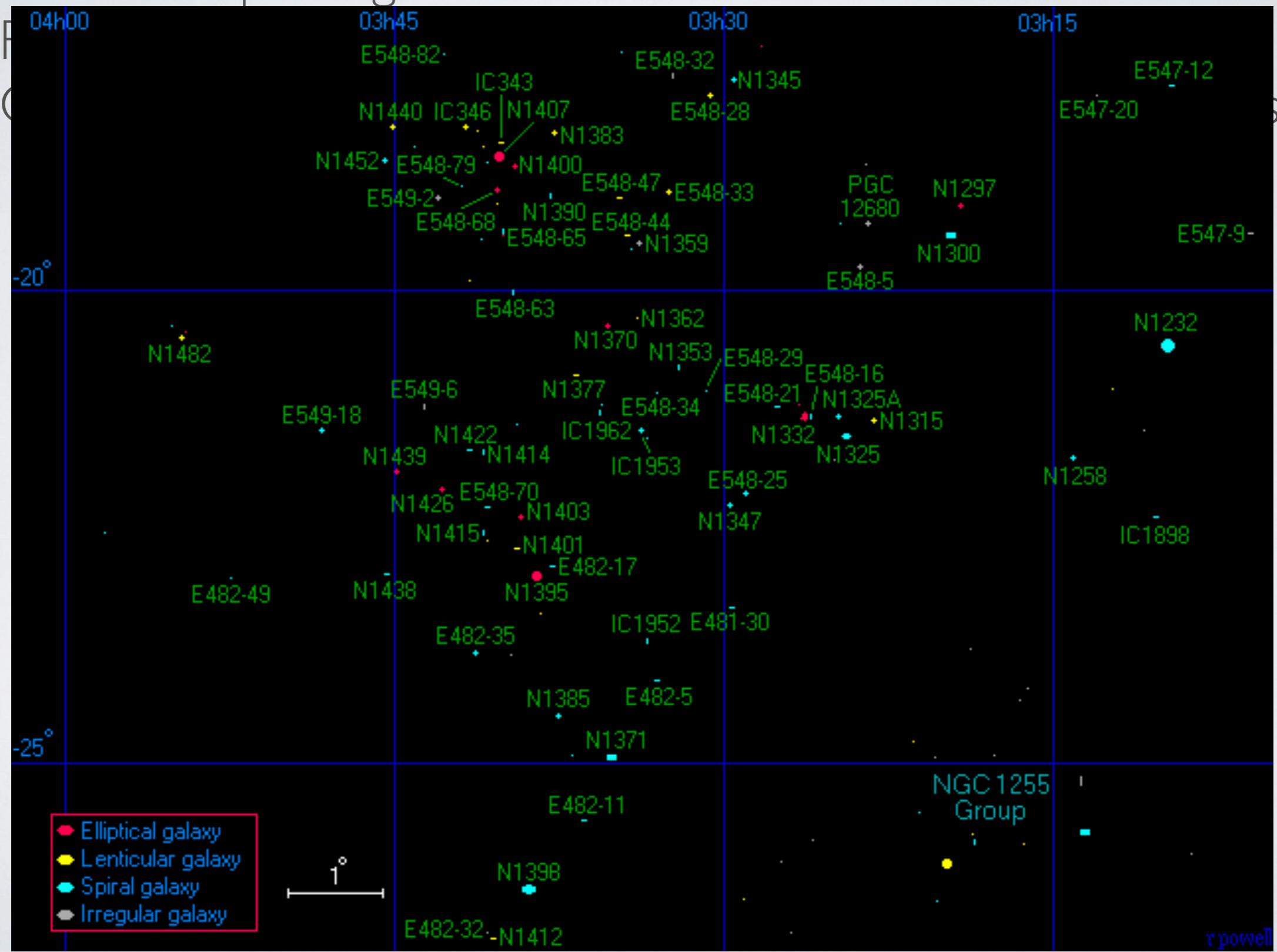
# BPT Diagnostic Diagrams



BPT Diagram	AGN-Seyfert	Composite-LINER	HII-Starforming
NII	43	8	199
SII	25	14	211
OI	27	6	217

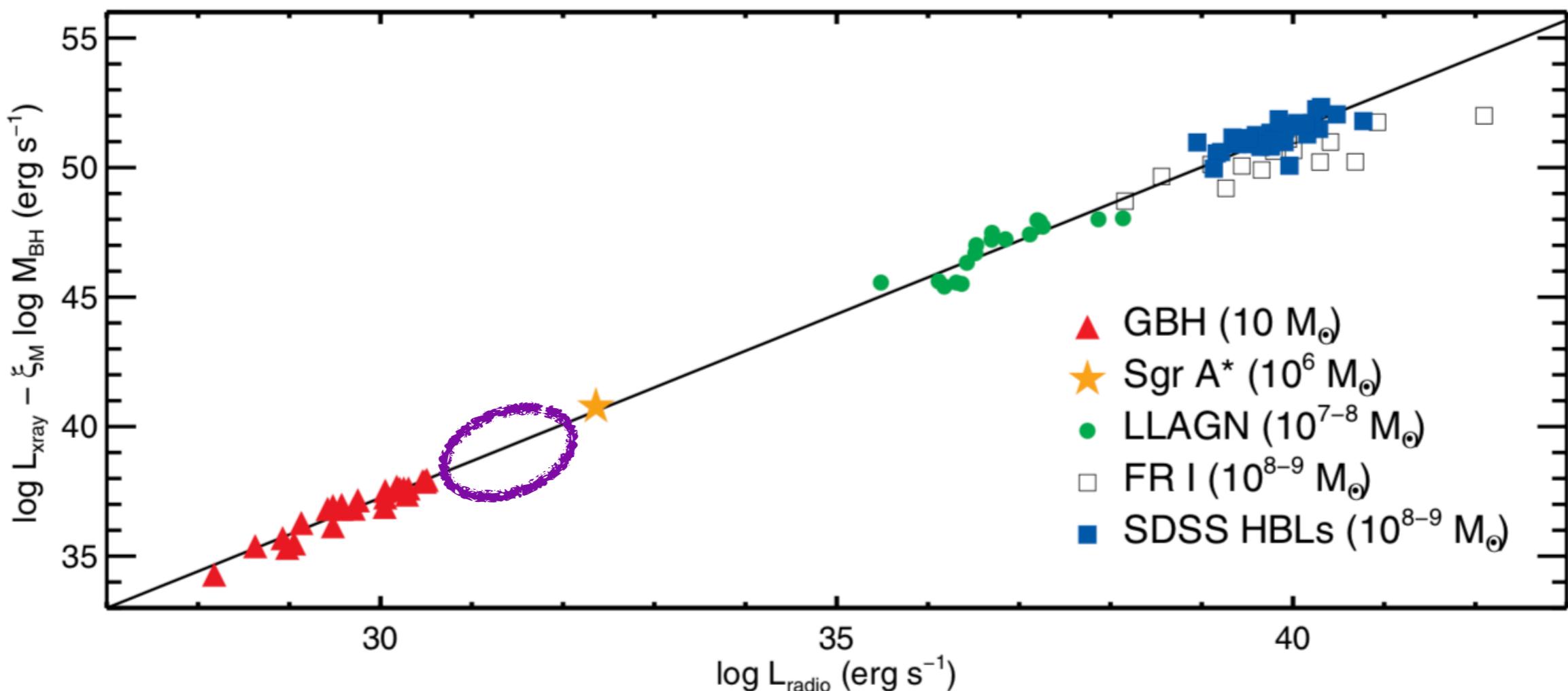
# Next Steps

- Better sampled light curves



# Next Steps

- Better sampled light curves
- Radio and X-ray follow up (VLA, Chandra, eROSITA)
- Ground based spectroscopy, HST, JWST, dynamical studies



## **Summary:**

We have conducted a search for IMBHs using variability:

### **The SIBLING Survey**

SIBLING is  $\sim$ 30-50 times more efficient than searches of broad components to Balmer lines

It is found that  $>4\%$  galaxies harbor an IMBH candidate

The host galaxies span  $Mg \sim -18:-22$  and morphological types are mostly Spirals

Follow up is underway

# Two Announcements



# Calan Postdoctoral Fellowship 2020

## ▼ Submission Information

**Publish Date:** Wednesday, August 7, 2019

**Archive Date:** Wednesday, September 11, 2019

To event remaining 33 days

## ▼ Job Summary

**Job Category:** Post-doctoral Positions and Fellowships

**Institution Classification/Type:** Large Academic

**Institution/Company:** Universidad de Chile

**Department Name:** Department of Astronomy

**Street Line 1:** Camino El Observatorio #1515

**City:** Las Condes

**State/Province:** Santiago

**Country:** Chile

## ▼ Announcement

### **Job Announcement Text:**

The Department of Astronomy ([DAS](#)) at Universidad de Chile invites applications for a two-year postdoctoral position in observational, theoretical, and/or computational astrophysics, as well as astronomical instrumentation. The selected fellow will be expected to conduct an ambitious and independent research program, and collaborate with members of the department. The position, based at the DAS in Santiago, Chile, is sponsored by the [CATA](#) grant and should be started in early 2020.



# International Astronomy Meetings

## Formation and Growth of Supermassive Black Holes

Date Monday, 7 December 2020 - Saturday, 12 December 2020

Location Pucon

Contact Dominik Schleicher

Address Astronomy Department, Universidad de Concepción, Concepción, Chile

Phone +56976550770

URL

Email [dschleicher@astro-udec.cl](mailto:dschleicher@astro-udec.cl)

