AGN Selection Opportunities and Challenges with the LSST

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Short introduction

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- Formation & Evolution of high-redshift quasars
- Co-Evolution of AGN and hosts

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- very luminous quasars at $z = 3 - 5$
- charaterize their population
- near-IR color cut
- random forests (classification, photo-z)

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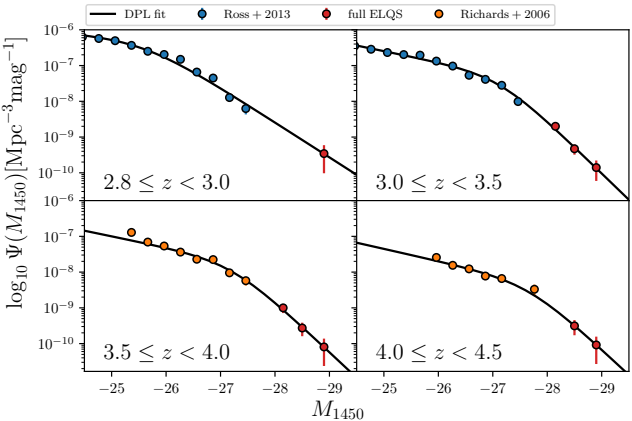

Schindler+2017(ApJ, 851, 13), Schindler+2018a(arxiv:1806.03374), Schindler+2018b(in prep.)

Motivation - The Quasar Luminosity Function

Type-I QLF

- measurements at all redshifts ($z = 0.3$ to ~ 6)

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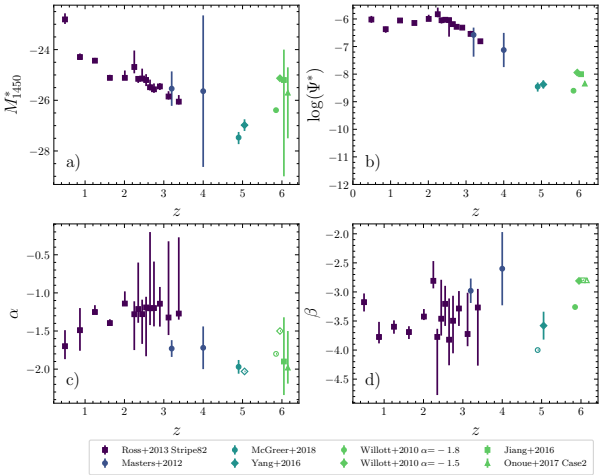

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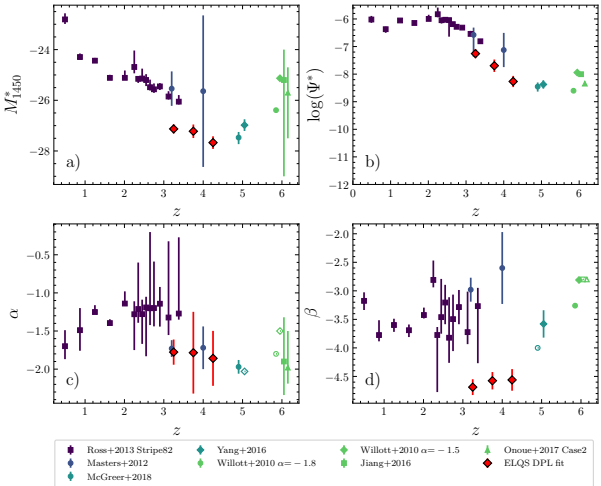

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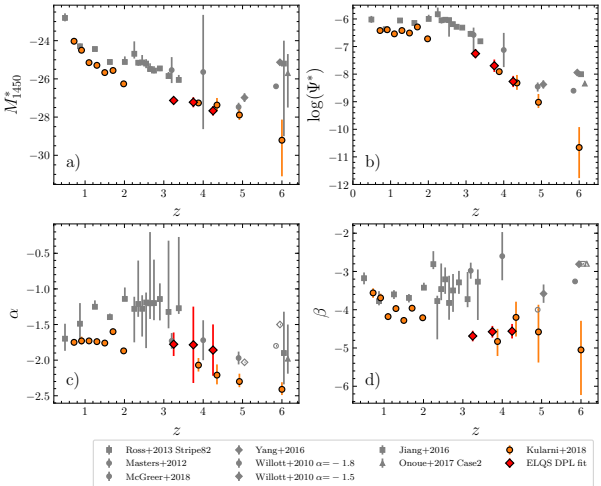

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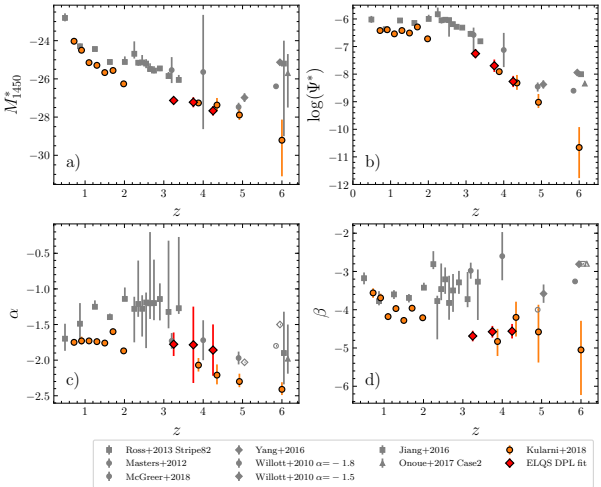
⇒ There is currently no general consensus on redshift evolution.



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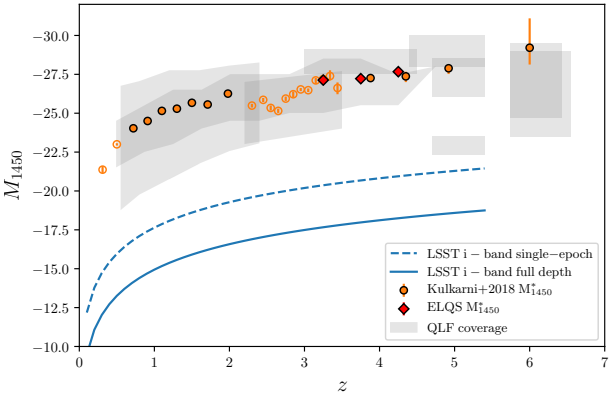

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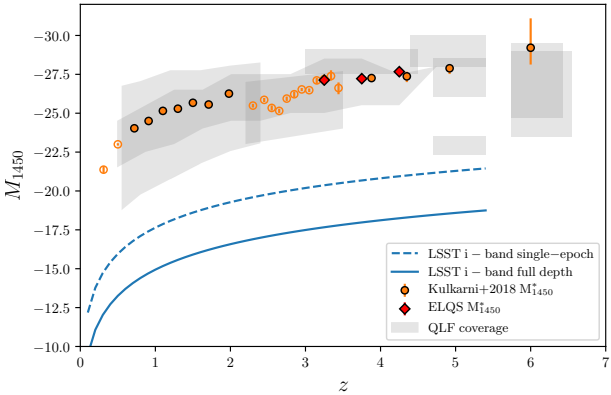

Potential for LSST

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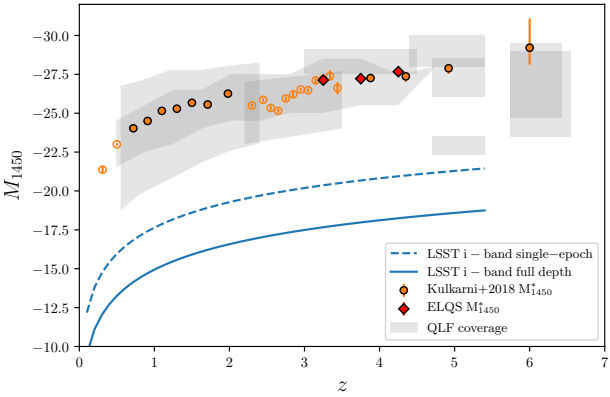

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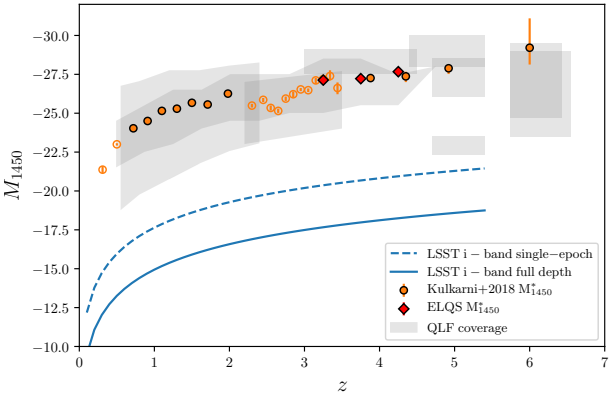

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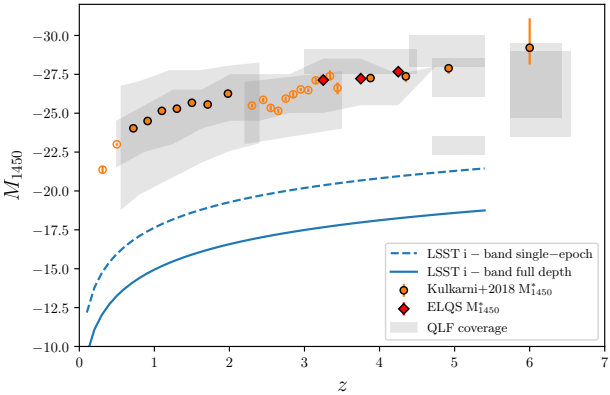

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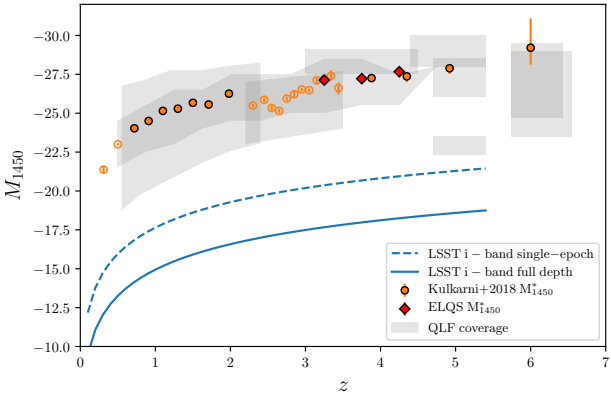

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⇒ LSST allows us to determine the ALF and its evolution over the full luminosity range!

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Is the source an AGN?

- Photometry - Mean Colors, Morphology, **Variability**
- **Astrometry**
- X-ray + Radio detections

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- Near-IR: VHS, EUCLID, WFIRST
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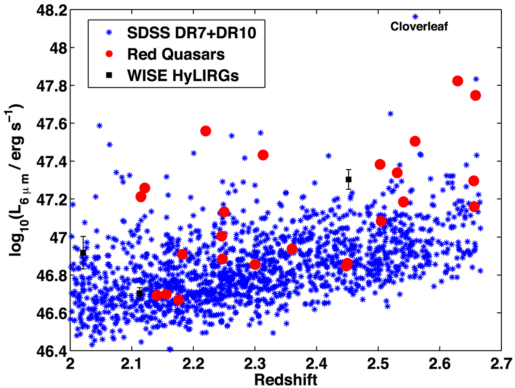
Challenge:

How complete (type/ redshift) are we?

Challenges - Intrinsically obscured type I AGN

Luminous heavily reddened type I AGN (Banerji+2013/+2015, Glikman+2018)



Banerji+2015

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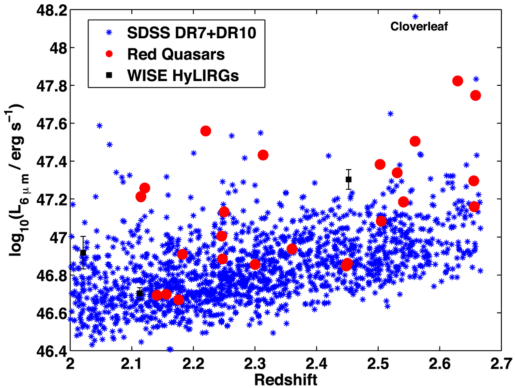

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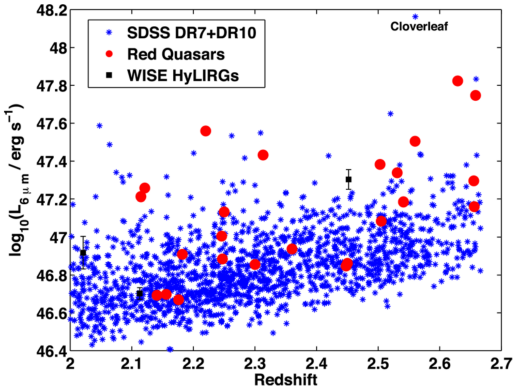

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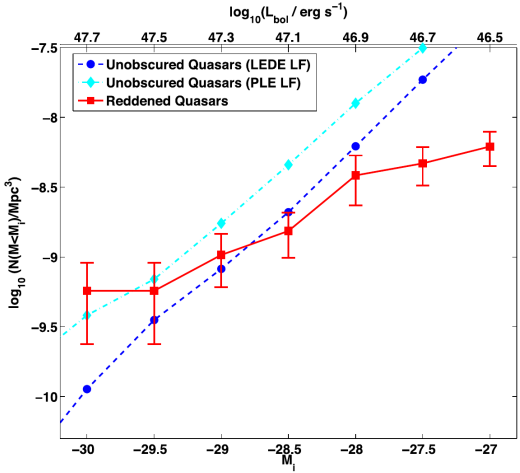

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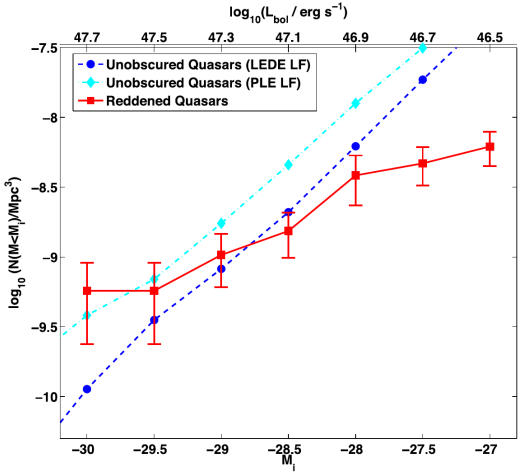
- Fraction of reddened type-I increase with increasing luminosity.
- Could this be a "blowout" phase?



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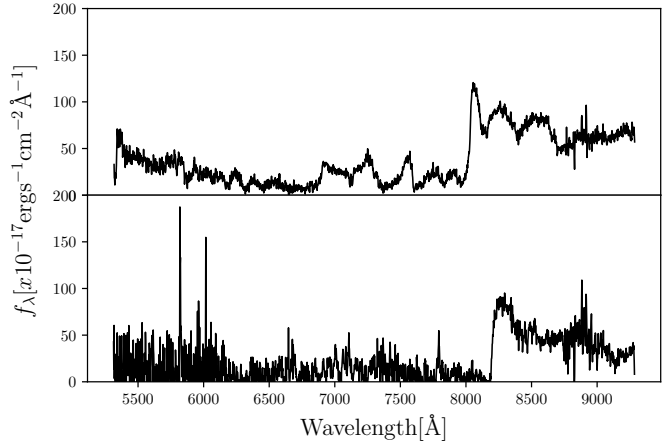
Challenge:

Is the photo-z precision good enough?
Can we avoid catastrophic failures?

Challenges - Exotic AGN and photometric redshifts



Wenzl, JTS + in prep.

Photo-z for high-z AGN

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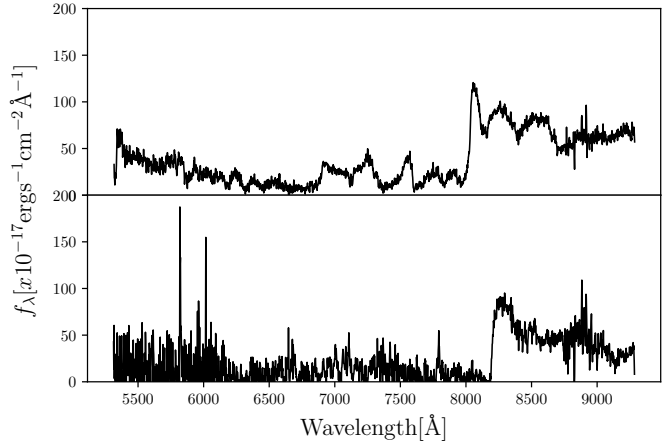

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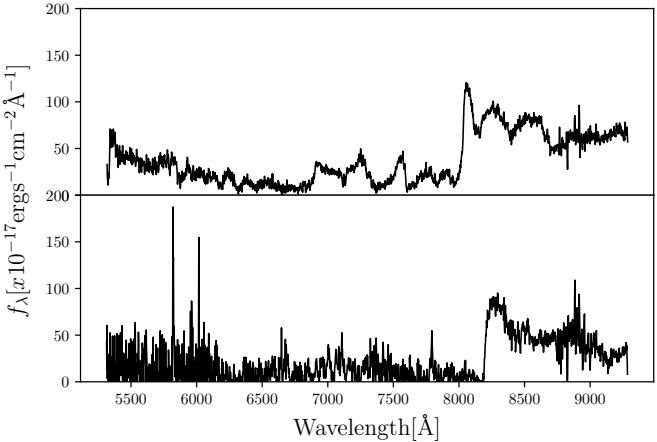

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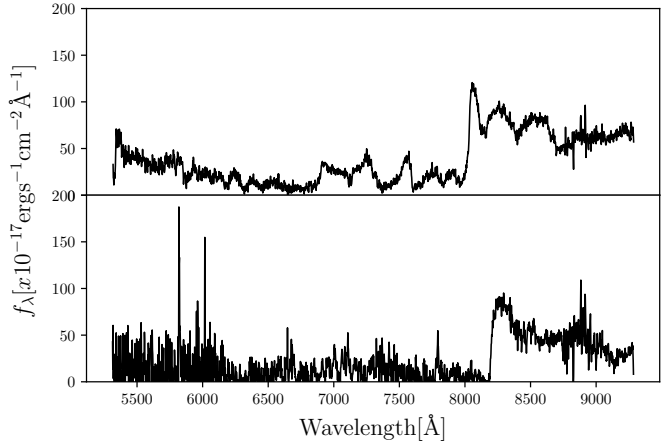

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Photo-z for high-z AGN

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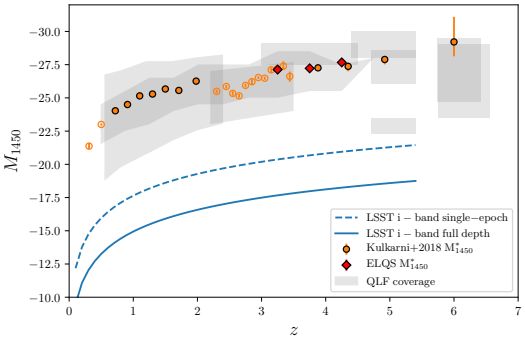
- Photo-z regression fails for the FeLOBAL

LLAGN - The ultimate challenge



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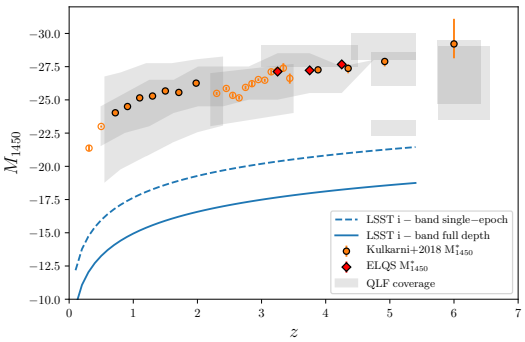

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- Galaxy vs. Seyfert

⇒ Deblending the data?

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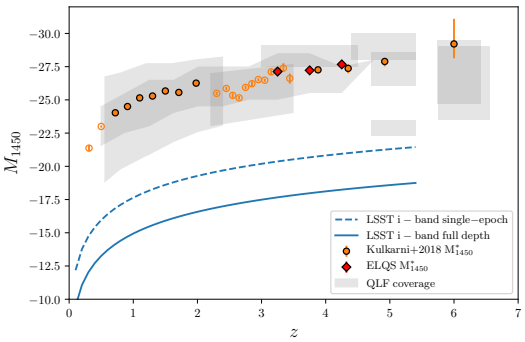

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Photo-z

- Both are at the same redshift!
- Confusion of galaxy/AGN signatures?

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- **Probe full dynamic range of AGN luminosities**
- **Astrometry** (Gaia, LSST) for AGN classification
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Challenges

- Biases and accuracy in classification and photo-z

⇒ Representative Training and "Truth" data sets (number, luminosity, features)

⇒ **Spectroscopic redshift survey** (in DDFs?)

- Obscured AGN

⇒ Multi-wavelength data synergies

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Experimenting with LLAGN

We need a small test set (photometry + imaging) to play with methods on how to distinguish galaxies from LLAGN