DISCLAIMER

This presentation is about a work in progress. Results are preliminary at best. Especially the diagram on the last slide should be treated very cautiously.

Nearby Low-Luminosity QSOs and the M-L Relation of Inactive Galaxies

CPB meeting 2022

2. June 2022

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Overview

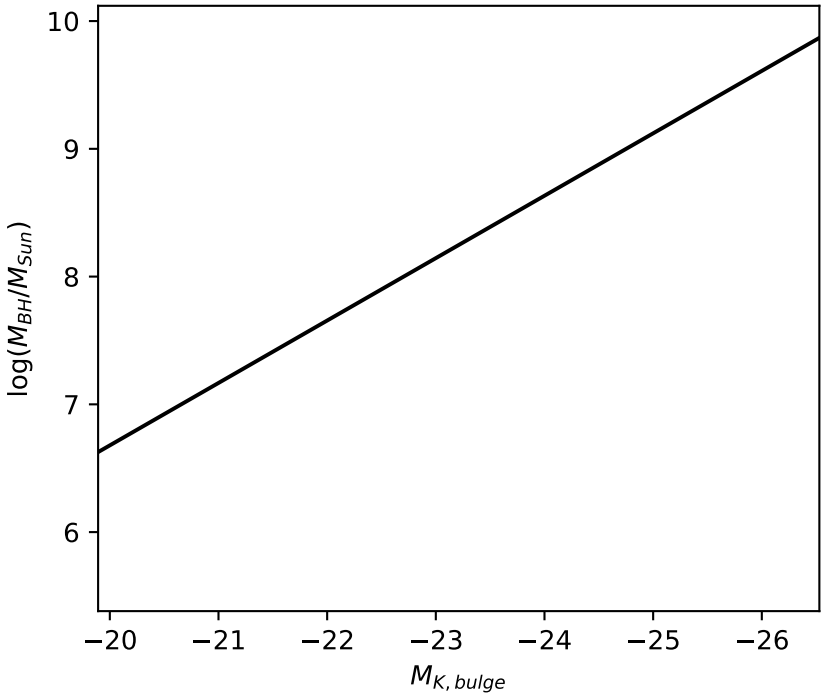
- BH – bulge relations
  - ➔ M_{BH} – L_{bulge} relation
- Low-Luminosity QSO sample
- Mass Estimator via NIR Emission Lines
- (Preliminary) Results

BH – Bulge Relations

- numerous relations assumed between central SMBH and its host galaxy (or at least the central component), e.g. M–σ, M–M, M–L, …
- unclear role of AGN

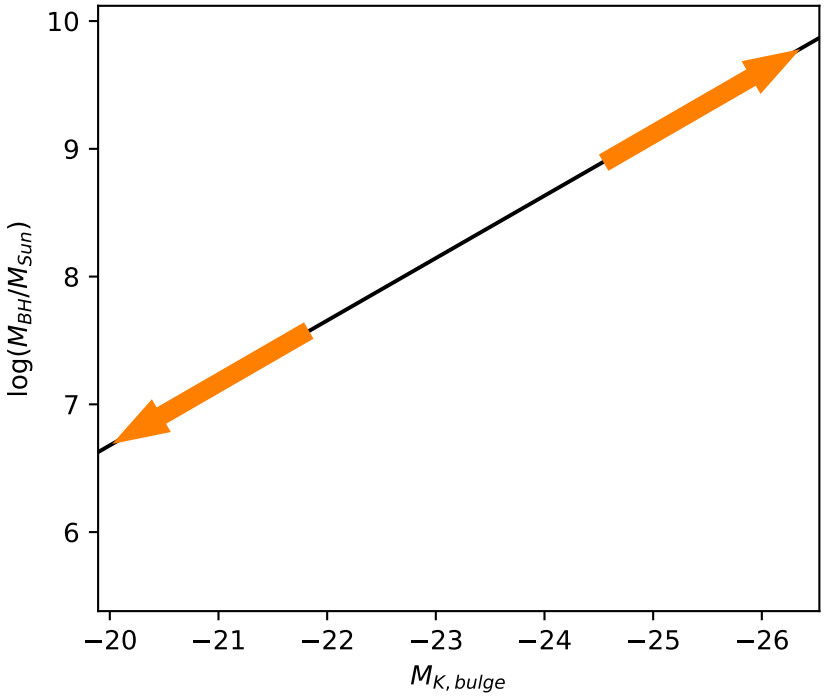
  ➔ might initiate or quench star formation

M_{BH} – L_{bulge} Relation



- relation for inactive galaxies
- Do active galaxies follow the same relation?
  - ➔ If not, which relation and why different?

M_{BH} – L_{bulge} Relation



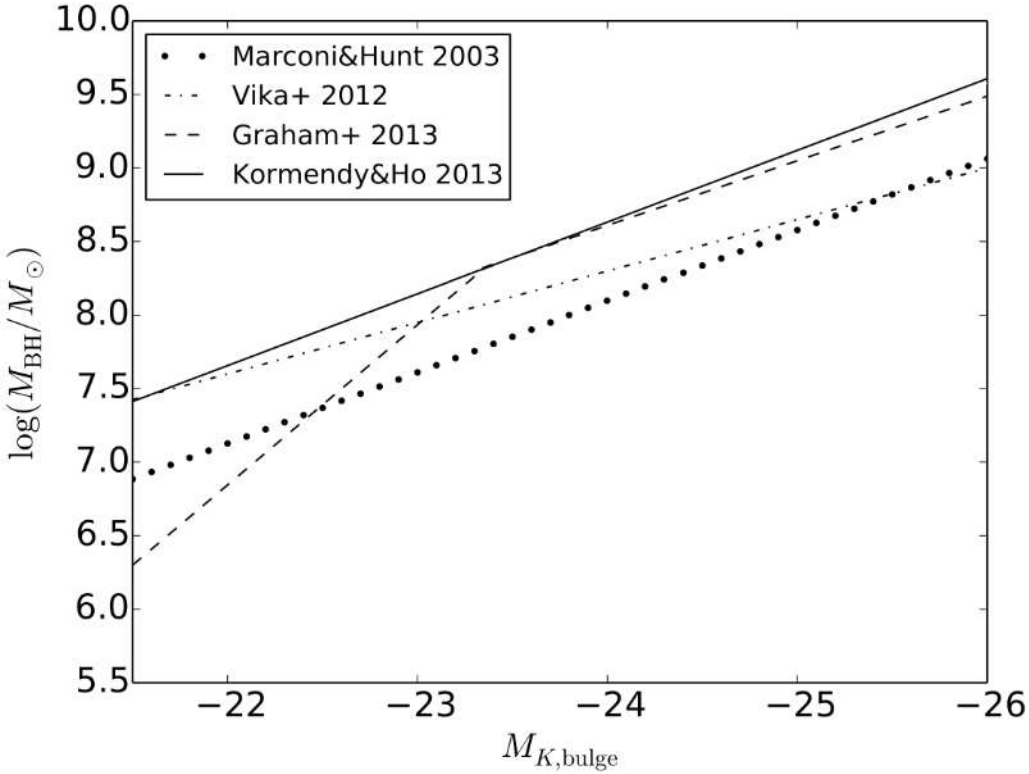
- active galaxies seem to follow the same relation
- but only two areas well covered:
  - close Seyferts
  - distant, powerful QSOs

Low Luminosity Type-1 QSO Sample

- low luminosity type-1 Quasi Stellar Object (LLQSO) sample
- closest, bright AGN that can be spatially resolved
- in total 99 objects (redshift $z \leq 0.06$)
- type-1 objects: narrow and broad emission lines
  - ➔ use broad component to find Broad Line Region (BLR) properties

LLQSOs vs. M_{BH} – L_{bulge} Relation

- paper series about LLQSO sample 2014-2016
- authors compare 16 objects from LLQSO sample with four suggested relations



based on: Busch et al. 2016

LLQSOs vs. M_{BH} – L_{bulge} Relation

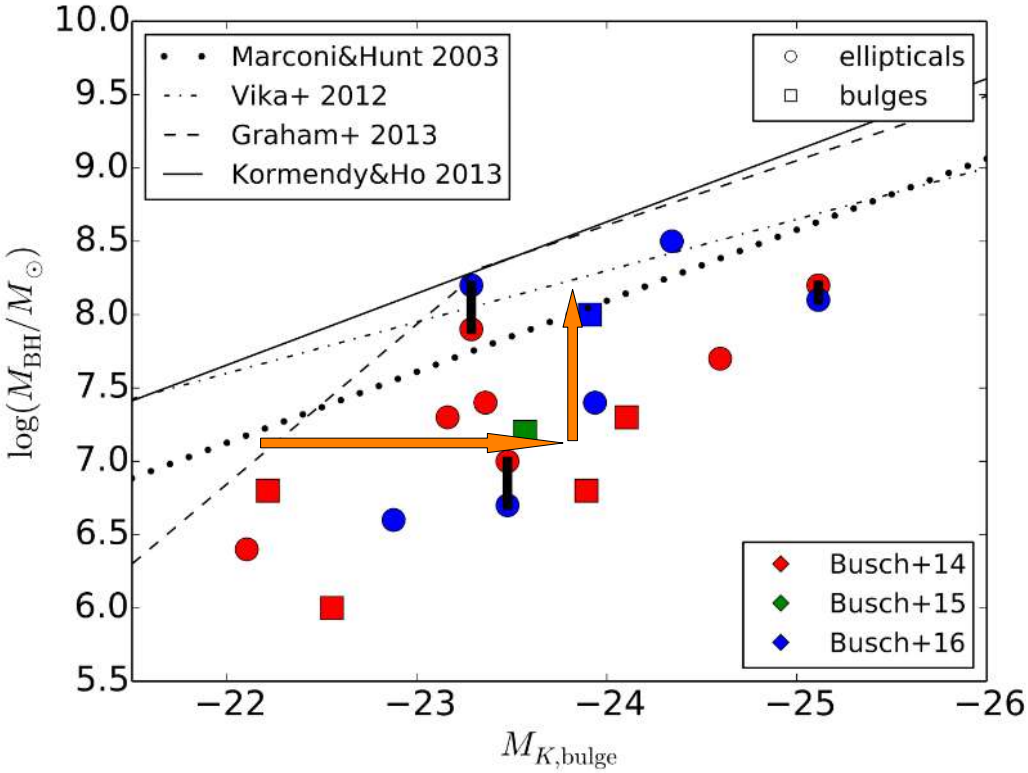
LLQSOs deviate from the suggested relations:

- undermassive BHs

  or

- overluminous bulges

➔evolution via over-luminous bulges (?)



based on: Busch et al. 2016

Long-Slit NIR Spectroscopy

- New Technology Telescope (NTT) with Son OF ISAAC (SOFI) mounted
- Long-slit Near-Infrared (NIR) spectroscopy (~ H- & K-band)

credit: Y. Beletsky (LCO)/ESO

BH Mass Estimator

- Kim et al. 2010: BH mass estimator using NIR emission lines (Paschen α & Paschen β)
- find three different estimators, of which one is favored due to stable results and physical parameters

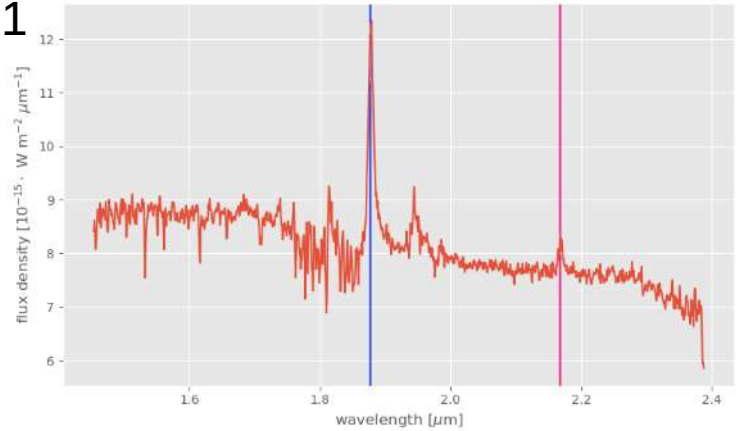
$$\frac{M}{\mathrm{M}_\odot} = 10^{7.16\pm0.04} \left(\frac{L_{\mathrm{Pa}\alpha}}{10^{42}\,\mathrm{erg\,s^{-1}}} \right)^{0.49\pm0.06} \left(\frac{\mathrm{FWHM}_{\mathrm{Pa}\alpha}}{10^{3}\,\mathrm{km\,s^{-1}}} \right)^{2}$$

Example Spectra

Paα

Brγ

01



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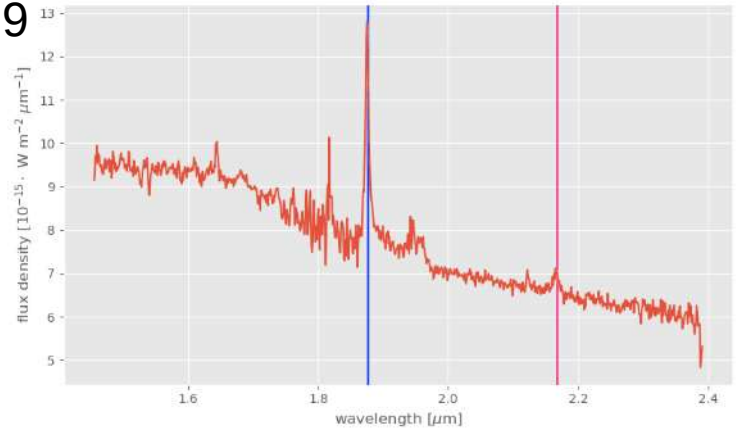

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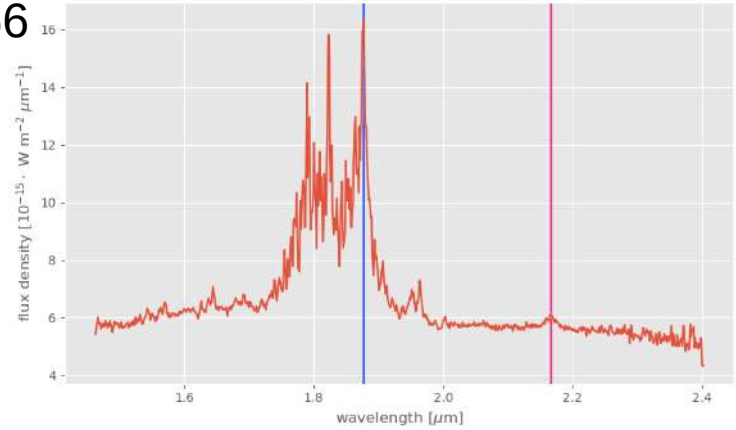

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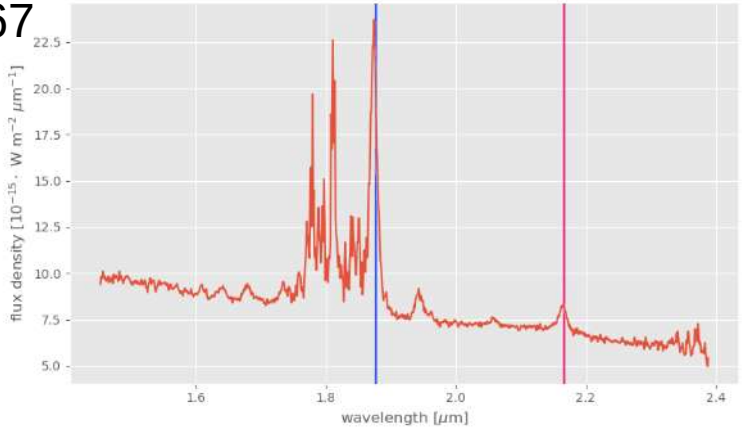
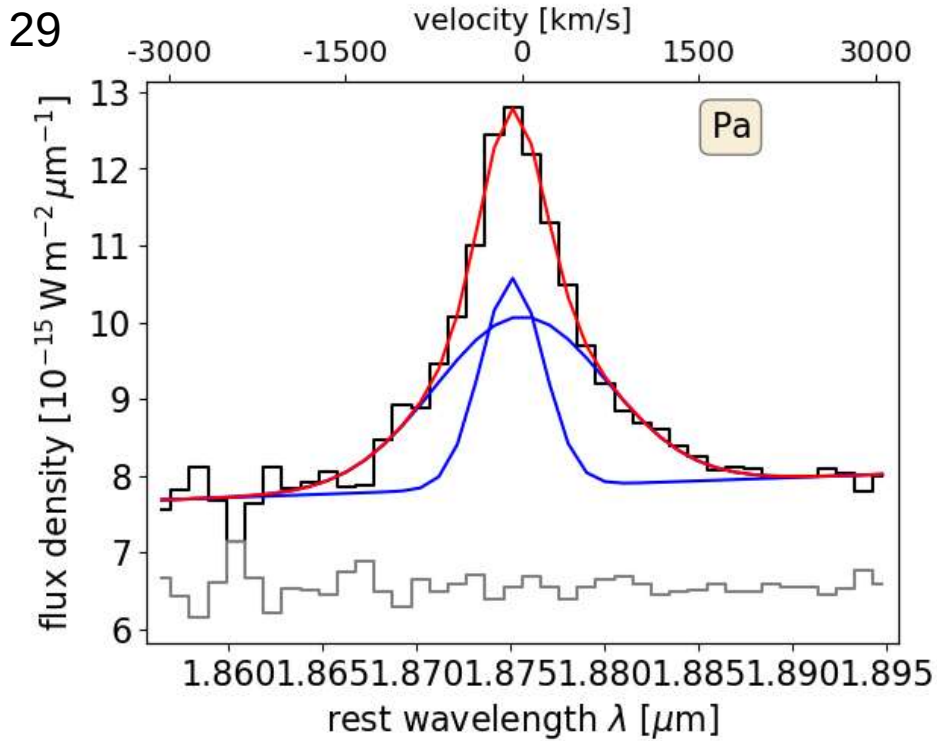
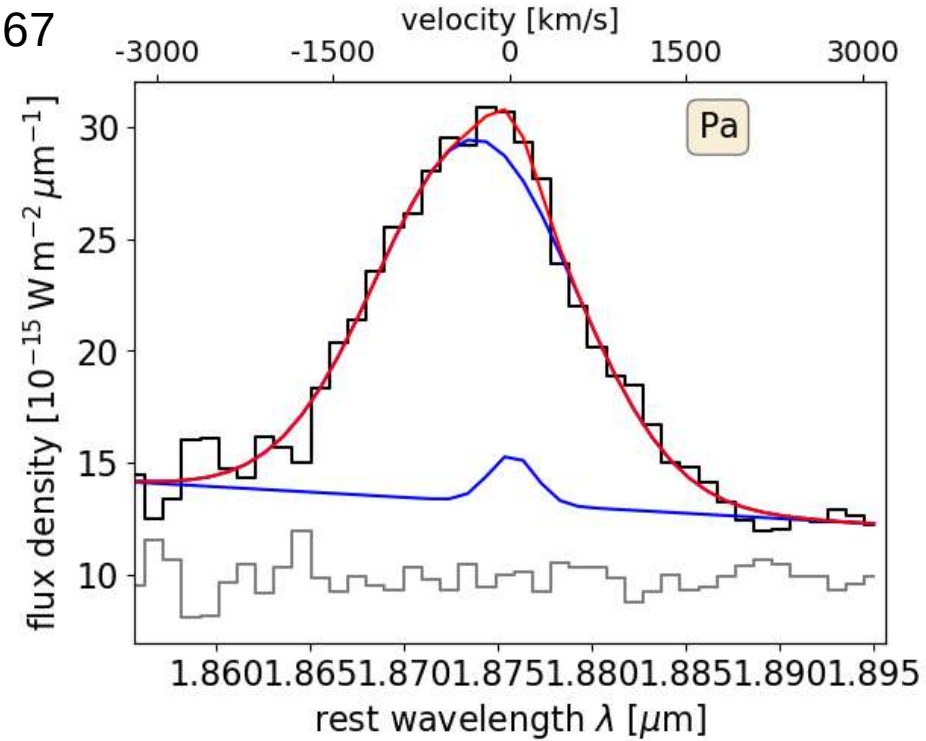


Example Paschenα Line Fits

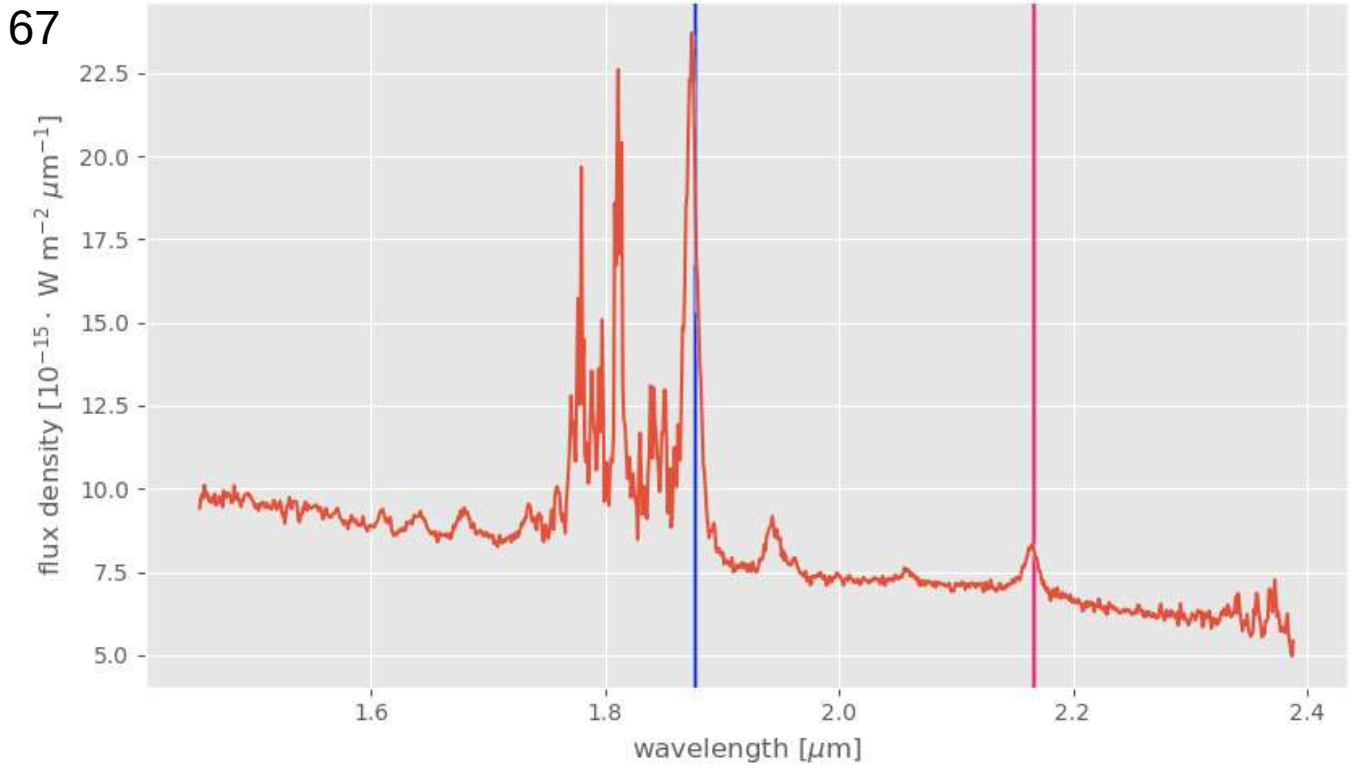




Example Spectra II

Paα

Brγ



M_{BH} – L_{bulge} Relation (Old & New LLQSOs)