The black hole - host galaxy relation for very low mass quasars

J. Sanghvi [1]☆, J.K. Kotilainen [2], R. Falomo [3], R. Decarli [4], K. Karhunen [1] and M. Uslenghi [5]

[1]Tuorla Observatory, **University of Turku**, Väisäläntie 20, 21500, Piikkiö, **Finland**

[2]Finnish Centre for Astronomy with ESO (**FINCA**), Väisäläntie 20, 21500, Piikkiö, **Finland**

[3]**INAF** – Osservatorio Astronomico di Padova, Vicolo Osservatorio 5, I-35122 Padova, **Italy**

[4]**Max-Planck-Institut für Astronomie (MPIA)**, Königstuhl 17, 69117 Heidelberg, **Germany**

[5]**INAF-IASF** – via E. Bassini 15, I-20133 Milano, **Italy**

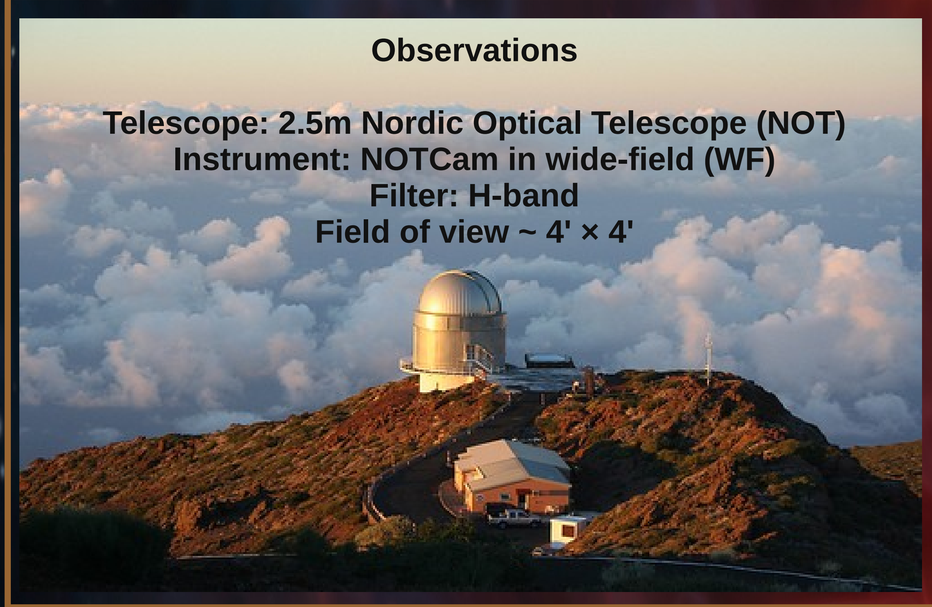
☆**Email me: jimsan@utu.fi**

What did we study ?

We have basically estimated, never before obtained, host galaxy mass ($\mathbf{M_{host}}$) of 37 low-mass quasars with their black hole masses ($\mathbf{M_{BH}}$) ranging from $10^{7}\,M_{\odot}$ to $10^{8.3}\,M_{\odot}$ observed using the NOT telescope at the redshift (***z***) ~ 0.5 -1. After deriving the M_{host} for our sample, we then compiled a large dataset of low and high mass quasars from previous studies of our group, with the QSOs lying at $z < 1$ (including the current sample) and studied the log-linear $M_{BH} - M_{host}$ mass relation with an extended parameter space caused by our sample. This study holds cues for the evolution of low-mass QSOs and their host galaxies at high-redshift. For more on this study, refer **Sanghvi et al. (2014)**.

Observations

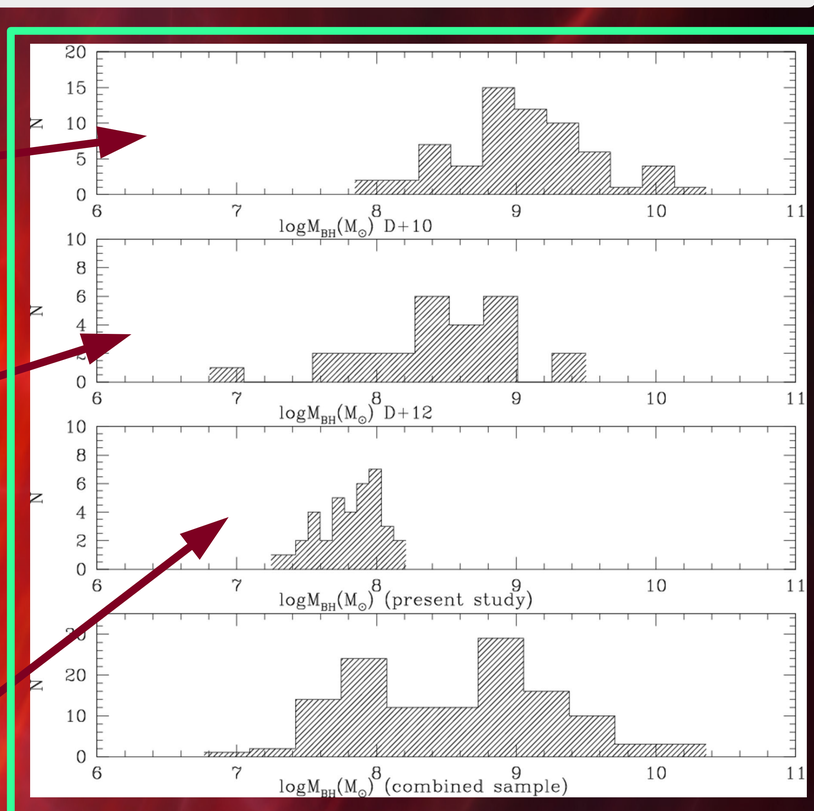
Telescope: 2.5m Nordic Optical Telescope (NOT)
Instrument: NOTCam in wide-field (WF)
Filter: H-band
Field of view ~ 4' × 4'



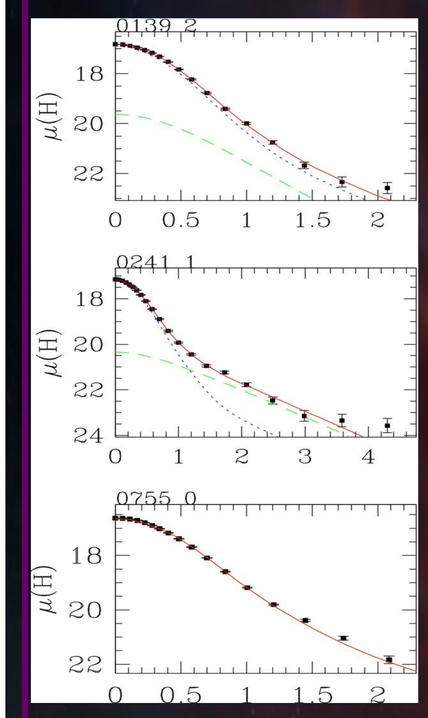
QSOs at *z* < 1 from Decarli et al. (2010a,b).

QSOs at *z* < 0.5 from Decarli et al. (2012).

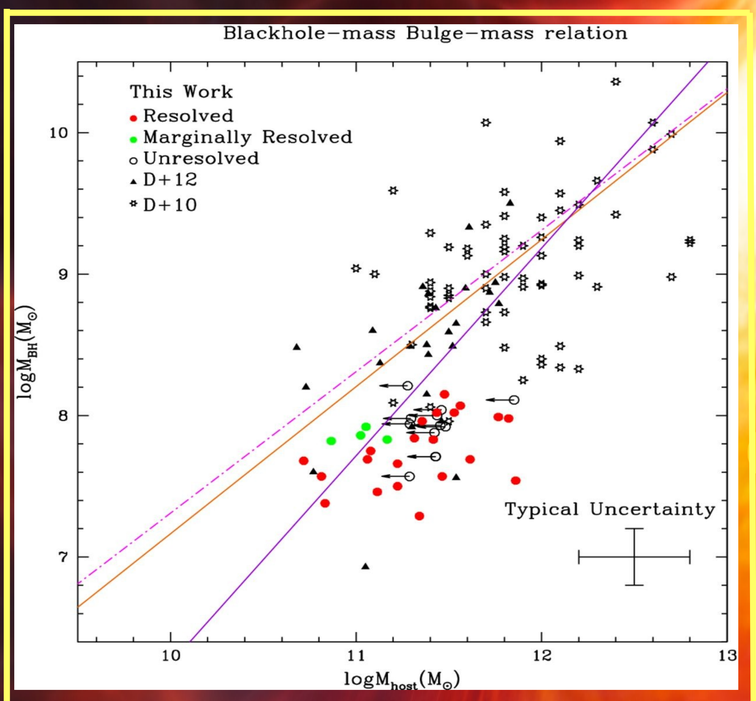
Current study 37 QSOs at *z* ~ 0.5 – 1.0



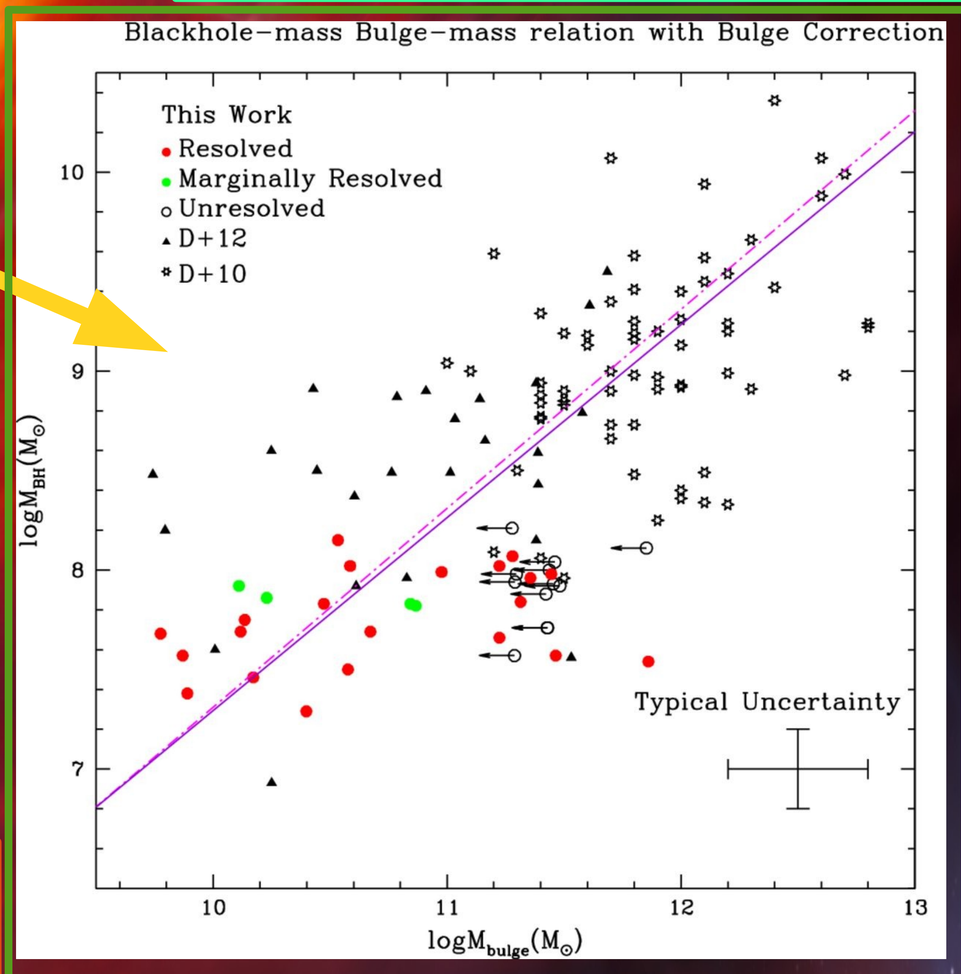
Homogeneous M_{BH} distribution of 89 QSOs from low-mass samples from our study & Decarli et al. (2012) and high-mass QSOs from Decarli et al. (2010a,b).



- The 2D image analysis was performed using an IDL 6.0 based software package called AIDA (Astronomical Image Decomposition and Analysis).
- AIDA fitted the nucleus region which is defined by the scaled PSF while the host galaxy is modeled by the Sérsic law convolved with the PSF.
- After inspection of the deviation of (PSF+galaxy) fit from the pure PSF fit using visual inspection and chi-squared ratio of the fits; each target was either classified as Resolved case, Marginally resolved case or Un-resolved case based on host galaxy detection.



- The best bilinear regression highly deviates from the local relation
- There is an apparent break in the relation at $\log M_{BH} \sim 8.2\,M_{\odot}$ caused due to highly disc dominated host galaxies of low-mass QSOs in our sample and in the sample of Decarli et al. (2012).
- To remove the effect of disc domination in host galaxy mass estimation, we used an analytical approach called Bulge(B)-to-Total(T) luminosity ratio or B/T ratio.
- For disc dominated galaxies ($n_s < 4$), we can estimate their bulge luminosity by- $\frac{B}{T} = \frac{n_s - 0.5}{3.5}$



- This plot is the result of the galaxies with no disc domination by only considering the bulge component.
- The best bilinear regression of the entire sample is **now consistent** with the local relation.

Conclusions

- There is an **apparent break** in the best fit bilinear regression relation at $\log M_{BH} \sim 8.2\,M_{\odot}$ in M_{BH}-M_{host} relation. Hence, it **deviates** from the local relation (i.e. the M_{BH}-M_{host} relation of local inactive galaxies).
- $3/4^{th}$ of our sample of 37 low-mass QSOs at $z \sim 0.5 - 1.0$ possess significant disc components. Hence, after the disc correction is performed, the best fit bilinear regression of the entire sample of 89 QSOs **is consistent** with the local relation.
- The **secular evolution** of galaxy discs can allow the stars and gas within the galaxy to redistribute themselves in response to instabilities. Hence, we promote the secular evolution of disc-dominated galaxies to likely contain **pseudo-bulges**.

To know more about our research and possible collaboration, scan the following QR code:

References

- Decarli R., Falomo R., Treves A., Kotilainen J. K., et al.,2010a, MNRAS, 402, 2441
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