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A low-luminosity type-1 QSO Sample

Overluminous host spheroidals or undermassive black holes?

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Introduction

Luminous quasi-stellar objects (QSO), residing in very massive ellipticals, are believed to originate in violent gravitational interaction of massive spiral galaxies (mergers). For less massive galaxies, the importance of internal (secular) and external (merger) processes of galaxy evolution is discussed. Especially the impact of the active galactic nucleus (AGN) is unknown.

We observed low-z low-luminosity (just below the classical Seyfert/QSO demarcation) type-1 QSOs. They are more luminous than other nearby AGN but still close enough that structures of the host galaxy can be resolved. We hope for insight into structural, dynamical and energetic properties to ultimately gain a look onto the origin of bulge-black hole correlation and feedback-mechanisms.

The sample

Our sample is a representative subsample of the Hamburg/ESO survey (Wisotzki et al. 2000) that is a wide angle survey for optically bright QSOs. The flux limit is $B_j \lesssim 17.3$, resulting in luminosities just below the classical Seyfert/QSO demarcation.

The sample contains only the nearest QSOs (redshift $z \lesssim 0.06$). These selection criteria result in 99 nearby type-1 low-luminosity QSOs (LLQSOs).

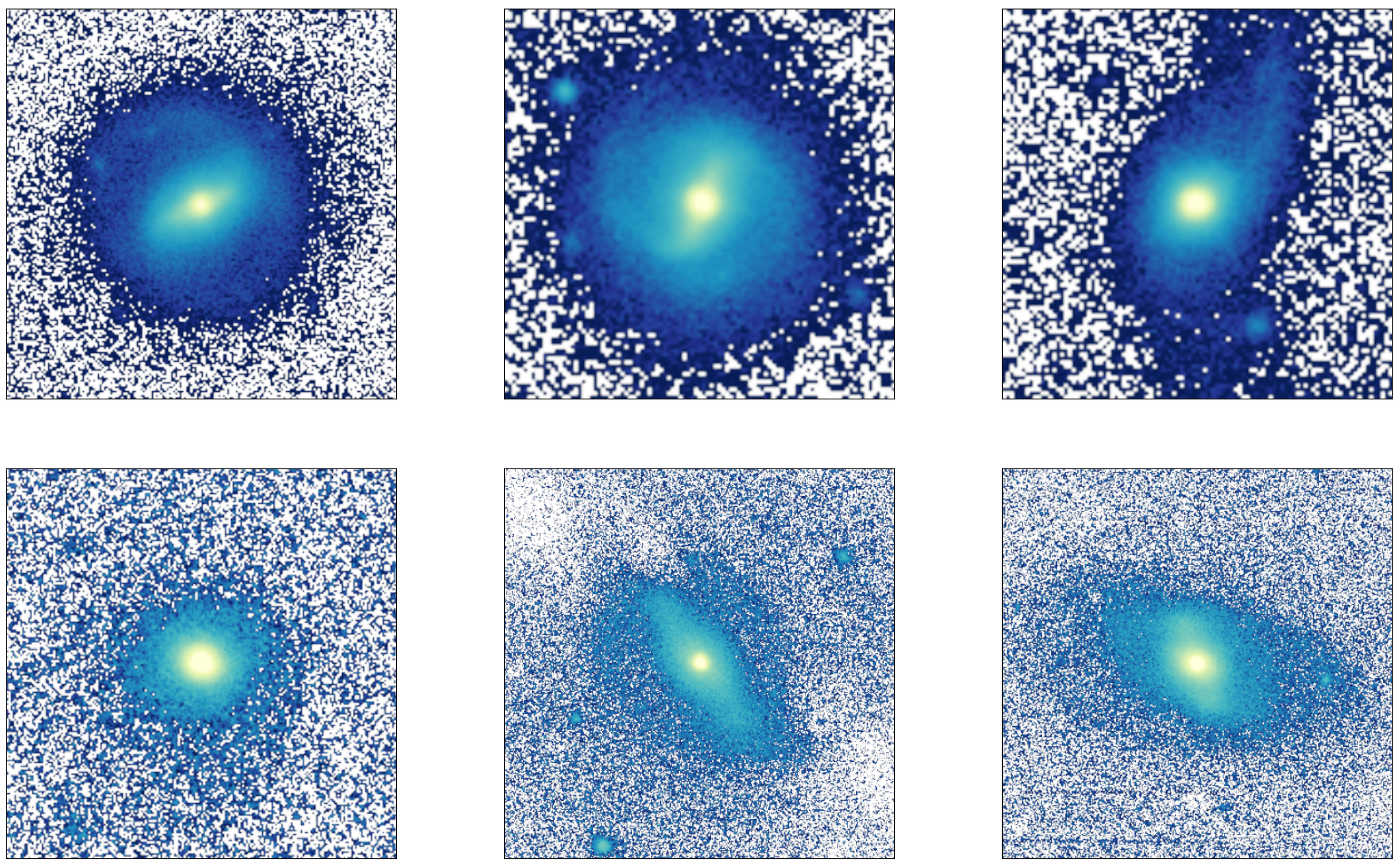

Fig. 1. *We obtained high-quality near-infrared images of 20 nearby active galaxies in J, H and K band (shown is K band). The galaxies in the upper panels have been observed with Sofl (NTT). The galaxies in the lower panels and in Fig. 2 have been observed with LUCI (LBT).*
The images are suitable for detailed study of colors and structural parameters (Busch et al., 2013).

2d-decomposition with BUDDA

We performed two dimensional decomposition of the surface brightnesses of the 20 galaxies. We used the BUlge Disk Decomposition Analysis (BUDDA) Code by Gadotti (2008) to separate disk, bulge, bar, and nuclear component (AGN), obtain the fractions of the single components and hope to reveal otherwise hidden substructures.

BUDDA fits the disk with an exponential law. Bulge and bar are fitted with a Sérsic-function using a Sérsic-index around 4 (bulge) or around 0.7 (bar). The AGN was modelled by an unresolved point source, convolved with a Moffat distribution, describing the PSF. Fig. 2 shows an example.

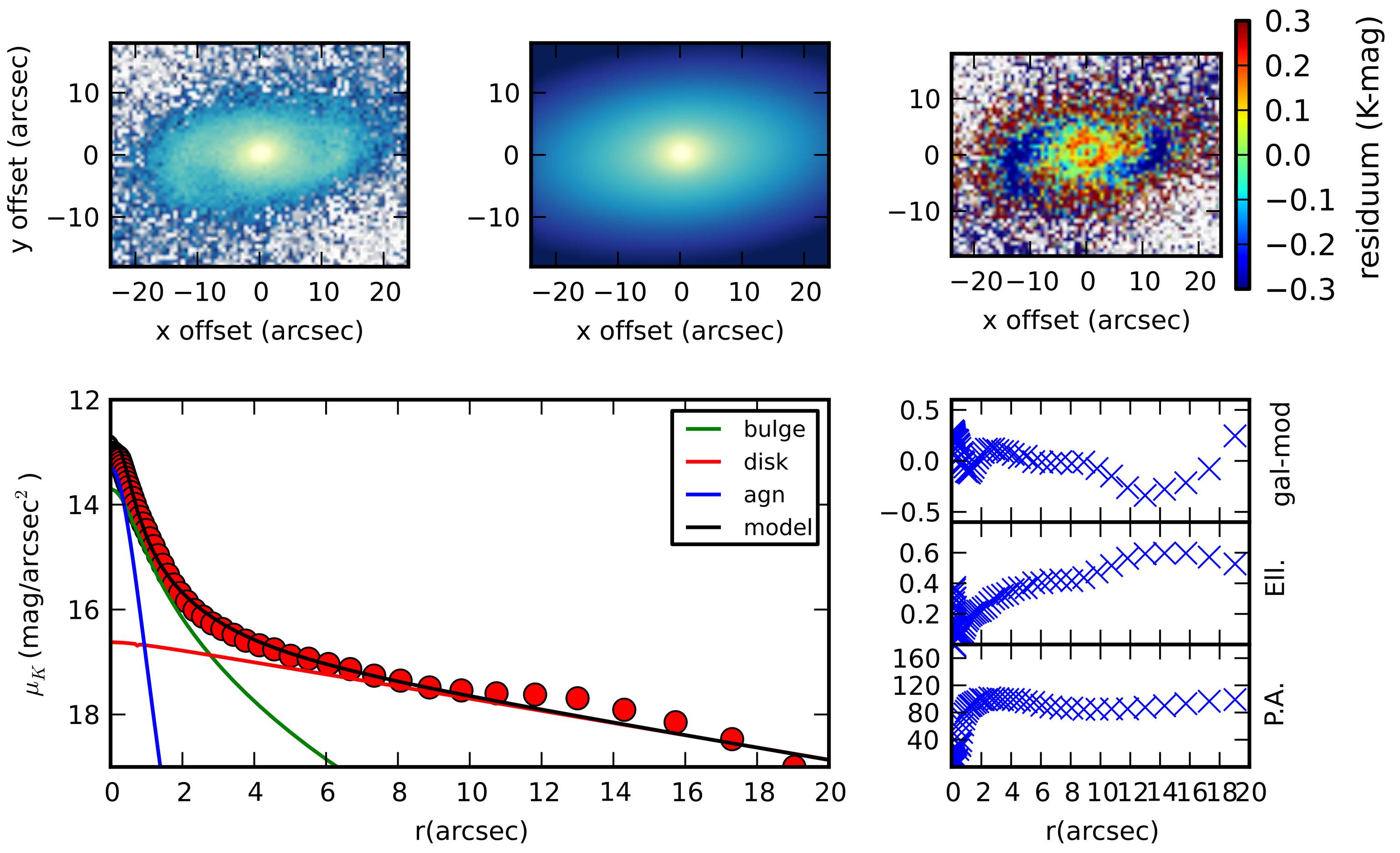

Fig. 2. *Results of the 2d decomposition in the K band for HE 1248-1348.*
Top: Galaxy, model and residual image. Blue regions are those where the original is brighter than the model, in red regions, the model is brighter than the original.
Bottom: radial profile of galaxy (circles) and of the fit components; lower right panels: residual plot, a plot of ellipticity and position angle.

The M_{BH}-L_{bulge} relation

Tight correlations between central supermassive black holes (SMBH) and properties of the host galaxy's central spheroid have been found (M_{BH}-σ, M_{BH}-L_{bulge}, M_{BH}-M_{bulge}) and are often interpreted as an indication for a coevolution scenario.

We investigate the M_{BH}-L_{bulge} relation in the near-infrared.

NIR bulge magnitudes are the result of the 2d decomposition with BUDDA. BH masses for eleven objects have been measured by Schulze et al. (2009) from single epoch visible spectra.

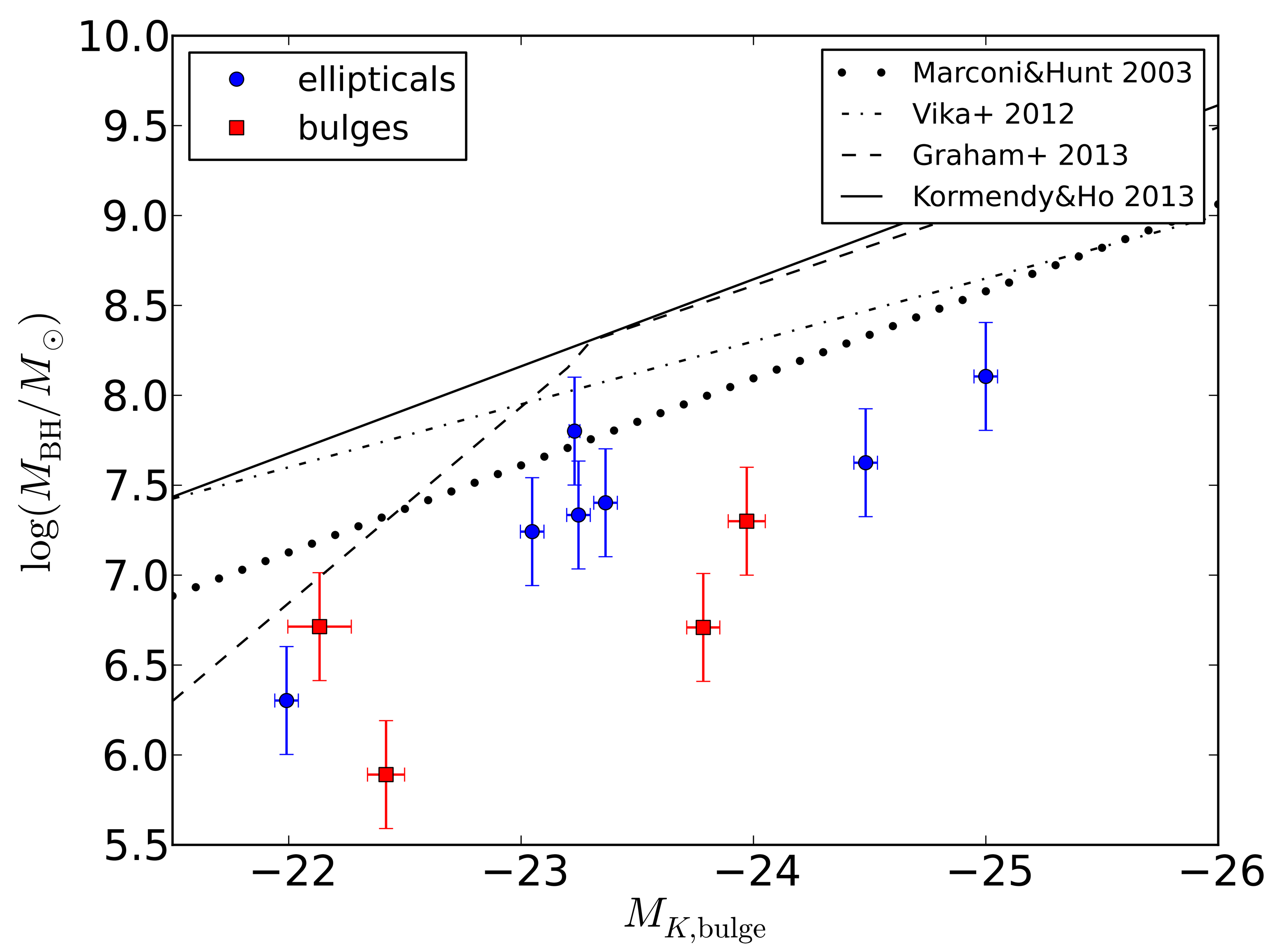

Fig. 3. *Black hole mass vs. K-band absolute magnitude.*
Our data points plotted together with M_{BH}-L_{bulge} relations for inactive galaxies from the literature: The observed low-luminosity QSOs do not follow these relations.

We compare our data with published M_{BH}-L_{bulge} relations and find that **the observed low-luminosity QSOs deviate from the relations for inactive classical bulges and ellipticals**. This could be explained by:

(a) the black holes being less massive *-or-*

(b) the bulges being more luminous than suggested by these relations.

The overluminosity of bulges could be explained by the existence of young stellar populations. Model calculations show that the mass-to-light ratio in the near-infrared is a good estimator of the age of the stellar population since it increases monotonically with time.

If one assumes that the deviation is caused only by younger populations, several galaxies would be totally dominated by 0.1 Gyr populations, in contrast to the traditonal view of bulge composition.

Another possibility would be that the central black holes are undermassive. This might indicate that the growth of the host precedes that of the black hole.

References

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Acknowledgements. Part of this work was supported by the German Deutsche Forschungsgemeinschaft, DFG project numbers SFB 494 and SFB 956, by DAAD 50753527 and BMBF 05A08PKA. GB is supported by the *Bonn-Cologne Graduate School of Physics and Astronomy* and the *Konrad-Adenauer-Stiftung.*

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