No Evolution in the $M_{BH}-M_{*,total}$ Relation Over the Last 9 Gyrs

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Keywords. galaxies: active, quasars: general, galaxies: evolution

We investigate 10 QSO host galaxies at $1 < z < 2$ in the COSMOS field (Scoville *et al.* 2007), observed with the *HST* in both ACS/WFC *I*-band and NICMOS/NIC3 *H*-band. We find that our galaxies with mean $z = 1.4$ follow the local $M_{BH}-M_{bulge}$ relation exactly – however, not with an explicit bulge mass, but with their *total* stellar mass.
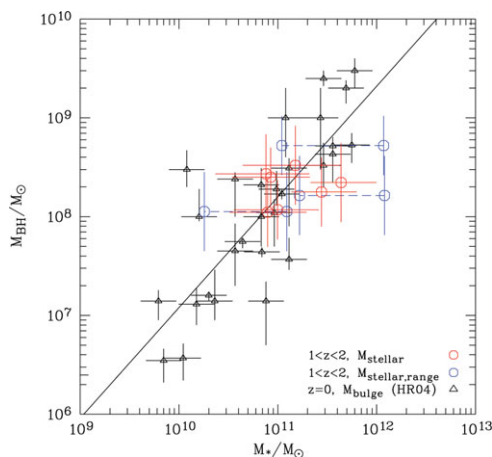

Figure 1. Black hole (BH) vs. stellar mass. Shown are the BH to bulge mass relation at $z \sim 0$ of Häring & Rix (2004) as small triangles and the regression line, and our total stellar masses at $z \sim 1.4$. Points with ranges bracket the masses for the three host galaxies unresolved in *I*-band. Stellar masses are computed using M/L from the general COSMOS stellar mass catalog (Ilbert *et al.* 2009) given the nucleus-removed host galaxy colors. Black hole masses were derived by Trump *et al.* (2009) and Merloni *et al.* (2009) using a virial approach.

This allows for two interpretations: (1) If the galaxies are bulge-dominated, then the $M_{BH}-M_{bulge}$ relation has not changed over the last 9 Gyrs, for galaxies of $\log M_*/M_\odot = 11.3$ or $\log M_{BH}/M_\odot = 8.2$. (2) Since we have indications that the galaxies contain substantial disk components the interpretation is different. Since the objects have to evolve towards the local $M_{BH}-M_{bulge}$ relation (with their bulge mass), but follow this relation at $z = 1.4$ with their total stellar mass, all mass-buildup of the bulge has to be fed from converting disk to bulge stars, induced by mergers or disk instabilities, and not by star formation. Black hole and bulge formation are disjoint and AGN feedback is likely neither a required nor possible ingredient to create the local $M_{BH}-M_{bulge}$ relation at these masses. Full results are published by Jahnke *et al.* (2009).

References

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