*Co-Evolution of Central Black Holes and Galaxies*
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# Probing the Evolution of Black Hole Mass Through Cosmic Time

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Our research addresses the observed evolution of $M_{\rm BH}$ and $L/L_{\rm Edd}$ of type 1 radio-quiet AGNs. Measurements of $M_{\rm BH}$ and $L/L_{\rm Edd}$ in a sample of sources at $z < 0.75$ using the "H$\beta$ method" (Netzer & Trakkhtenbrot 2007) as well as new measurements of these properties at $0.75 < z < 2$ using the "Mg II $\lambda$2798 method") show significant evolution of $L/L_{\rm Edd}$ for any value of $M_{\rm BH}$ up to $z = 2$ (see Figure 1). In a dedicated near-IR project we obtained the most reliable sample of $M_{\rm BH}$ and $L/L_{\rm Edd}$ estimates for $z \sim 2.3$ and $z \sim 3.4$ AGN (Netzer *et al.* 2007; Shemmer *et al.* 2004); the distribution of $L/L_{\rm Edd}$ is very broad (Figure 1) and $\sim$1/2 of the sources have $L/L_{\rm Edd} < 0.2$, implying $t_{\rm growth} > t_{\rm universe}$ and hence an earlier epoch of fast growth. Our on-going Gemini–VLT campaign focuses on $z \sim 4.8$ sources, with the Mg II line observed in the $H$-band (Figure 2). The analysis of $\sim$1/3 of the spectra uncovers, again, a broad distribution of $L/L_{\rm Edd}$ , with several sources having $L/L_{\rm Edd} \gg 1$, suggesting an early episode of fast BH growth.

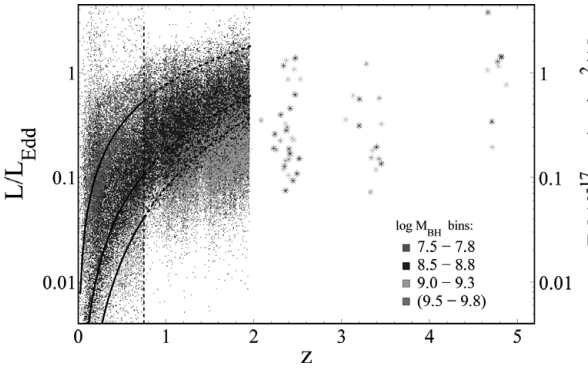


**Figure 1.** The obsevred evolution of $L/L_{\rm Edd}$ with redshift from our combined sample of $z \lesssim 4.8$ AGNs.

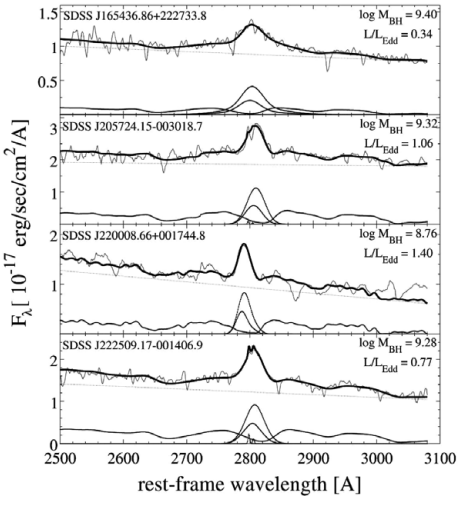


**Figure 2.** Sample Gemini/NIRI spectra from our $z \sim 4.8$ project.

## References

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