Measurements of local supermassive black holes (SMBHs) and their host galaxies relations between their properties, e.g. the *M*BH--*M*∗,bulge relationship. These relations indicate a coevolution of SMBHs and their host galaxies, and how they coevolve through time can answer questions about galaxy formation and SMBH feedback. However, current methods for determining black hole and stellar masses at higher redshifts can have large uncertainties, leading to discrepancies in the *M*BH--*M*∗,bulge relationship. We propose an HST imaging survey of ten quasars with previous reverberation mapping measurements, along with their host galaxies to test a new method of measuring stellar and bulge masses. We will perform image decomposition to determine the colors of host galaxies, which will then be used to measure the host masses. HST is the only telescope with fine enough resolution to image these high redshift quasars. If this method for determining stellar and bulge masses is successful, we will gain a better understanding of the *M*BH--*M*∗,bulge  relation at high redshift, leading to a more developed view of host-galaxy and SMBH coevolution through time.

(see next page for original)

Original Abstract:

**The Sloan Digital Sky Survey Reverberation Mapping Project: The MBH-Host Relations at 0.2 ≲ z ≲ 0.6 from Reverberation Mapping and Hubble Space Telescope Imaging**

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**Abstract**

We present the results of a pilot Hubble Space Telescope (HST) imaging study of the host galaxies of ten quasars from the Sloan Digital Sky Survey Reverberation Mapping (SDSS-RM) project. Probing more than an order of magnitude in black hole (BH) and stellar masses, our sample is the first statistical sample to study the BH-host correlations beyond z > 0.3 with reliable BH masses from reverberation mapping rather than from single-epoch spectroscopy. We perform image decomposition in two HST bands (UVIS-F606W and IR-F110W) to measure host colors and estimate stellar masses using empirical relations between broadband colors and the mass-to-light ratio. The stellar masses of our targets are mostly dominated by a bulge component. The BH masses and stellar masses of our sample broadly follow the same correlations found for local RM active galactic nuclei and quiescent bulge-dominant galaxies, with no strong evidence of evolution in the *M*BH--*M*∗,bulge relation to z ∼ 0.6. We further compare the host light fraction from HST imaging decomposition to that estimated from spectral decomposition. We find a good correlation between the host fractions derived with both methods. However, the host fraction derived from spectral decomposition is systematically smaller than that from imaging decomposition by ∼30%, indicating different systematics in both approaches. This study paves the way for upcoming more ambitious host galaxy studies of quasars with direct RM-based BH masses at high redshift.

<https://ui.adsabs.harvard.edu/abs/2021ApJ...906..103L/abstract>