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Stellar Populations in the Most Luminous Obscured Quasars at $z > 0.5$

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There is evidence that the growth of stellar populations and supermassive black holes (SMBHs) are coupled across cosmic time: the redshift evolution of star formation rate and quasar number density are similar; SMBH masses in local inactive galaxies are correlated with the velocity dispersion of their stellar bulges. Models predict that SMBHs predominantly grow in brief quasar phases accompanied by starbursts, but on-going starbursts in luminous quasars have been difficult to quantify. There have been extensive photometric studies of quasar host galaxies. However, spectroscopic studies that provide crucial information on stellar populations such as age and velocity dispersion are scarce, especially at the highest luminosities, where the stars are vastly outshone by the quasar.

To study stellar populations in luminous quasars, we target obscured (type 2) quasars. The circum-nuclear obscuring material works as a natural coronagraph, allowing us to study the host galaxies in a luminosity regime virtually inaccessible for unobscured quasars. Our targets were selected to have high intrinsic luminosities ($M_V < -26$ mag), and they are likely to be accreting at close to Eddington rates. Our goal is to search for direct evidence for ongoing or recent starburst that may accompany peak quasar activity.

In our pilot study of nine SDSS luminous obscured quasars (Liu *et al.* 2009), we found a substantial contribution from very young stellar populations (< 0.1 Gyr) in all cases. Furthermore, we detected Wolf-Rayet emission in three objects, indicating the presence of an extremely young post-starburst phase (~ 5 Myr; e.g., Brinchmann *et al.* 2008). Population synthesis modeling of the stellar continuum lends further support to the young stellar ages. The scattered light component was carefully constrained using broad Hβ, if any. The inferred fraction of infant stellar populations in luminous quasars directly tested the link between on-going starburst and luminous quasar activity.

To get more statistically significant results, we conducted deep Gemini/GMOS spectroscopy of an additional 21 luminous obscured quasars. With improved sensitivity and an enlarged sample, we have (i) confirmed the high frequency of infant starbursts from Wolf-Rayet emission features and population synthesis modeling of the stellar continuum, (ii) quantified old stellar populations from stellar absorption features; (iii) measured stellar velocity dispersions and estimated BH masses, and (iv) found a significant contribution from scattered quasar light to the observed continuum. With a sample size of 30, we correlated the quasar and galaxy properties to probe the physical link and mutual influences between starburst and quasar activity, as an important test of our understanding of the nature and evolution of the coupled growth of bulge stellar populations and SMBHs.

References

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