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Probing quasar host galaxies with spectrophotometric decomposition

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The co-evolution of AGN/SMBHs and their host galaxies is one of the main topics in the field of galaxy evolution. The key is to understand the relation between the masses of SMBHs and the properties of their hosts. For quasars where AGN are in the most active phase, their brightness prevents us from directly probing their host galaxies in the optical. Previous studies usually rely on two independent methods to estimate the host galaxy components, including imaging decomposition and spectral decomposition. Results from two different methods were often inconsistent, and information drawn from individual methods was limited. To better understand quasar host galaxies and their relation with SMBHs, we propose to apply our recently developed spectral fitting code to the Subaru Hyper Suprime-Cam (HSC) imaging data and DESI spectral data. Our code performs both imaging and spectral decomposition and takes advantage of both methods that allow a robust decomposition of the AGN and galaxy components. In our method, we first do imaging/morphological decomposition in five HSC broad bands and set constraints on the flux ratios of host galaxy to AGN in different bands. With these flux ratios, we perform a global spectral fitting of the DESI quasar spectrum and derive host galaxy parameters. This method can help us break the degeneracy of the quasar and host galaxy components in the spectral fitting and better determine the host galaxy properties of DESI quasars. We mainly use Bagpipes for the spectro-photometric joint modeling of the host galaxy component in our fitting. Our current sample of quasars selected from the DESI DR1 (Iron) is confined to those showing extended morphologies in the HSC images, whose sample size is around 2000. We will extend this spectral decomposition work to future DESI quasar spectra, especially the discovered Changing-look AGNs in DESI quasars. This study illustrates the importance of host galaxy spectral components in quasar spectra and will expand the current knowledge of quasar host galaxies with the wealth of DESI quasar spectra.

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