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Hosts and triggers of AGNs in the Local Universe

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Based on the spectroscopic and shear catalogs for SDSS galaxies in the local Universe, we compare optically-selected active galactic nuclei (AGNs) with control star-forming and quiescent galaxies on galactic, inter-halo and larger scales. We find that AGNs are preferentially found in two specific stages of galaxy evolution: starburst and 'green valley' phases, and that the stellar population of their host galaxies is quite independent of stellar mass, different from normal galaxies. Combining galaxy-galaxy lensing and galaxy clustering on large scales, we measure the mass of AGN host halos. The typical halo mass is about $10^{12}h^{-1}\mathrm{M}_{\odot}$, similar to the characteristic mass in the stellar mass-halo mass relation (SHMR). For given stellar mass, AGN host galaxies and star-forming galaxies share the same SHMR, while quiescent galaxies have more massive halos. Clustering analysis on halo scales reveals that AGNs are surrounded by a larger number of satellites (with stellar mass down to 1/1000 of the mass of the central galaxy) than star-forming galaxies, and that galaxies with larger stellar velocity dispersion have more satellites. The number of satellites also increase with halo mass, reaching unity around $10^{12}h^{-1}\mathrm{M}_{\odot}$. Our results suggest a scenario, in which the interaction of the central galaxy with the satellites triggers an early episode of star burst and AGN activities, followed by multiple AGN cycles driven by the non-axisymmetric structure produced by the interaction. The feedback from the starburst and AGN reduces the amount of cold gas for fueling the central black hole, producing a characteristic halo mass scale, $\sim 10^{12}h^{-1}\mathrm{M}_{\odot}$, where the AGN fraction peaks.

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