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Properties and Morphology of Dual AGN in the ASTRID Simulation at $z=2$

We examine the host galaxy morphologies for a sample of a few thousand dual AGN (both active supermassive black holes) with separation distances of 0.5 kpc to 30 kpc using the large volume, high resolution cosmological hydrodynamical simulation Astrid at $z=2$. We employed a kinematic decomposition method to examine the morphologies of galaxies in our simulation by segregating star particles into disc or spheroidal components. Galaxies hosting AGN pairs typically have stellar masses $\sim 10^{11} M_{\odot}$ and star formation rates $\sim 10 M_{\odot}/\text{yr}$ star formation rates, which are approximately 100 and 10 times higher, respectively, than the mean values of the overall galaxy population. The distribution of host galaxy morphologies for AGN pairs is consistent with that of the overall population. Dual AGNs reside in bulge-dominated galaxies ($\sim 60\%$), and in disk-dominated galaxies ($\sim 20\%$), while the remaining ($\sim 20\%$) pairs are in galaxies with different morphologies. Compared to all dual AGN, black holes hosted in disk-dominated galaxies have relatively smaller values of both star formation rate and stellar mass, with mean values of $\sim 10 M_{\odot}/\text{yr}$ and $\sim 10^{10} M_{\odot}$, respectively. Moreover, these pairs have black holes with similar masses and luminosities.

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