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LOCAL ENVIRONMENTAL EFFECTS ON AGN ACTIVITIES

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ABSTRACT

We performed statistical analysis for a nearby ($0.01 < z < 0.05$) volume limited ($M_r < -19$) sample of galaxies via visual inspection and the definition of galaxy pair systems based on the Sloan Digital Sky Survey Data Release 7 in order to confirm the effects of galaxy interaction on AGN activities. We found that local environmental effects such as galaxy interaction have an influence on the enhancement of the frequency and the strength of the AGN activity. This article is the summary of the paper which will be submitted soon.

Key words: galaxies: active - galaxies: interactions

1. INTRODUCTION

Active Galactic Nucleus (AGN) are one of the most powerful objects in the universe. These days, it is generally accepted that AGNs are powered by the accretion of materials onto a supermassive black hole (SMBH; Lynden-Bell et al., 1969), which is located in the center of the galaxy. Over the last few decades, there have been many studies of the physical mechanisms powering the AGN. Several mechanisms, including stellar winds, disk instabilities and galaxy-galaxy interactions, have been proposed to explain this phenomenon, but the primary mechanism that turns a quiescent SMBH into an AGN is still unclear.

Of these mechanisms, galaxy mergers provide an appealing mechanism for triggering galactic nuclear activities, as modern cosmology predicts that there are frequent interactions between a galaxy and its environment during its evolution. Many statistical studies have been undertaken with large samples, to investigate the link between AGN host galaxies and their environments. Some found some hints for the positive effects of environments on AGN activity (Miller et al., 2003; Kauffmann et al., 2004; Serber et al., 2006; Alonso et al., 2007; Koss et al., 2010; Schawinski et al., 2010; Ellison et al., 2011; Silverman et al., 2011; Liu et al., 2012), but others found no significant evidence (Schmitt, 2001; Grogin et al., 2005; Coldwell & Lambas, 2006; Gabor et al., 2009; Sabater et al., 2012). Several factors including AGN diagnostics, data sets, and particularly the definition of the merger criteria, may contribute to these controversial results. In this study, we tried to statistically find the link between the local environment surrounding galaxies and galactic activity, using homogeneous samples.

2. DATA & METHODOLGY

Using the nearby($0.01< z <0.05$) volume-limited($M_r <$-19) ∼50,000 galaxy samples of DR7 (Abazajian et al., 2009) from the Sloan Digital Sky Survey (York et al., 2000), we identified galaxies undergoing small scale environmental effects with two distinct approaches. We performed a visual inspection to find peculiar morphologies such as galaxy mergers and tidal features, and classified these peculiar objects as galaxies undergoing local environmental effects. Similarly, we defined pair systems with criteria ($r_p <$115kpc, $\Delta V <$200km/s), which might include interacting systems. We statistically investigated the differences in the strength and incidence of AGN galaxies between peculiar/pair systems and non-peculiar/isolated objects. We used BPT diagram (Baldwin et al. 1981) to define AGN objects.

3. SUMMARY

- Peculiar galaxies have higher AGN frequencies than normal galaxies, and a similar trend is shown for the pair-isolated cases.
- Peculiar galaxies show stronger AGN activity than normal galaxies, and the peculiar AGN fraction dramatically increases to ∼50% for high-luminosity (L[OIII]>8) AGN hosts.
- For paired galaxies, the AGN fraction is more enhanced when they have less massive and/or bluer (more gas rich) companions.

We statistically found that the local environment affects AGN activity. The fact that the majority of merging galaxies are non-AGN galaxies can be caused by the difference between merging timescales, gas infalling timescales and AGN life times, so these timescales should be considered for detailed analysis.

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