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THE CLOSE ENVIRONMENT OF AGN

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We have studied the circumgalactic environment of Bright IRAS Galaxies (BIRGs), LINERs, and Seyfert galaxies. The aim of our work was to compare the environment of different types of AGN. We have found that type 2 AGN (LINER 2 and Seyfert 2) shows large companions with a frequency similar to that of BIRGs. This is not the case for type 1 AGN. We suggest that an evolutionary sequence from starbursting systems, to type-2 and eventually to type-1 AGN, may be appropriate for most AGN and may be independent on luminosity.

Our Seyfert sample consists of 72 objects of type 1 and 60 of type 2. The Bright IRAS sample consists of 87 objects, with luminosity between $10^{10}L_{\odot} \leq L_{fir} \leq 10^{12}L_{\odot}$. Finally, the LINER sample consists of 193 objects. This sample has been split in three groups. The first one consists of 103 objects and contains only type-2 LINERs (hereafter L2). The second group includes 63 transition LINERs which may represent a combination of HII and LINER characteristics (hereafter TL). The third group includes 27 LINERs with broad Hα emission (hereafter L1, the so-called LINER 1s).

We have searched for companions within 3 galactic diameters and within 300 kpc of projected linear distance. We have corrected our results for contamination by optical companions (i.e. not physically associated) using Poisson statistics. The results for the search of companion galaxies of diameters $D_C \geq 10$ kpc within a search radius up to 140 kpc are presented in Figure 1. Detailed results and methodology can be found in Dultzin-Hacyan et al. (1999), and in Krongold et al. (2002a,b). Our results show that type 2 AGN (Sy2 and L2) show an excess of companions when compared to non-active galaxies, and similar environments to Starbursts and mixed AGN-Starburst galaxies (TL and BIRGs). On the other hand type 1 AGN show companions with the frequency of non-active galaxies.

If interactions play a role in triggering nuclear activity, an important consideration is that type 1 AGN may require a long timescale to emerge. The time needed for a type-1 AGN could be longer than the escape time of an unbound companion from the very close environment, or comparable to the timescale needed for an evolved merger ($\sim 10^9$ yr). This can explain why BIRGs and type-2 AGN are found more often with closer companions. Our results support the evolutionary scheme proposed in Krongold et al. (2002a,b) and in Dultzin-Hacyan et al. (this volume).

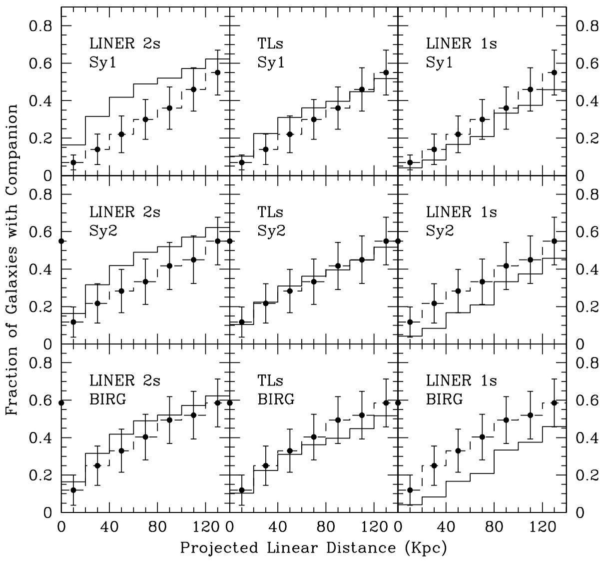

Fig. 1. The distributions of the nearest observed companion with diameter $D_c \geq 10$ kpc, binned over 20 kpc, up to a projected linear distance of 140 kpc, for Sy1, Sy2, BIRG, and LINER 2, TL and LINER 1 galaxies. Upper panel: LINERs vs. Sy1 galaxies. Middle panel: LINERs vs. Sy2s. Lower panel: LINERs vs. BIRG galaxies. In all cases, solid lines correspond to the LINER sample, while dashed lines refer to Sy1 in the upper panel, Sy2 in the middle, and to BIRG in the lower panel. The error bars are at a 2σ confidence level.

REFERENCES

Krongold, Y., Dultzin-Hacyan, D., de Diego, J.A. & Marziani, P., 2002b, submitted to ApJ.

Krongold, Y., Dultzin-Hacyan, D., & Marziani, P. 2002a, ApJ, 572, 169.

Dultzin-Hacyan, D., Krongold, Y., Fuentes-Guridi, I. and Marziani, P. 1999, ApJ, 513, L111.

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