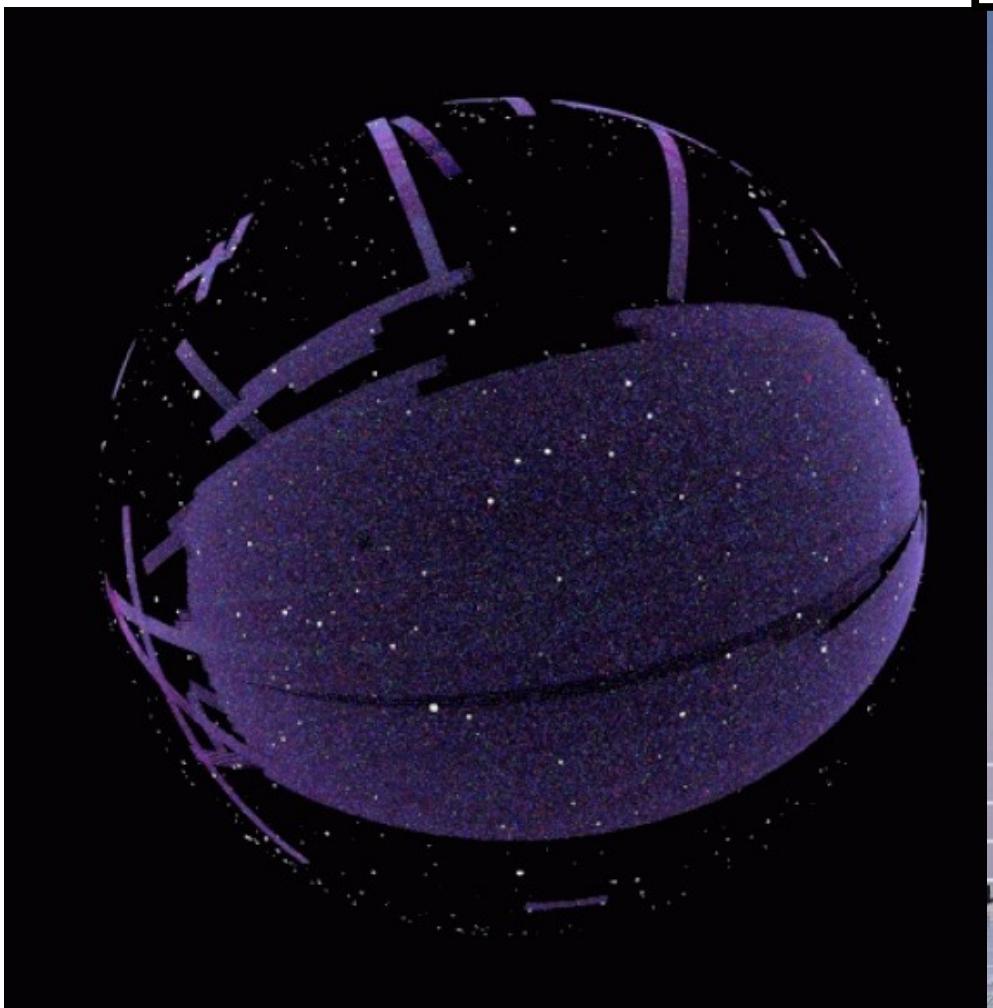
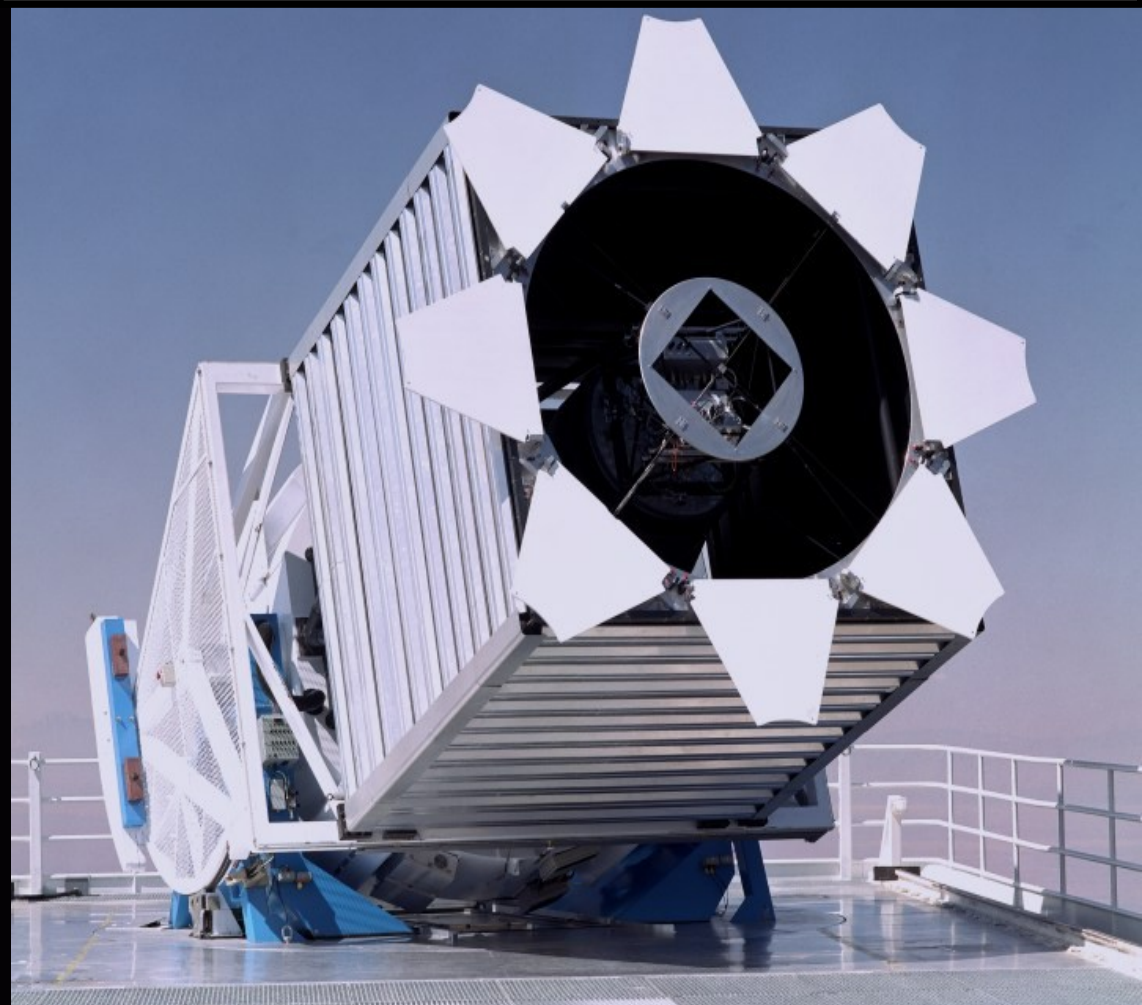
Sloan Digital Sky Survey

The role of tidal interactions in triggering AGN and star formation: view from the SDSS





COLLABORATORS:

Cheng Li (SHAO/MPA)

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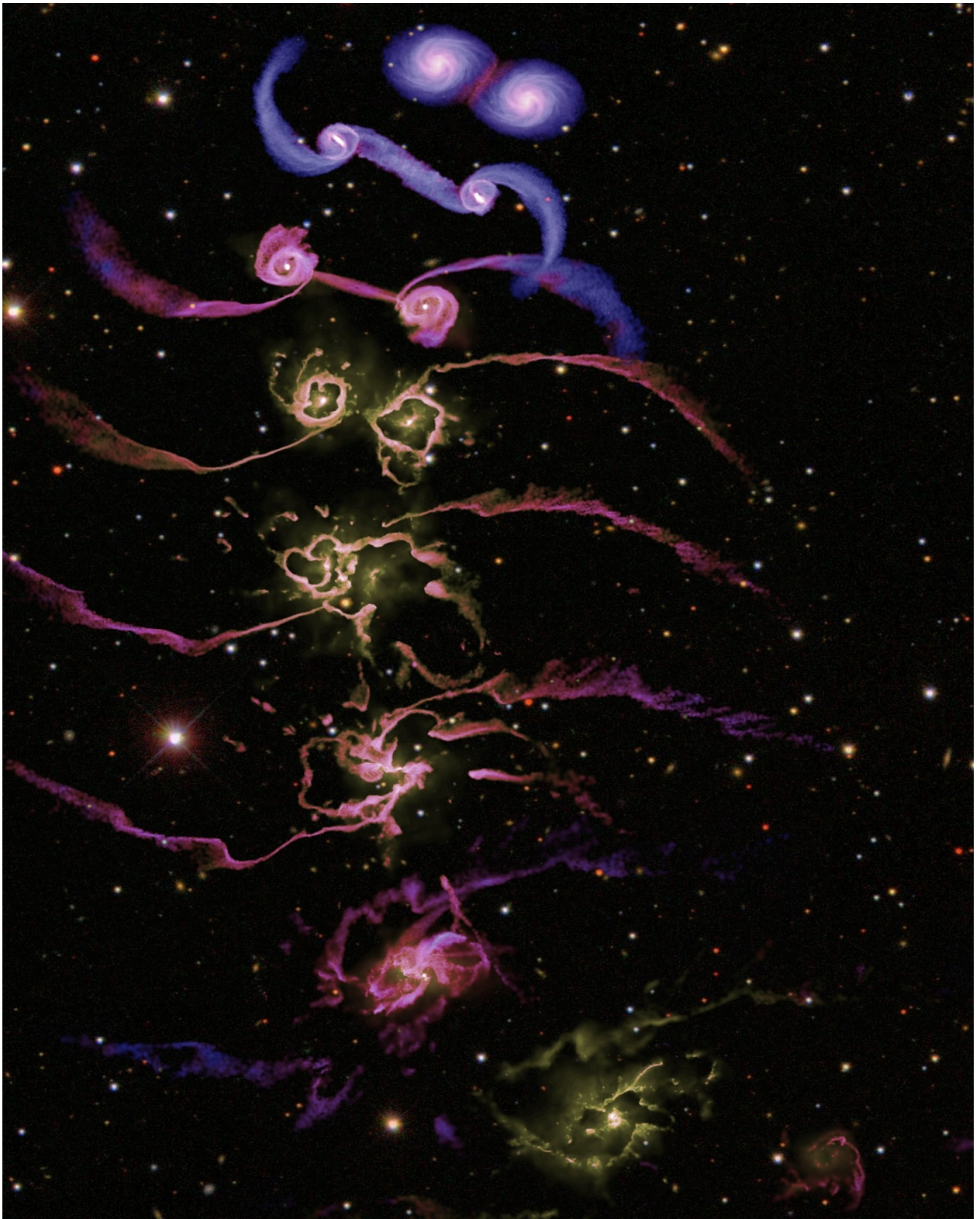
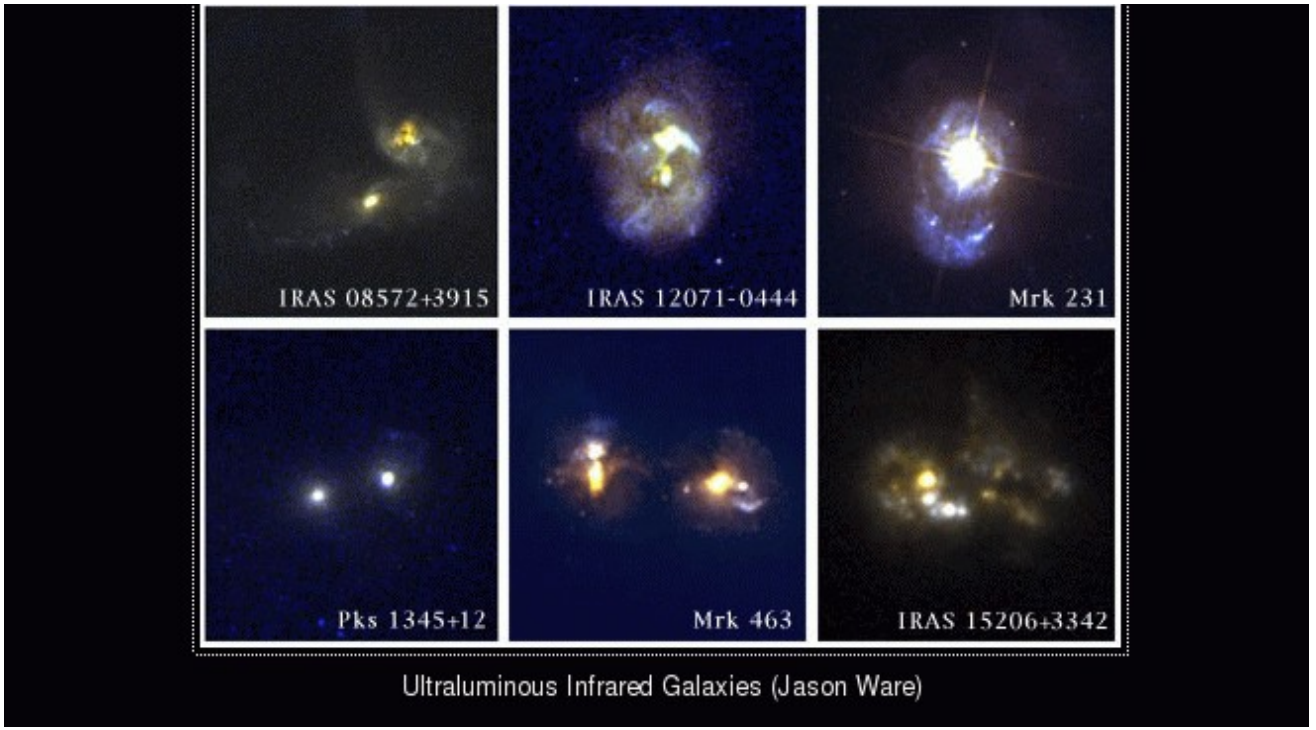
Wang Lan (Peking University/MPA)

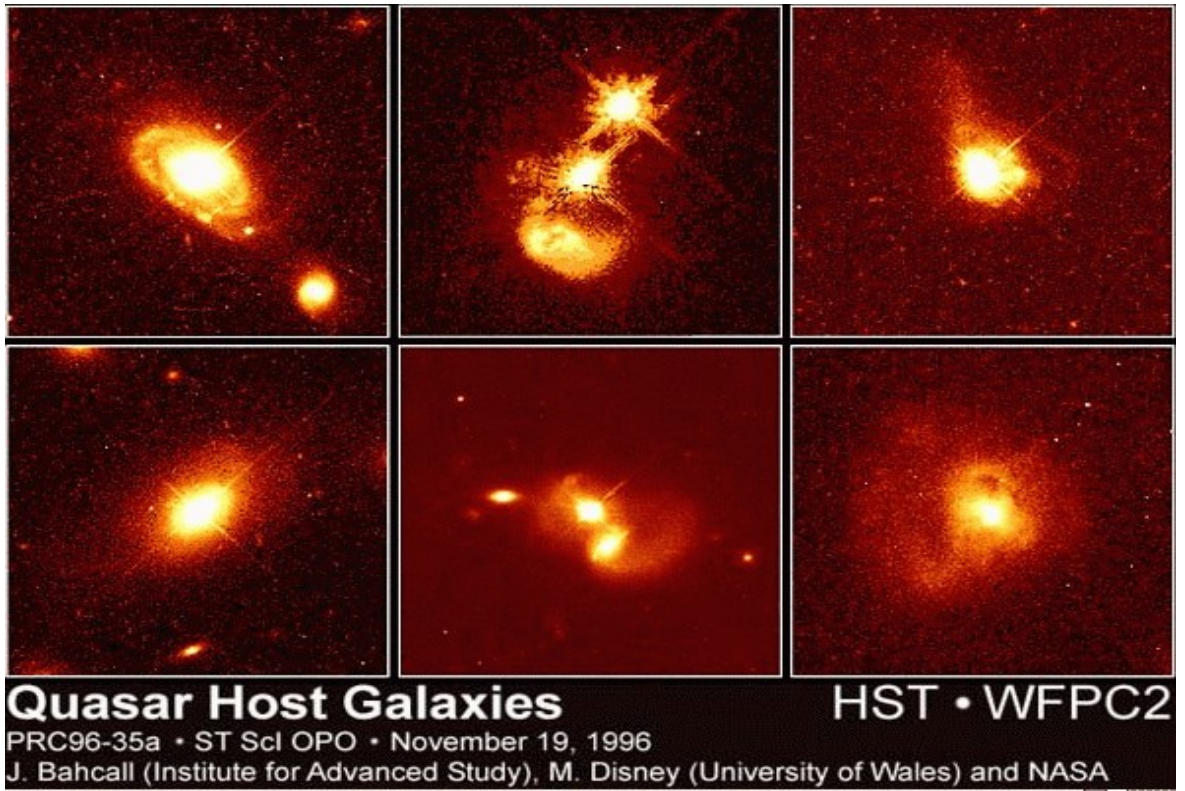
Simon White (MPA)



Is this a significant mode of black hole growth in the Universe?



ULIRGs



QUASARs

STAR FORMATION RATES IN NORMAL AND PECULIAR GALAXIES*

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Yale University Observatory

Received 1977 February 24; accepted 1977 June 29

ABSTRACT

Morphologically normal and peculiar galaxies show very different distributions in the ($U - B$, $B - V$) diagram. To interpret these differences, we have constructed an extensive grid of galaxy models with decreasing star formation rates (SFRs) and with bursts on various time scales. Normal galaxies have colors that are consistent with a monotonically decreasing SFR, and very few can have experienced large variations in SFR with time scales $\lesssim 5 \times 10^8$ yr. In contrast, the peculiar galaxies have a large scatter in colors that is consistent with bursts as short as 2×10^7 yr involving up to $\sim 5\%$ of the total mass. Nearly all of this scatter is associated with galaxies showing evidence of tidal interaction; moreover, interacting systems that are at early stages of dynamical evolution, as inferred from the absence of long tidal tails, have colors consistent with the most recent bursts. These results provide evidence for a "burst" mode of star formation associated with violent dynamical phenomena.

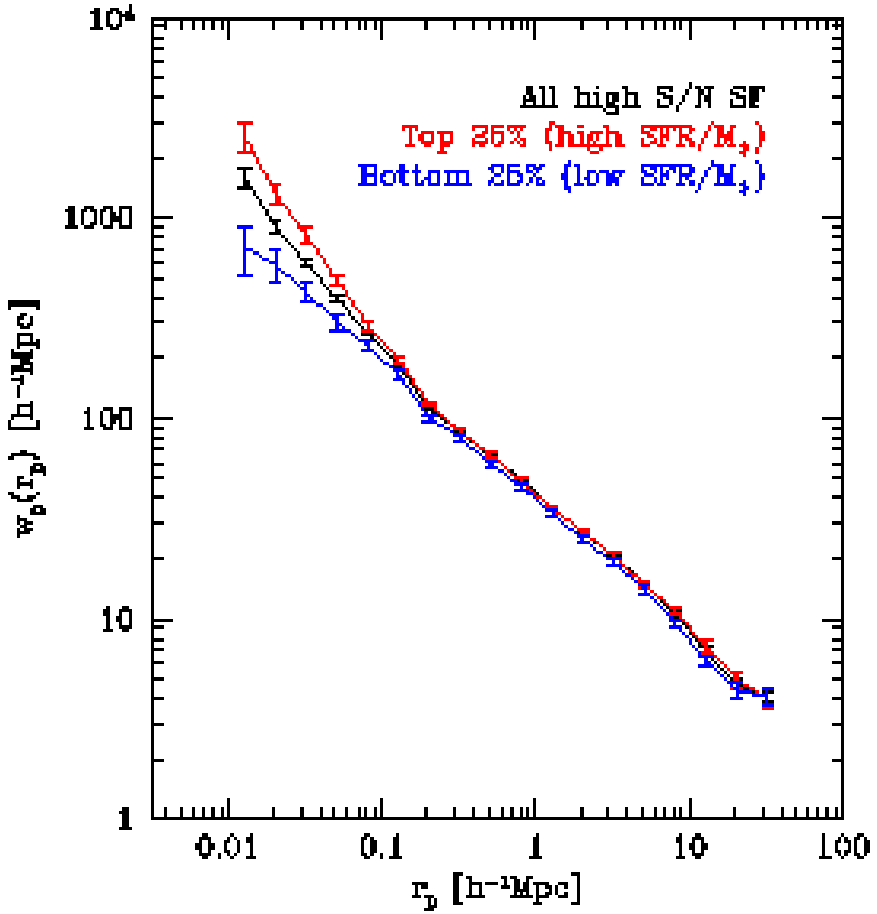
1978

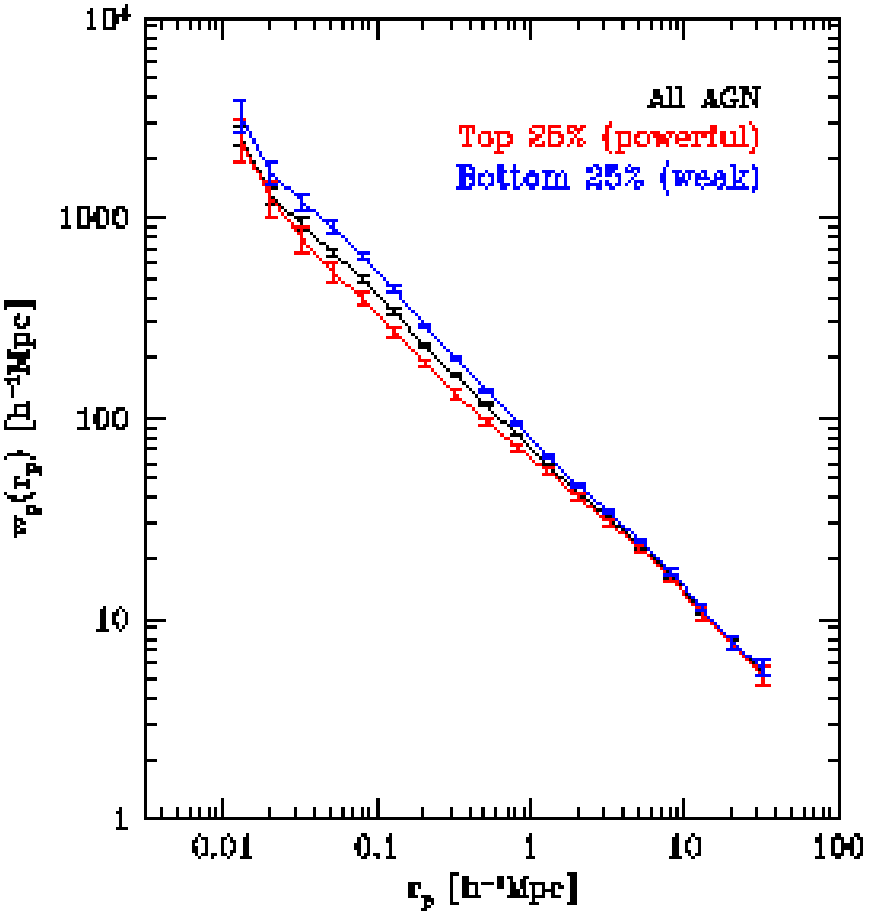
AGN Host Galaxies at z ~ 0.4–1.3: Bulge-dominated and Lacking Merger-AGN Connection

N. A. Grogin, C. J. Conselice, E. Chatzichristou, D. M. Alexander, F. E. Bauer, A. E. Hornschemeier, S. Jogee, A. M. Koekemoer, V. G. Laidler, M. Livio, R. A. Lucas, M. Paolillo, S. Ravindranath, E. J. Schreier, B. D. Simmons, and C. M. Urry

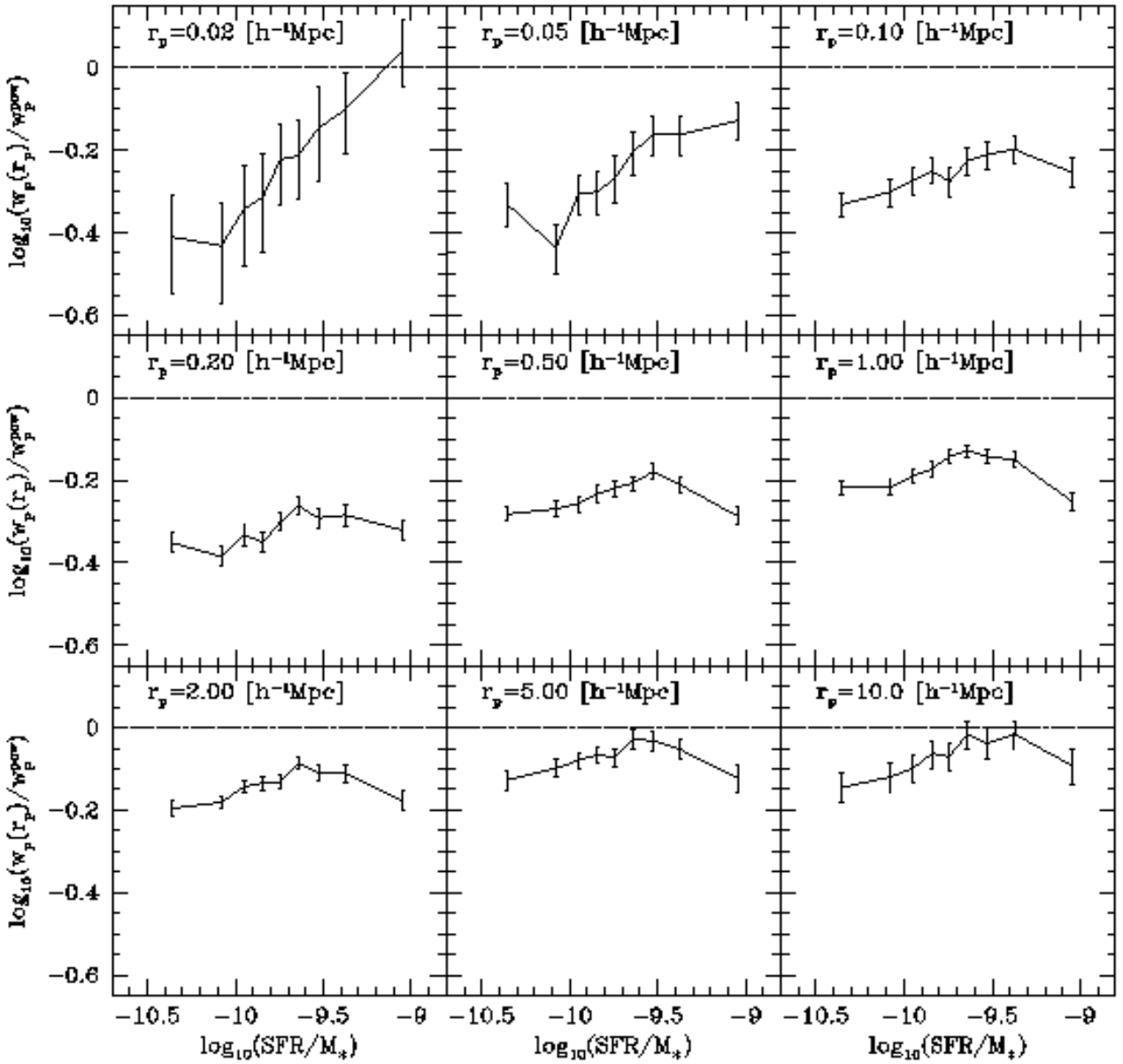
2006

A statistical approach: the cross-correlation function of star-forming galaxies compared to AGN with neighbouring galaxies.

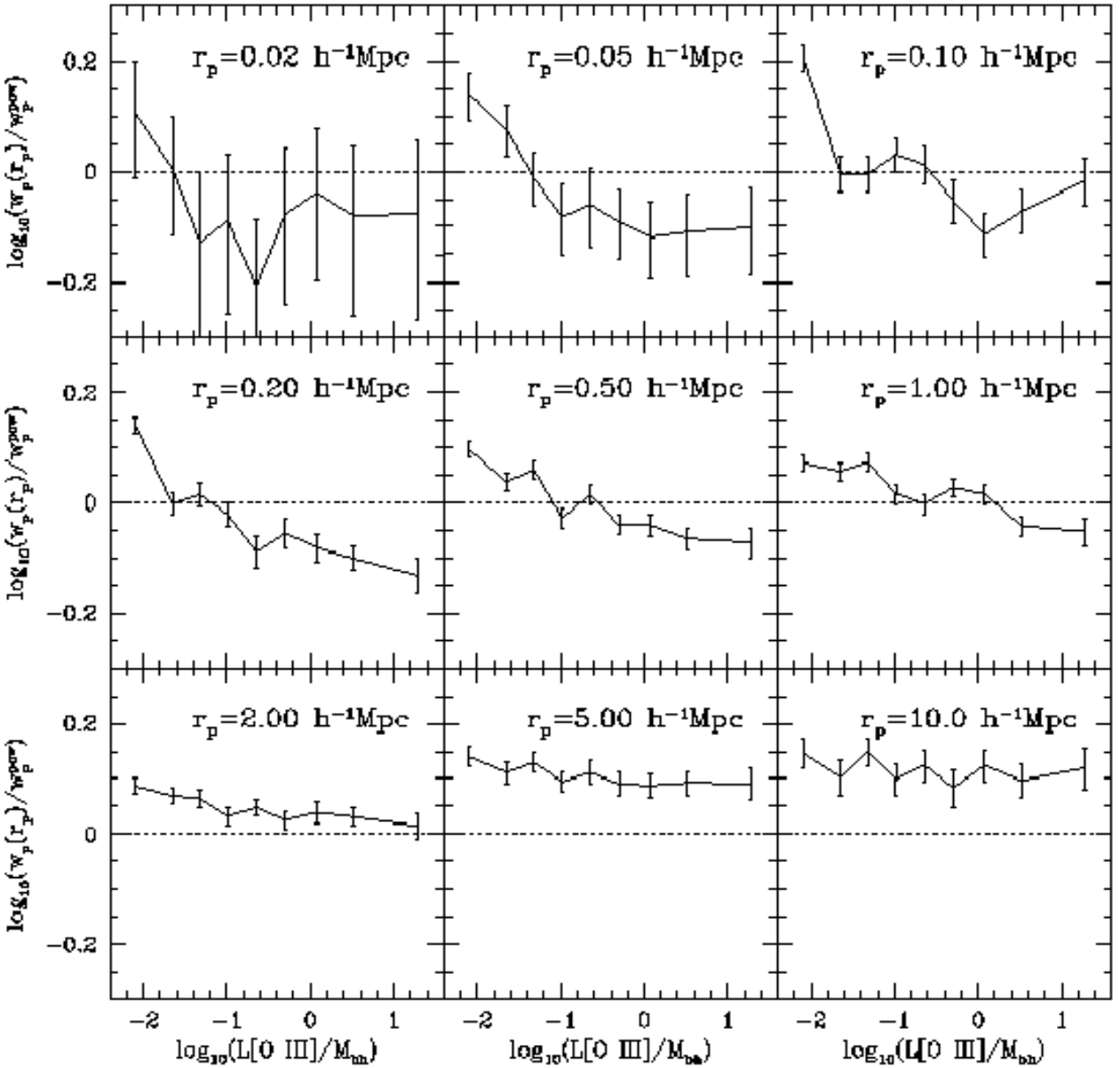




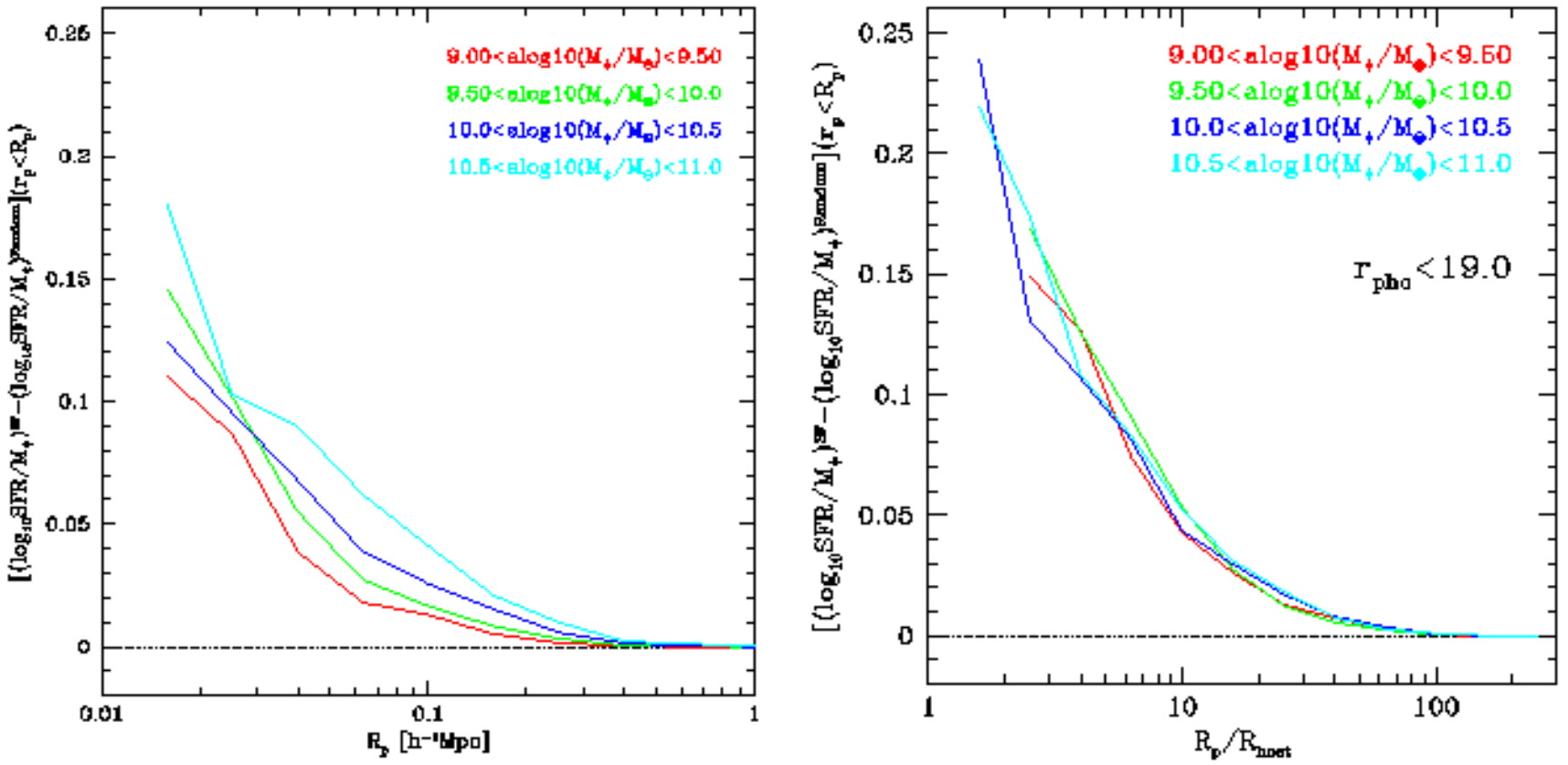
Star-forming Galaxies



AGN

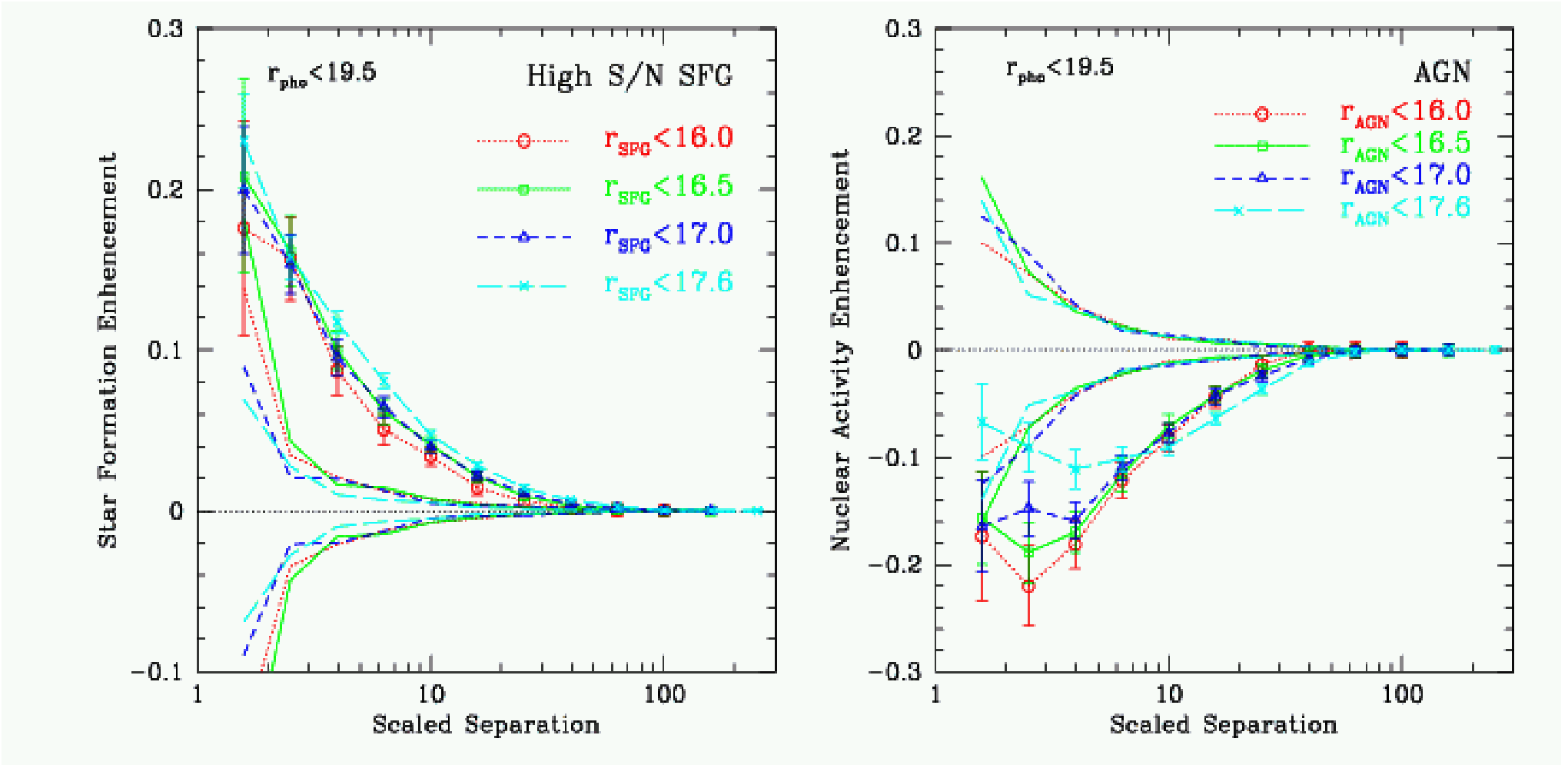

r_p=0.02 h^-1Mpc
r_p=0.05 h^-1Mpc
r_p=0.10 h^-1Mpc
r_p=0.20 h^-1Mpc
r_p=0.50 h^-1Mpc
r_p=1.00 h^-1Mpc
r_p=2.00 h^-1Mpc
r_p=5.00 h^-1Mpc
r_p=10.0 h^-1Mpc
0.2
0
−0.2
−2
−1
0
1
log10(L[O III]/Mbh)

A "Universal" Star-formation Enhancement Function?



When scaled to the size of the galaxy, there is no dependence on host mass.

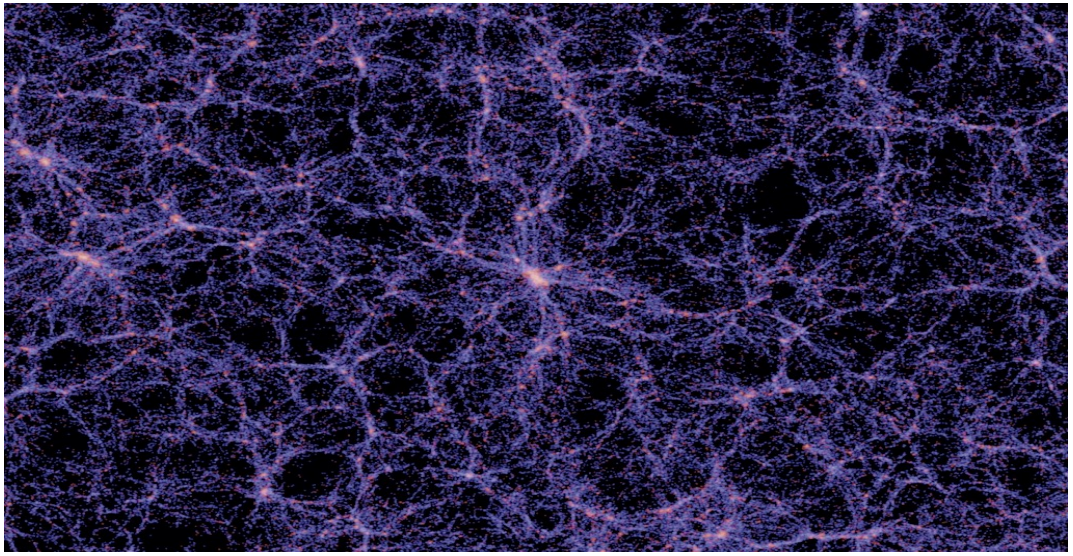
The enhancement in star formation activity for galaxies with close companions is NOT mirrored by a corresponding enhancement in AGN activity.

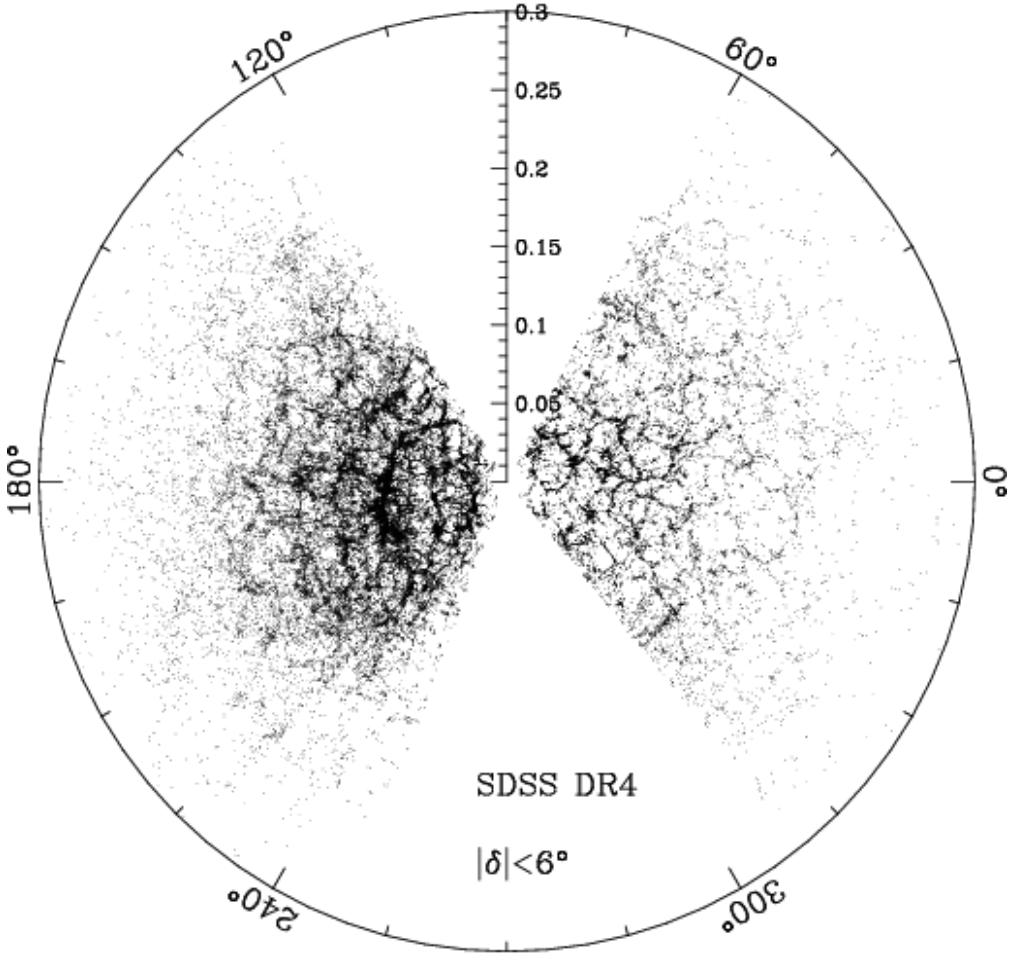


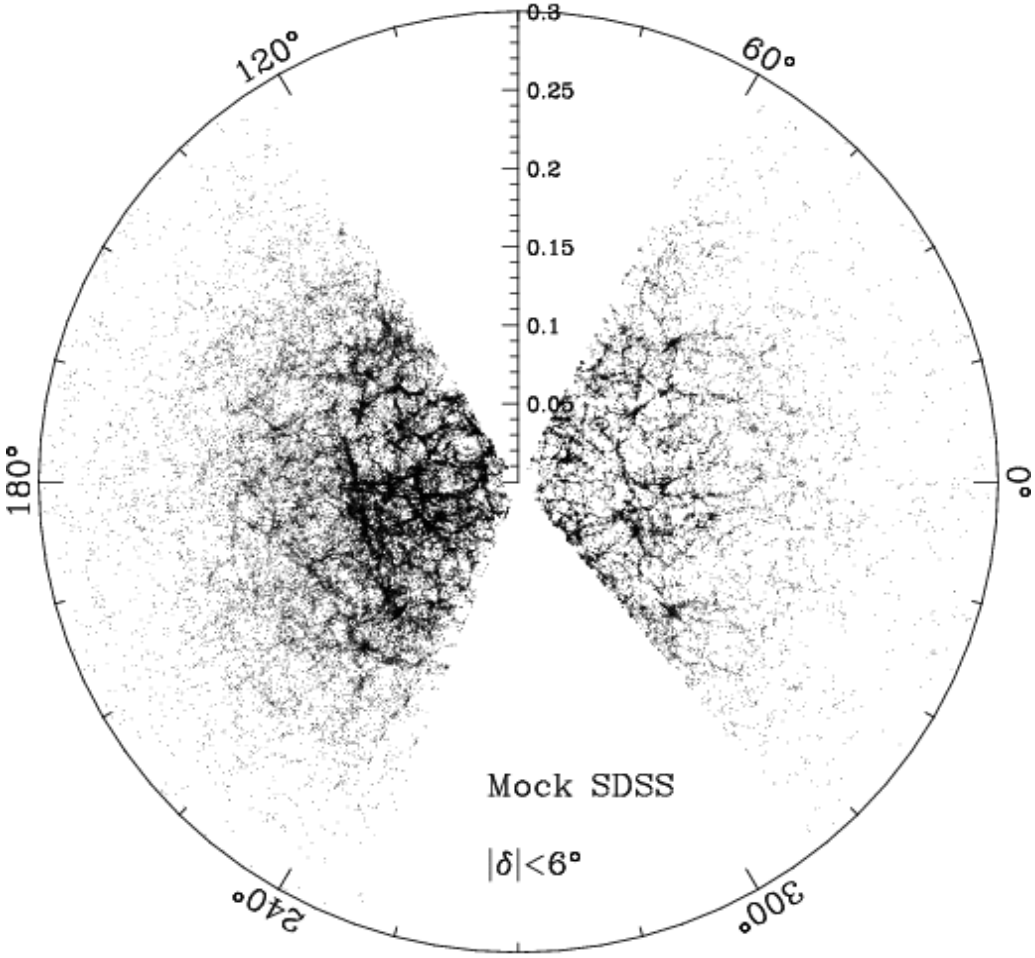
SO HOW DO WE UNDERSTAND THE

“**WEAKER THAN AVERAGE**”

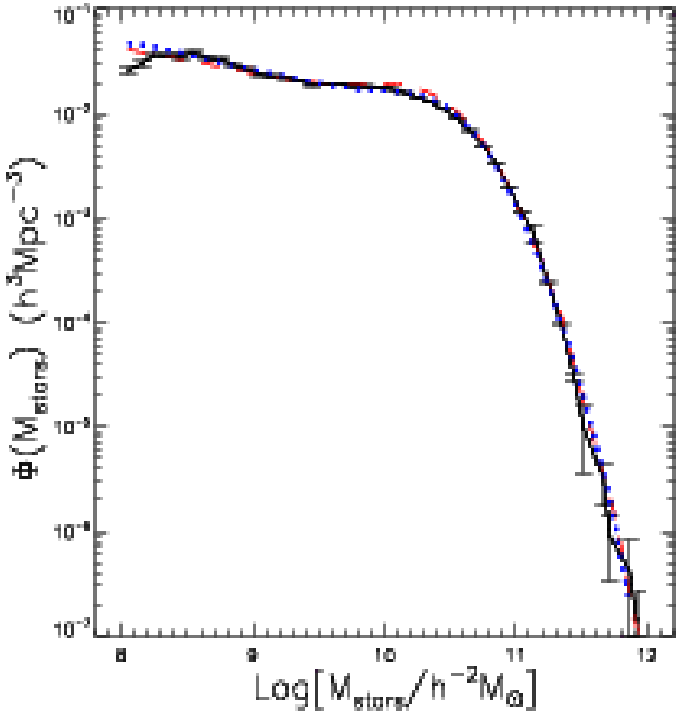
CLUSTERING OF AGN??

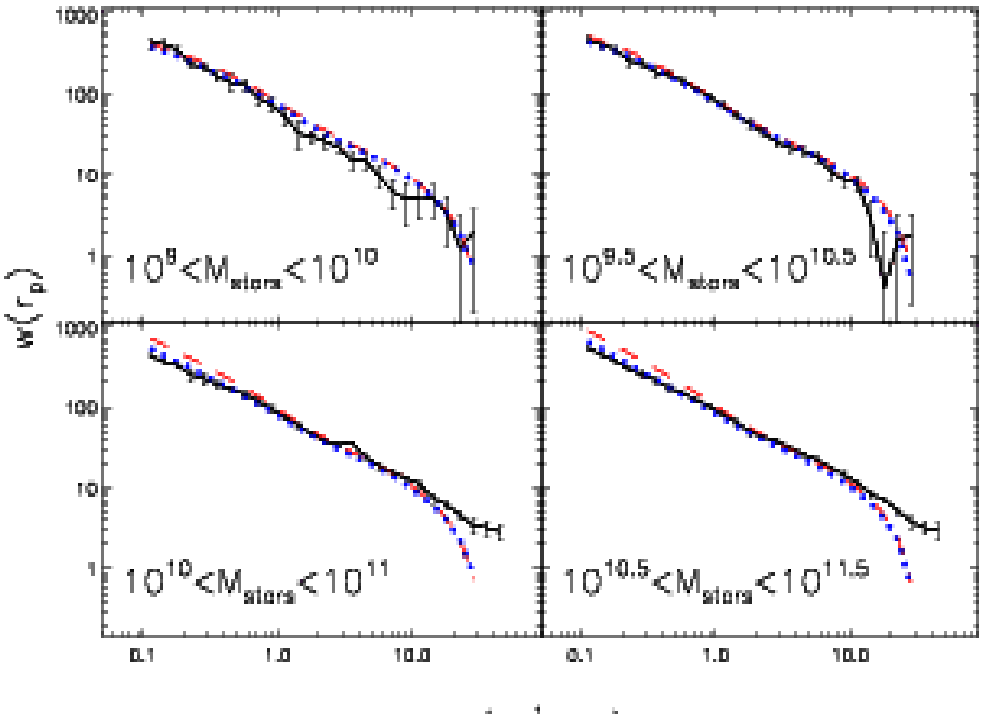



120°
60°
180°
0°
240°
300°
0.3
0.25
0.2
0.15
0.1
0.05
SDSS DR4
|δ|<6°


120°
60°
180°
0°
240°
300°
0.3
0.25
0.2
0.15
0.1
0.05
Mock SDSS
|δ|<6°

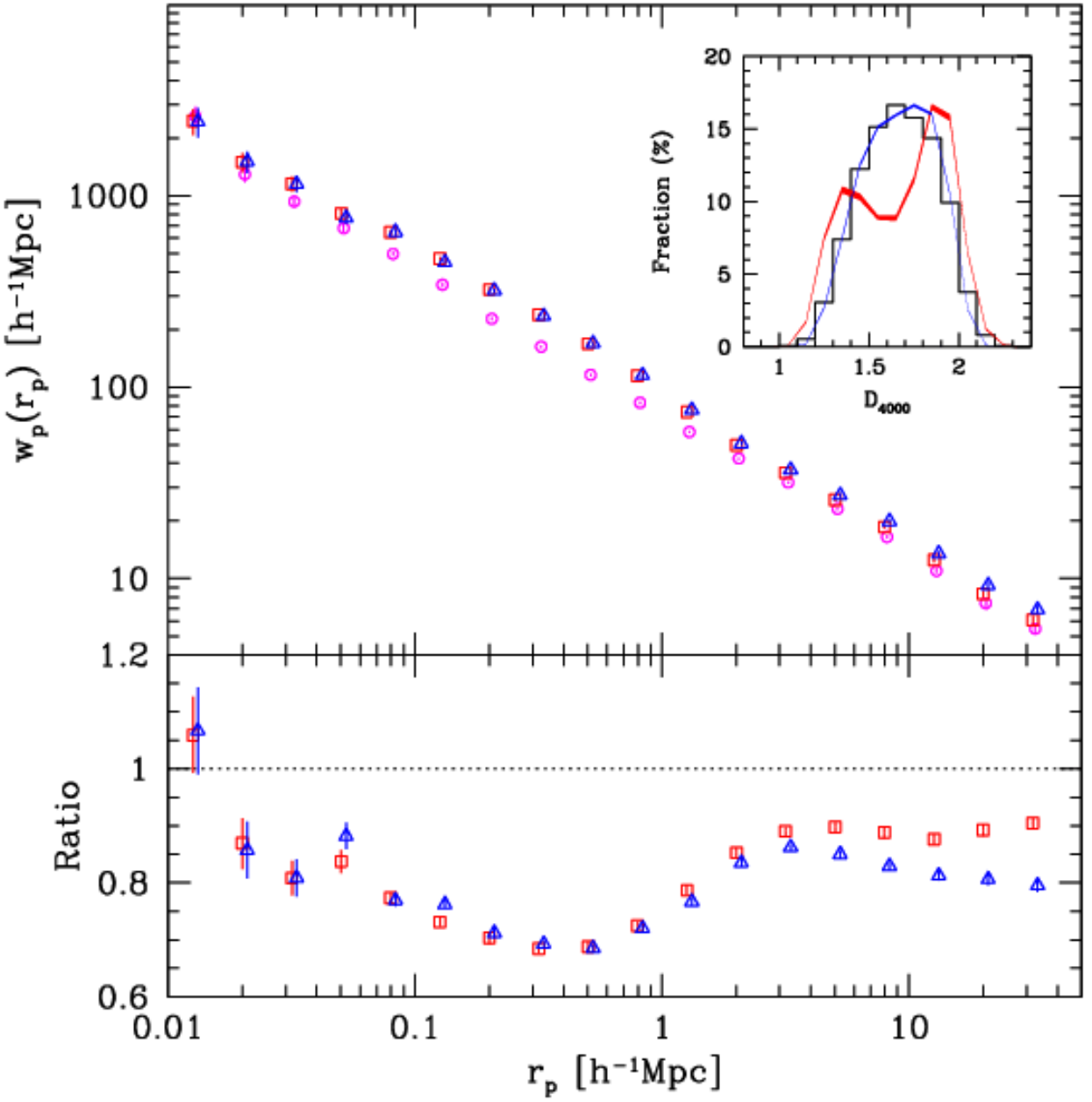
Our mock catalogues are constructed so that they EXACTLY reproduce the observed stellar mass function and the two point correlation function as a function of mass from SDSS.

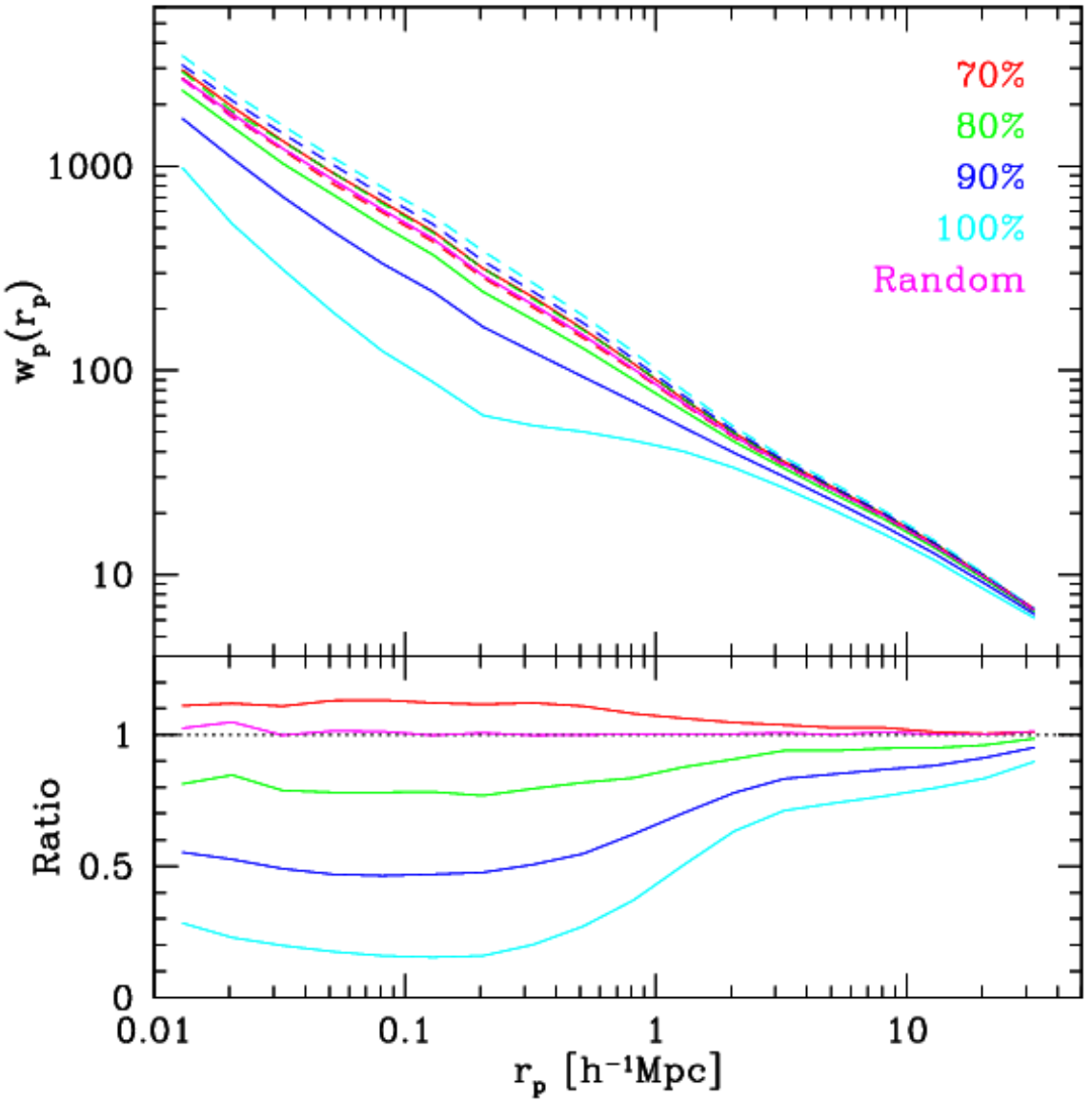




Lan Wang et al 2006

What we are trying to model: the cross-correlation function of AGN compared to a control sample of non-AGN matched in redshift, stellar mass and concentration index.

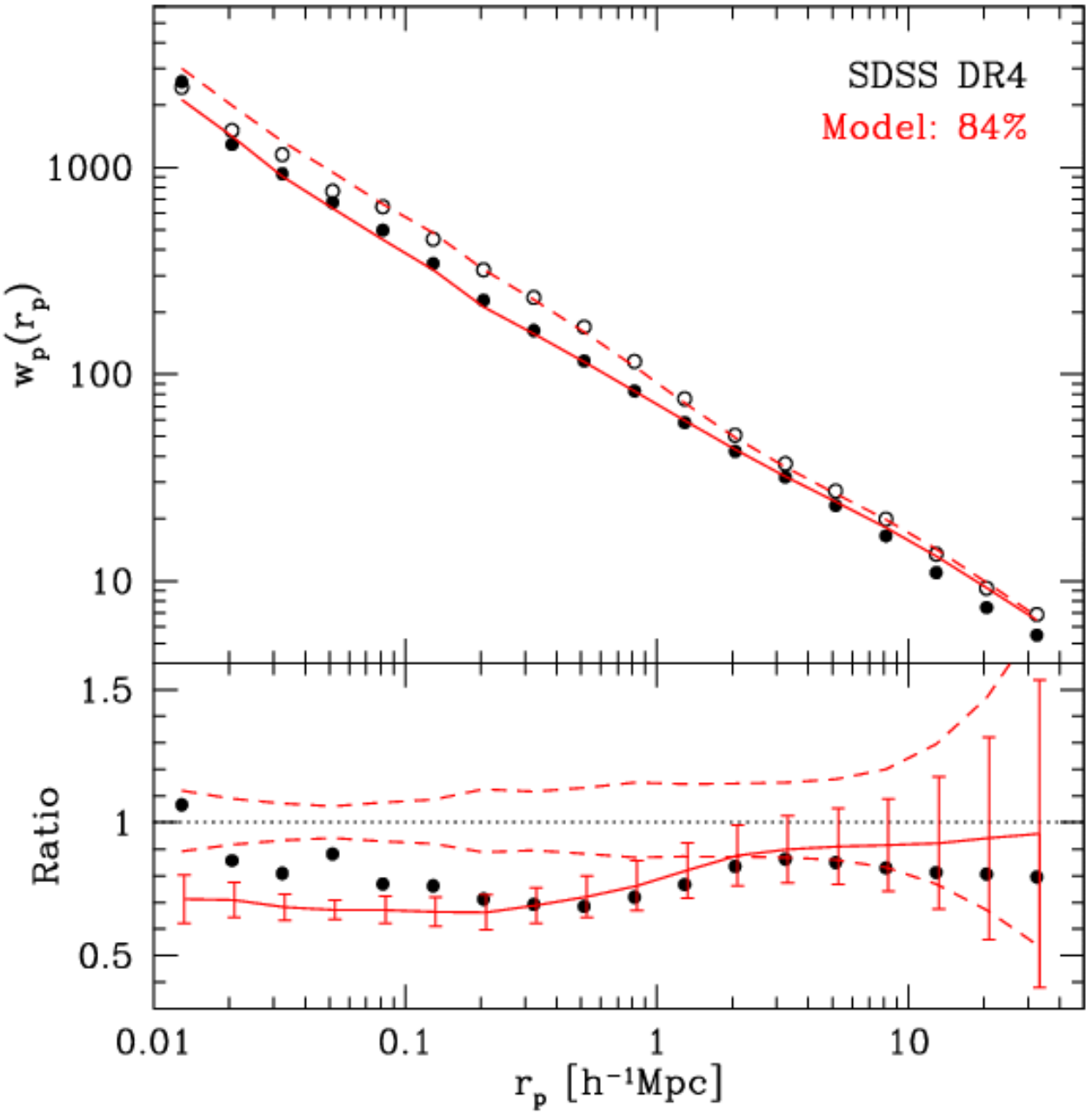




The Model:

For every AGN in our sample, we select a galaxy in the mock catalogue with the same stellar mass and redshift, but the probability of the galaxy to be an AGN will depend on whether it is a “central” or “satellite” galaxy in the halo.

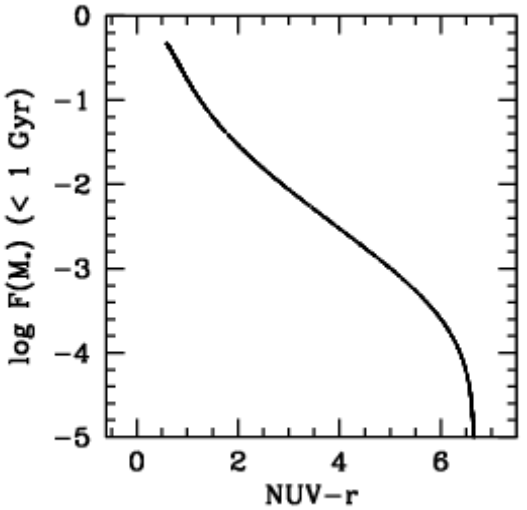
Best-fit Model: AGN have an enhanced probability of being found in central galaxies as compared to a random galaxy of the same stellar mass.

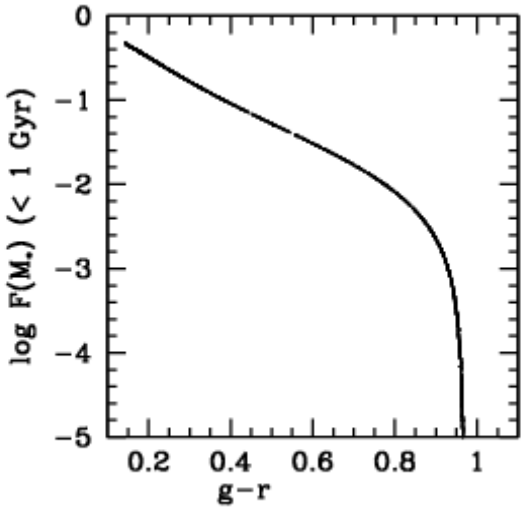


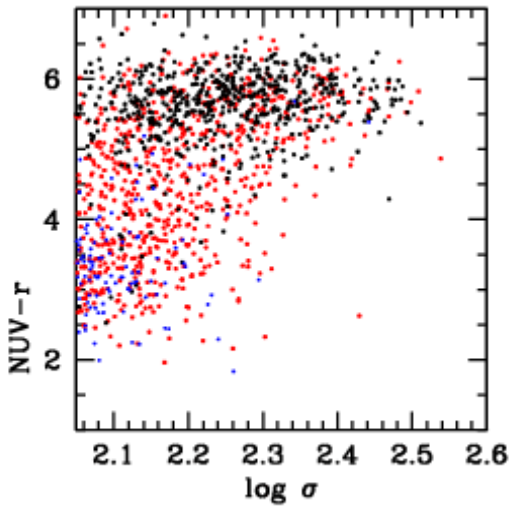
The Galaxy Explorer (GALEX) satellite has uncovered a population of early-type galaxies with blue UV/optical colours. Almost all are AGN.

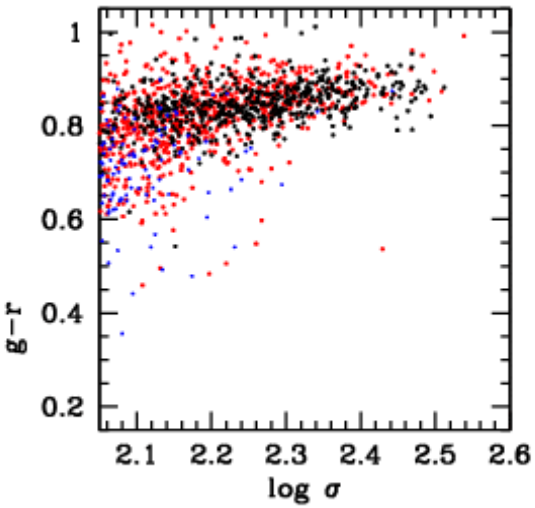
Kauffmann, Heckman and the GALEX science team 2006

PI: Chris Martin



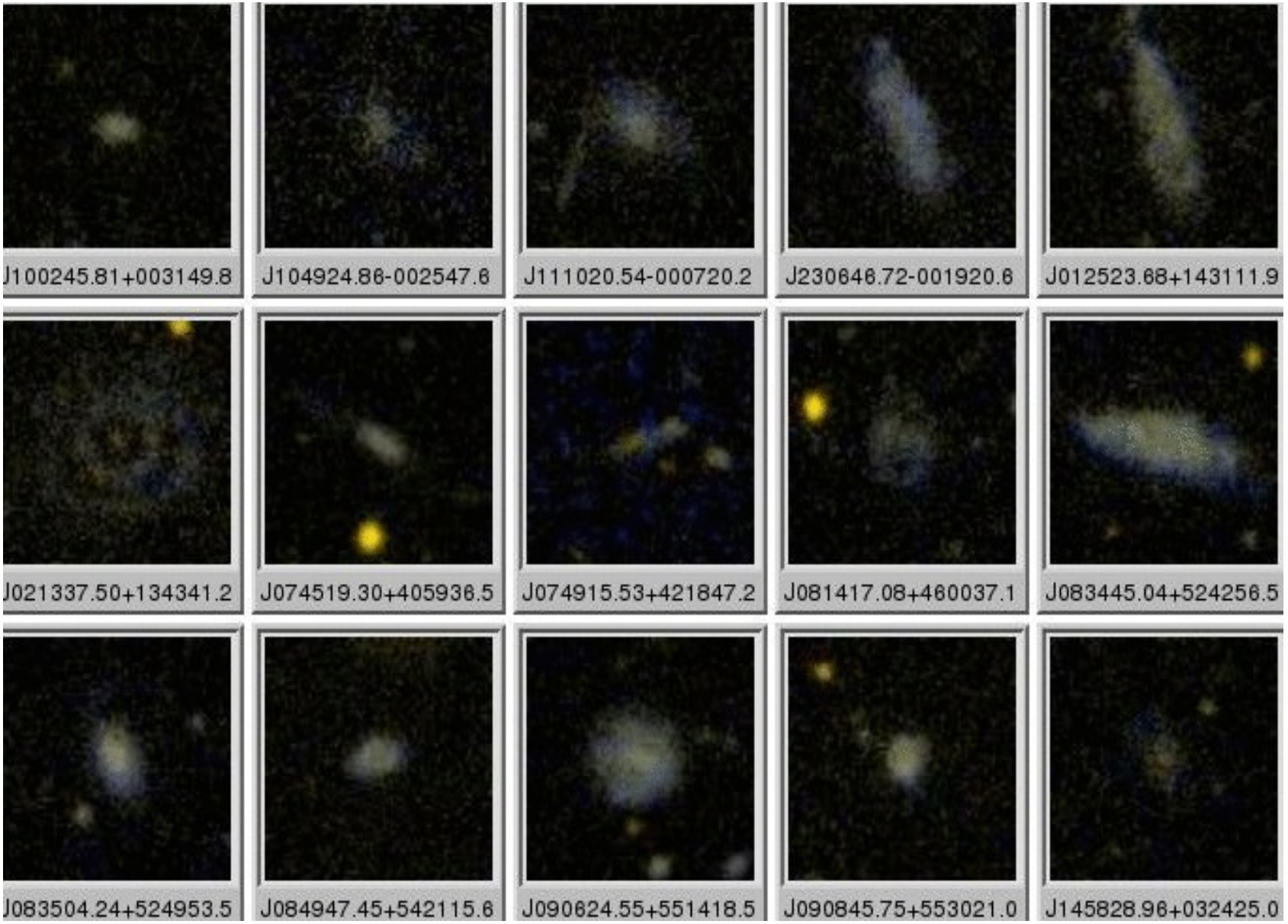




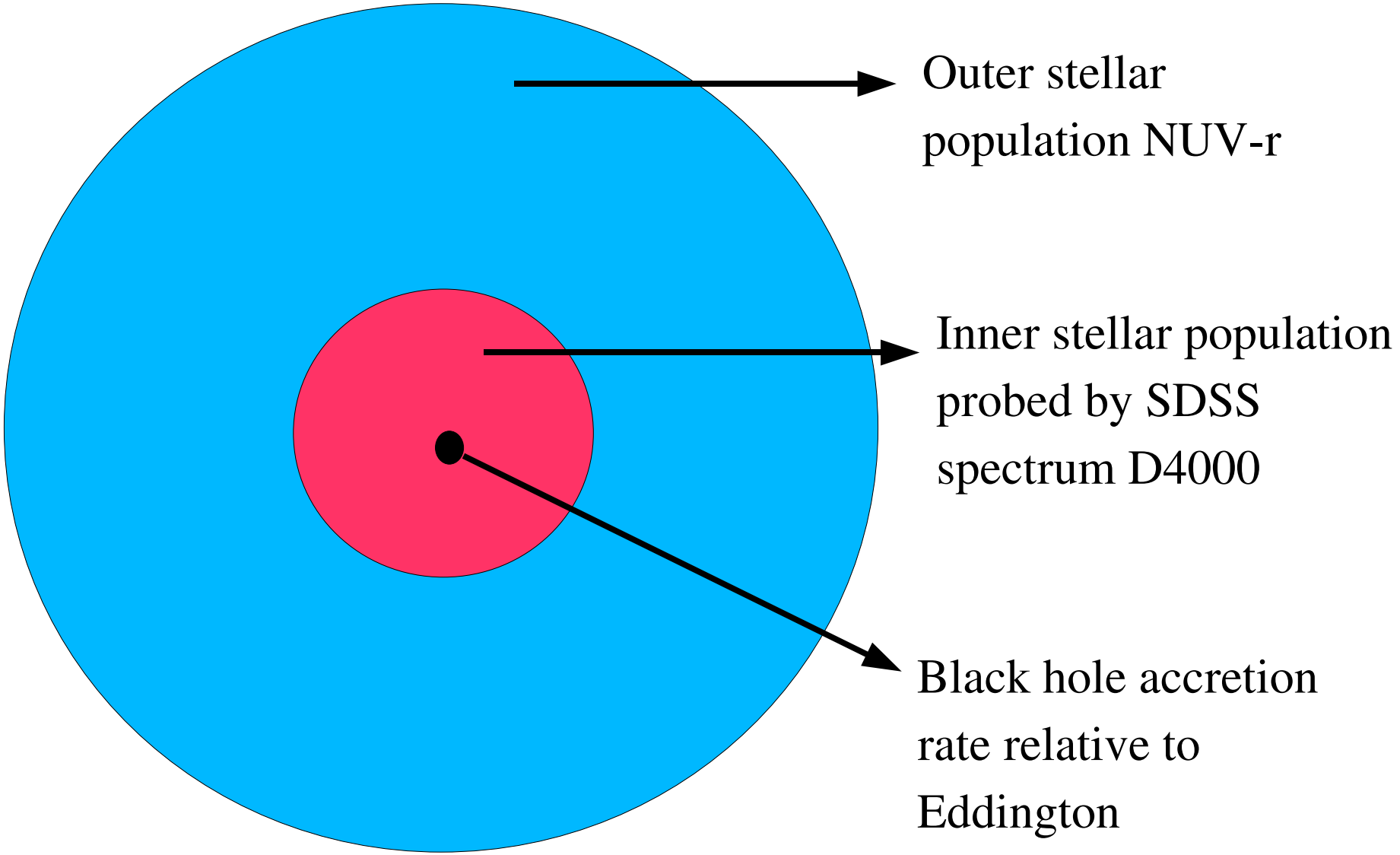


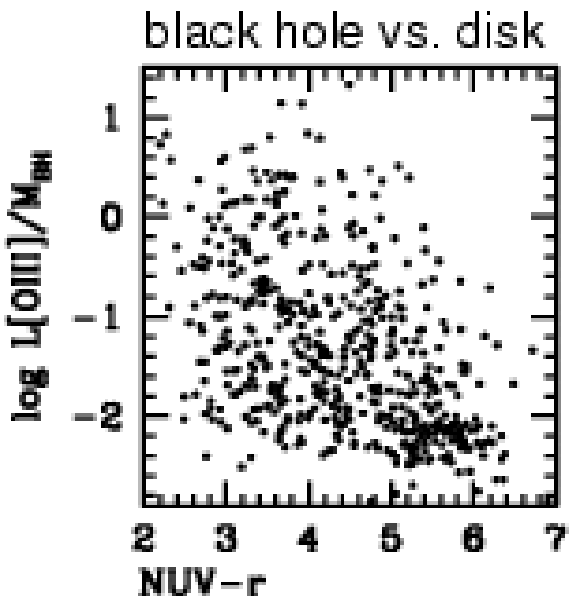
Where is the UV light coming from?

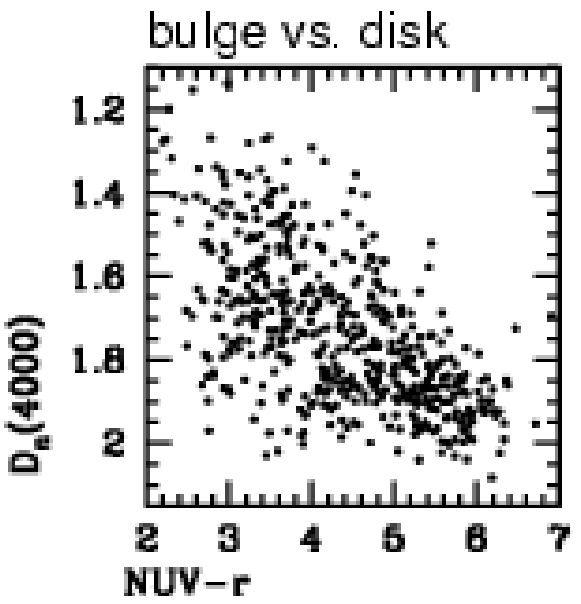
Answer: From EXTENDED disks

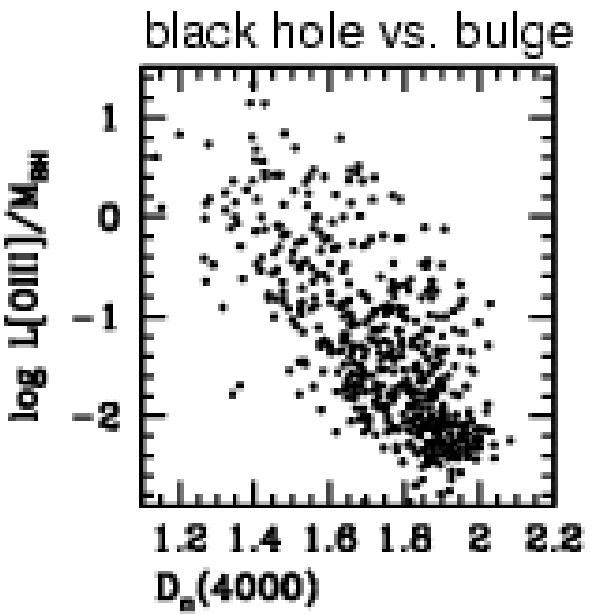


What is the relation between the UV bright outer “disk” and the AGN??









ANSWER:

The UV bright outer stellar population is a NECESSARY BUT NOT SUFFICIENT condition for bulge and black hole growth.

AN EMERGING PICTURE?

We propose that optical AGN activity occurs in those galaxies where ongoing accretion of COLD GAS can occur. This explains why optical AGN are preferentially located at halo centres.

Cold gas accretion forms an extended disk. Instabilities in the disk (which may be internally generated) results in the transport of gas to the nucleus.

Accretion onto the black hole is limited by gas-supply, but tidal interactions and mergers are not the primary mechanism that control this supply in the local Universe.