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A Halo Model of Local IRAS Galaxies Selected at 60 Micron Using Conditional Luminosity Functions

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(Submitted on 26 Oct 2010)

Using conditional luminosity functions (CLFs) which encode the luminosity distribution of galaxies as a function of halo mass, we construct a halo model of IRAS galaxies selected at 60 micron. An abundance matching technique is used to link galaxy luminosity to the host halo mass. The shape of the mass - light relation at 60 micron is different from those derived at r-, K- and B-band. This is because the 60 micron LF can not be fitted by a Schechter function with a sharp exponential cutoff. We then seek the parameters in the CLFs that best fit the LF and power spectrum. We find that the predicted galaxy bias as a function of L60 from the best-fit model agrees well with the clustering measurements. At the faint end of the LF where quiescent star-forming galaxies dominate, most IRAS galaxies are central galaxies in halos of M >~ 10^{10} h^{-1} M_sun but a non-negligible fraction are satellites typically hosted in more massive halos. The majority of IRAS galaxies with L60 >~ 10^{10} h^{-2} L_sun are M82 type starbursts which are central galaxies hosted in halos of M >~ 10^{12.5} h^{-1} M_sun. In comparison, optical galaxies generally reside in much more massive halos. The rate of change in L60 (an indicator of recent star formation) as a function of halo mass at M >~ 10^{12.5} h^{-1} M_sun is much larger that d L_optical / dM or d L_NIR / dM indicating the existence of physical mechanisms which are very efficient in converting cold gas into stars, possibly dynamical effects arising from interactions or mergers. We further calculate the space density of major mergers for halos massive enough to host ultraluminous infrared galaxies (ULIRGs) using the mean merger rate derived from the Millennium simulations. Compared to the space density of local ULIRGs, it implies that either the majority of major mergers at z~0 do not lead to ULIRGs or the ULIRG phase is relatively short.

Comments: 8 pages, 5 figures, submitted to MNRAS
Subjects: **Cosmology and Extragalactic Astrophysics (astro-ph.CO)**
Cite as: **arXiv:1010.5484v1 [astro-ph.CO]**

Submission history

From: Lingyu Wang [view email]
[v1] Tue, 26 Oct 2010 19:03:41 GMT (140kb)

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