

GAME OF GALAXIES YOU MAKE STARS OR YOU DIE

A new morphological catalog of 12000 IRAS galaxies: setting the $z=0$ baseline for star-forming galaxies

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Introduction

The star formation rate (SFR) density is much lower now than at $z=2$. Optical galaxy surveys (e.g. SDSS) are not the best way to study star-forming galaxies: half of all the energy emitted by AGN and stars over cosmic history has been absorbed by cold, interstellar gas and dust, and re-emitted in the infra-red (IR). A large IR-selected survey has never been used to probe the multiwavelength properties of star-forming galaxies in the local universe – until now.

Aim

Characterise the local star-forming galaxy population in terms of morphology, luminosity, stellar mass, star-formation rates, emission line activity, environment & merger events. Explore effects of mergers and bars on star formation.

Sample & Data

11,965 galaxies from the Imperial IRAS Faint-Source redshift Catalogue (IIFSCz), all with IRAS photometry & SDSS spectra: 99% have $z < 0.2$
+ OSSY catalog emission line widths \rightarrow BLAGN
+ SDSS Galaxy Groups Catalog \rightarrow environments

Visual Morphological Classifications (SDSS images)

Two classifiers, 5 categories, sure/unsure flags, comments column. 'Sure' sample:

- ~ 47% Spirals
- ~ 20% Mergers
- ~ 14% Ellipticals
- ~ 12% Irregulars
- ~ 7% Barred Spirals



Emission Line Activity: Spirals vs Barred Spirals (Face On)

BPT Analysis for Barred Spirals

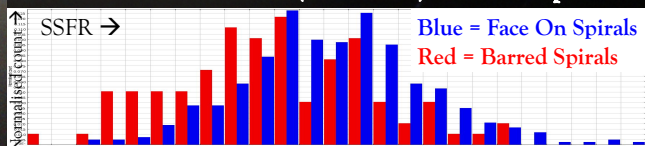
BLAGN removed

BPT Analysis for Face On Spirals

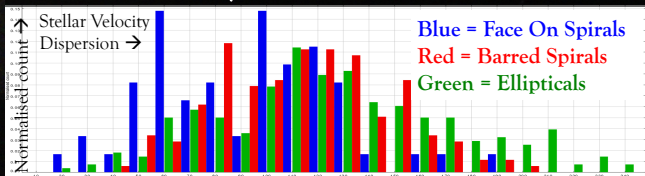
BLAGN removed



Barred Spirals have lower mean Specific SFR than Unbarred Spirals, but BPT shows they are as frequently star forming! So star formation is equally common regardless of the presence of a bar, but it occurs at a lower level (lower SSFR) in Barred Spirals.



Barred Spiral stellar velocity dispersions are statistically significantly different to those of Unbarred Spirals, but statistically consistent with those of Ellipticals, due to bulge kinematics. The same is true for forbidden line widths (sometimes used to estimate black hole mass).



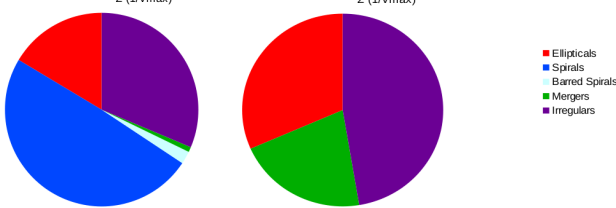
IR luminosity: morphologies in the lowest & highest bins

log LIR < 9

$\Sigma (1/V_{max})$

log LIR > 12

$\Sigma (1/V_{max})$



Preliminary Findings & Future Work

- Sample dominated by low-IR luminosity (LIR) Spirals
- Galaxy-galaxy interaction required to reach $\log(LIR/M_{sun}) > 12$
- Quantitative measurement of Specific SFR increase due to non-major merger interaction: 70%, or $SSFR = 2.6 \times 10^{-10}/yr$
- Highest possible LIR without any merger: disturbed spiral with $\log(LIR/M_{sun}) = 11.6$
 \rightarrow To Do: Check minor mergers. Can we make a ULIRG without a major merger?
- Significant differences in prevalence of AGN/SF activity, Specific SFR and stellar velocity dispersion/forbidden line widths in Spirals with and without a bar
- Have got GALEX + 2MASS + WISE photometry
 \rightarrow To Do: Fit UV-to-FIR spectral energy distributions in MAGPHYS; get dust mass, SF histories, SFR, effective absorption
- To Do: Compare full sample SFRs from FIR, H α , UV & MAGPHYS (test estimators!)
- To Do: Environment VS morphology, SF history, Specific SFR, AGN etc

REFERENCES

Oh, K., Sarzi, M., Schawinski, K., Yi, S. K. 2011, ApJS, 195, 13
Wang, L., & Rowan-Robinson, M., 2009, MNRAS, 401, 35
Yang, X., Mo, H. J., van den Bosch, F. C., et al. 2007, ApJ, 671, 153

Papers are coming...

- Hyde et al. a), b) in prep
- Carpineti et al. in prep

How much of an increase in SSFR can a non-major merger interaction cause?

