A side story on Spitzer 70µm

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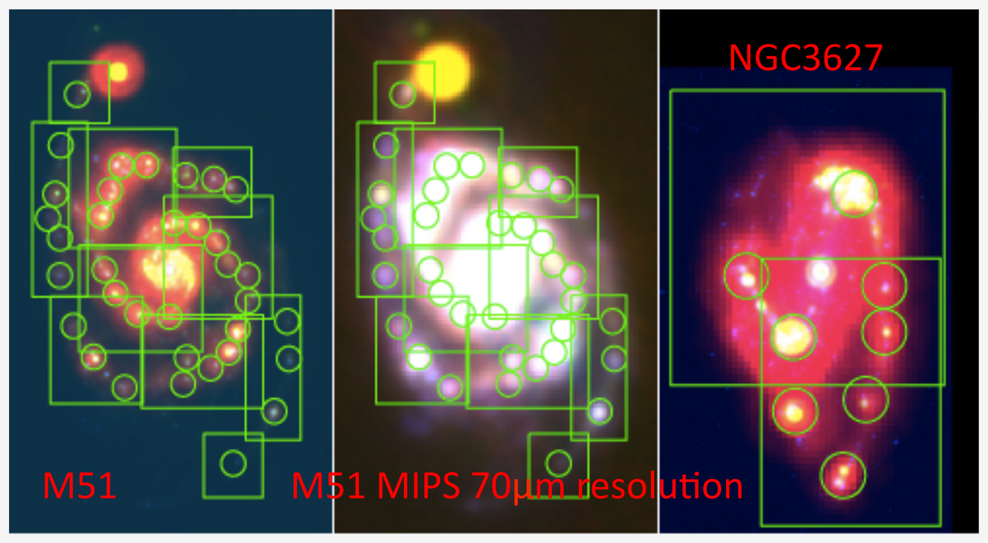
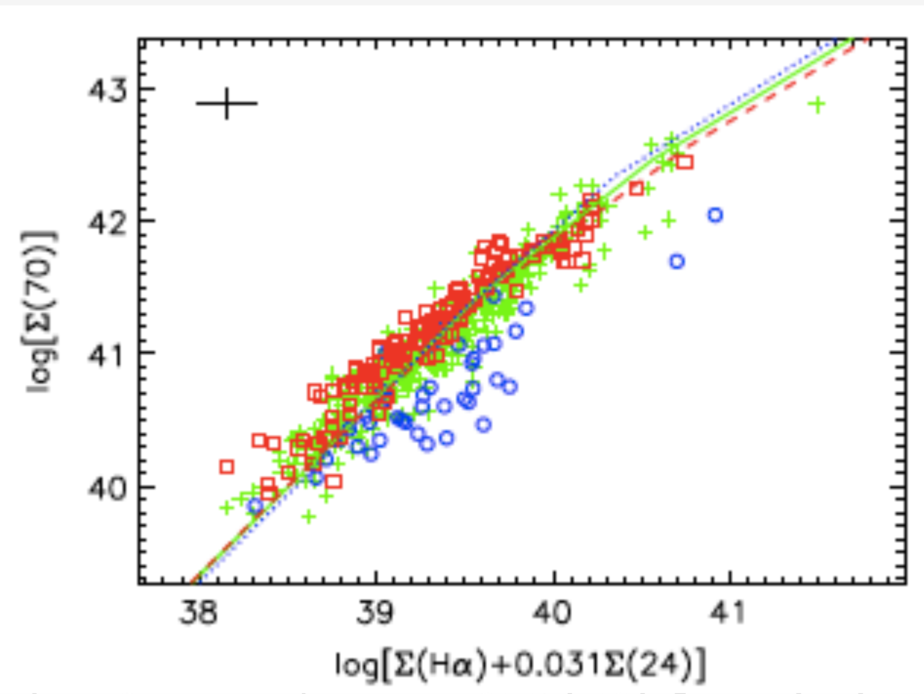
Abstract: A SFR(70) calibration of Spitzer 70um for sub-galactic regions is established using a combination of Spitzer 24µm and Hα as reference SFR indicator. Albeit weak, a dependence on metallicity is also found. By comparison to SFR(70) for whole galaxies, a large fraction of 70µm emission is thought to be coming from dust heated by evolved stellar populations.

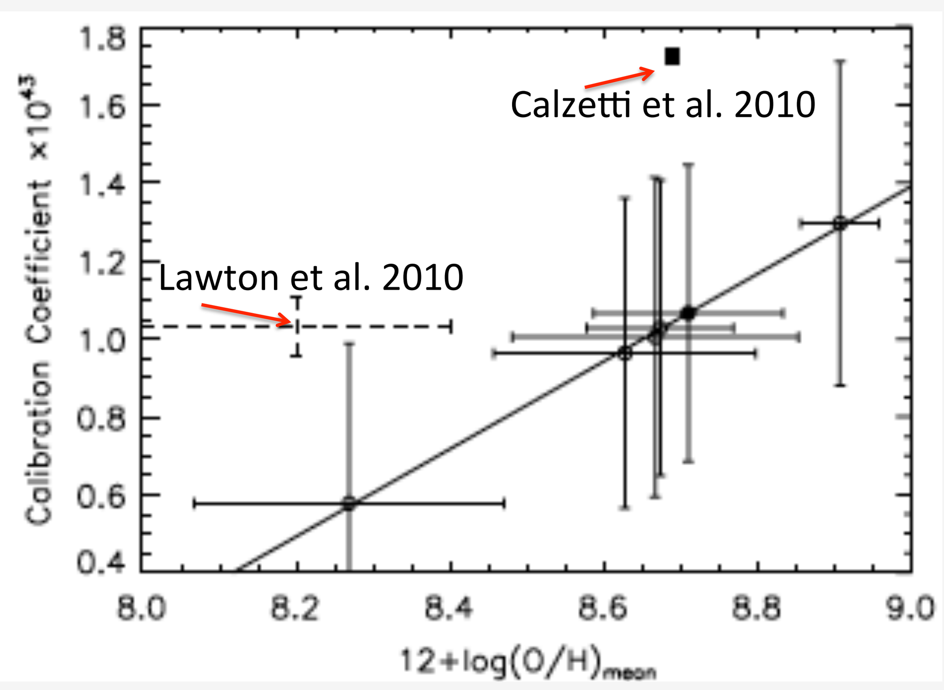
- Sample: 40 galaxies, spirals and irregulars, from SINGS sample
- Photometry at Spitzer 70µm resolution, region sizes: ~50pc to 2kpc



- SFR ($M_\odot$/yr)=L(70) (ergs/s) / 1.067×10^{43}
- Scatter mainly due to metallicity



- Comparison to SFR(70) for whole galaxies (Calzetti et al. 2010) reveals that ~40% 70µm emission on average from these galaxies are from dust heated by evolved stellar populations unassociated with current star formation.



The Golden Standard of SFR: Initial Results from CFHT

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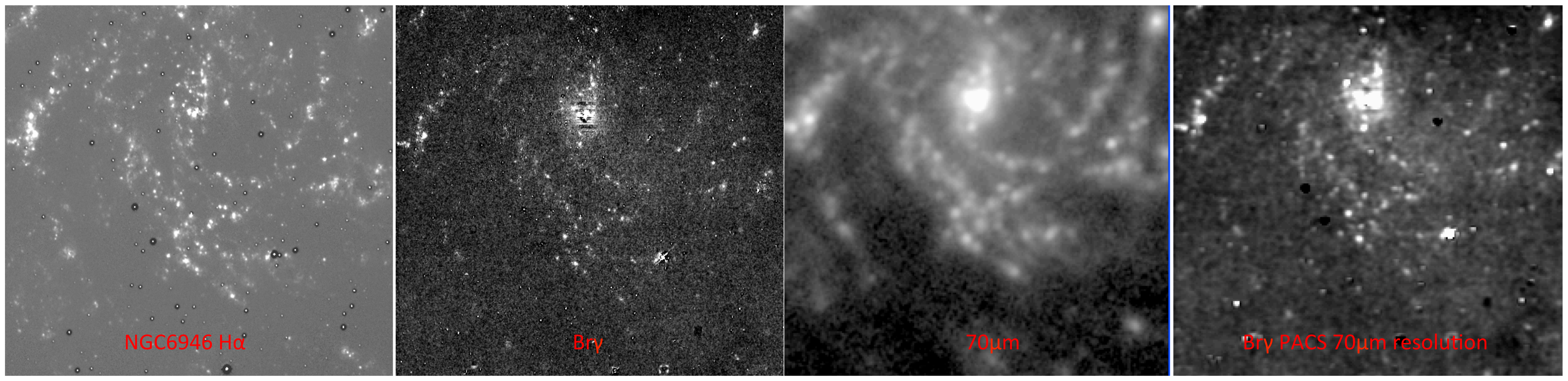
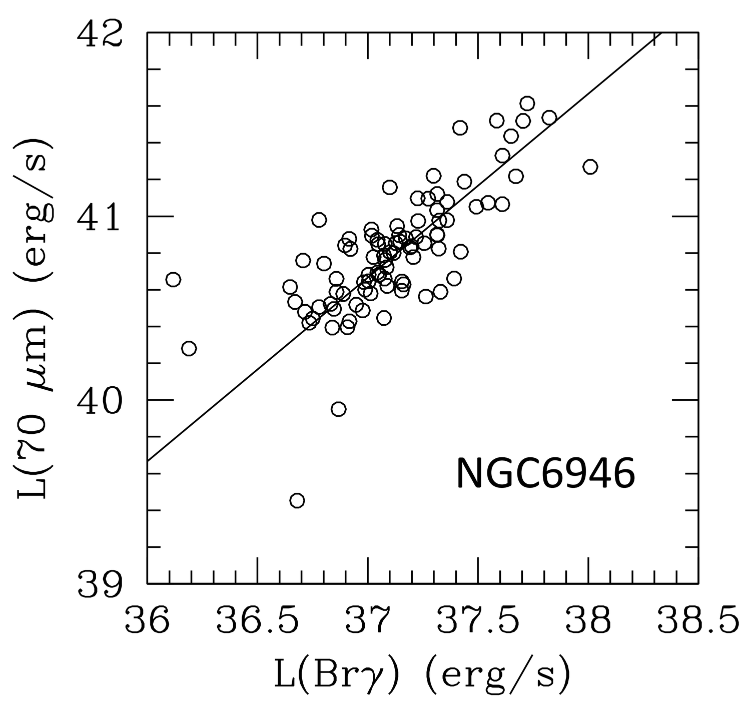
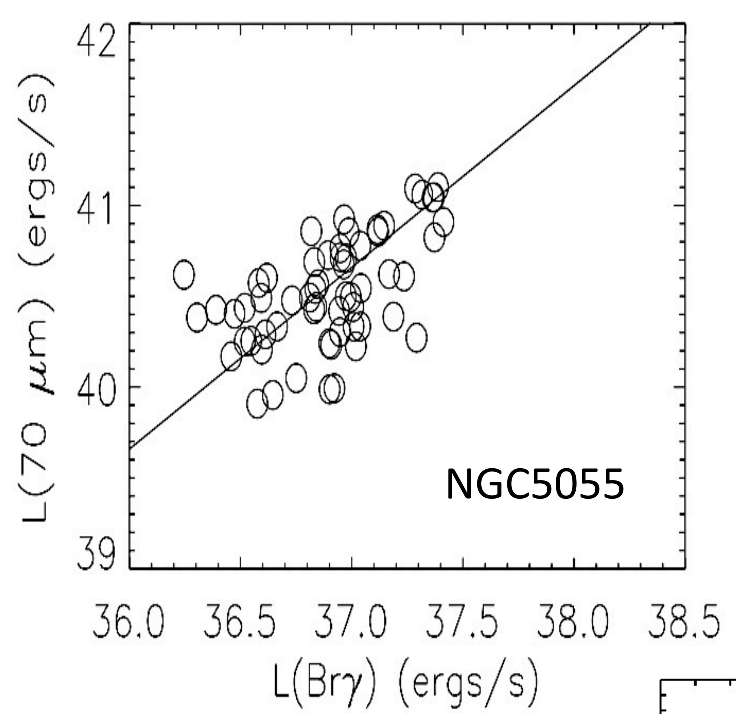
Abstract: We use the Brγ recombination emission line as a `Golden Standard' of Star Formation Rate to test the validity and calibration of the Herschel PACS 70µm emission as a SFR indicator for HII regions in external galaxies. Brγ offers the double advantage of tracing ionizing photons directly, and being relatively insensitive to the effects of dust attenuation. For our first experiment, we use CFHT archival Brγ and Ks images of two KINGFISH galaxies: NGC5055 and NGC6946. We establish the calibration of SFR(70) against Brγ for the two galaxies and compare it with previous studies of SFR(70) at different scales. The HII region luminosity functions using the Brγ emission line is presented as well.

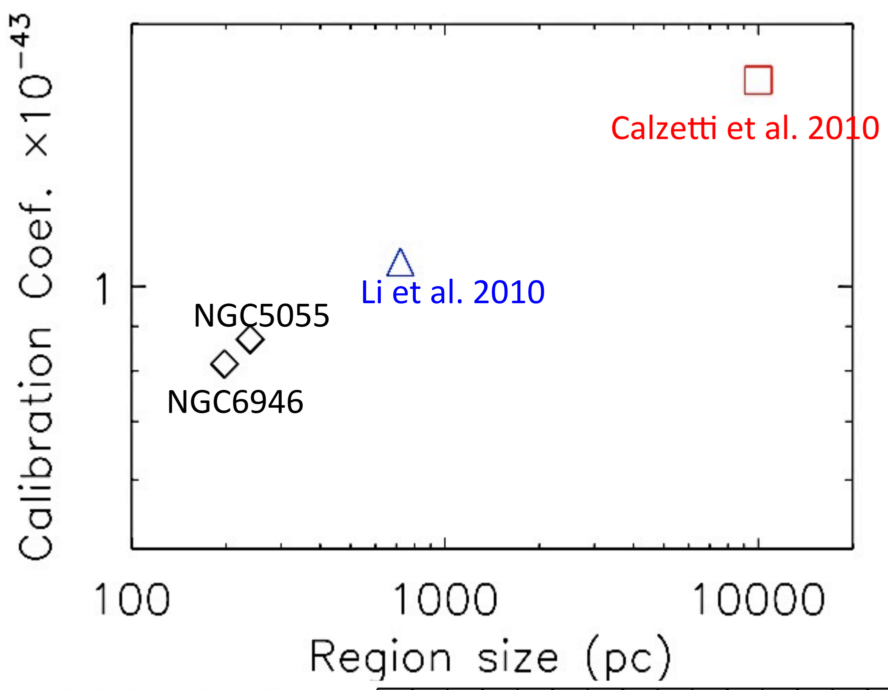
- Sky-subtracted and calibrated WIRCAM images retrieved from CFHT archive
  - NGC6946: 61×110s Brγ; 61×10s Ks; NGC5055:12×200s+87×100s Brγ; 112×20s Ks
- Combined and continuum-subtracted;
- Calibration with standard stars and Pα images (>95% agreement); 1.2’’PSF



- SFR(70) calibrated using Herschel 70µm images from KINGFISH, with Brγ as reference SFR;
  - Photometry at PACS 70µm resolution: 5.5’’, with fixed aperture size 6’’
- SFR ($M_\odot$/yr)=L(70) (ergs/s) / 0.815×10^{43} [NGC6946]
- =L(70) (ergs/s) / 0.870×10^{43} [NGC5055] (left panel below)
- Comparison between different scales (right panel below):
  - less contamination from non-star-forming heating dust on 70µm for smaller regions

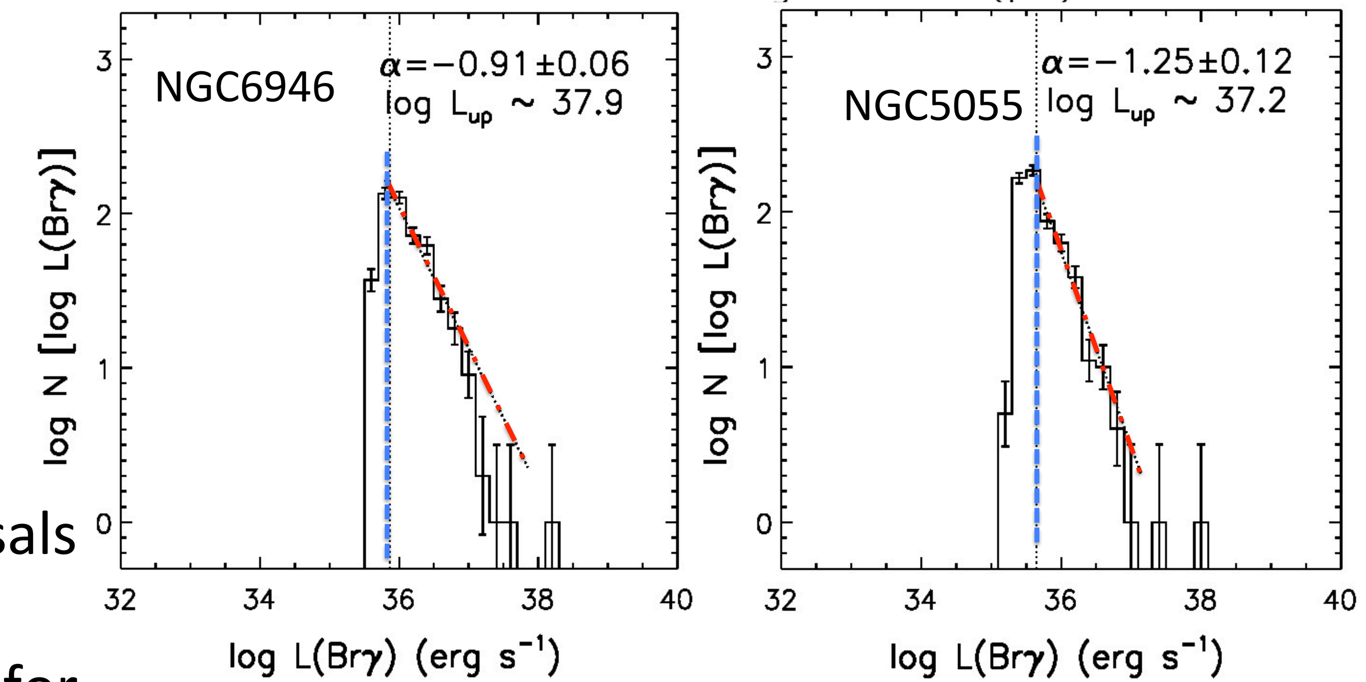






- HII region Brγ luminosity function:
  - Complete limit ~10^{36} ergs/s
  - Slope (~-1) consistent with previous studies

Li et al. in prep. 2011



- Future work:
- More KINGFISH galaxies observation proposals to WIRCam on CFHT and NEWFIRM on CTIO Blanco (2011A observed; 2011B submitted) for further study to probe the ultimate calibration and the diffuse FIR emission near HII regions

Main references: Calzetti, D., et al. 2010, ApJ, 714, 1256; Lawton, B., et al. 2010, ApJ, 716, 453; Li, Yiming, et al. 2010, ApJ, 725, 677L