GAMA photometry and the CSED

David Hill (dth4@st-and.ac.uk)

L.S. Kelvin, A.S.G. Robotham, S.P. Driver and the GAMA team

University of St Andrews

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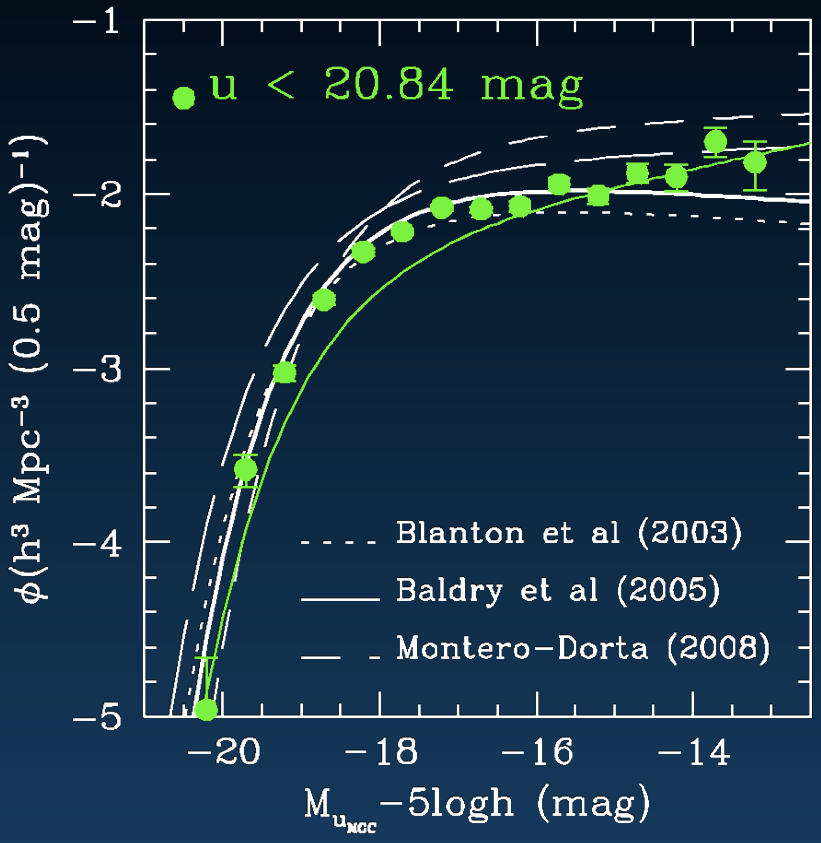
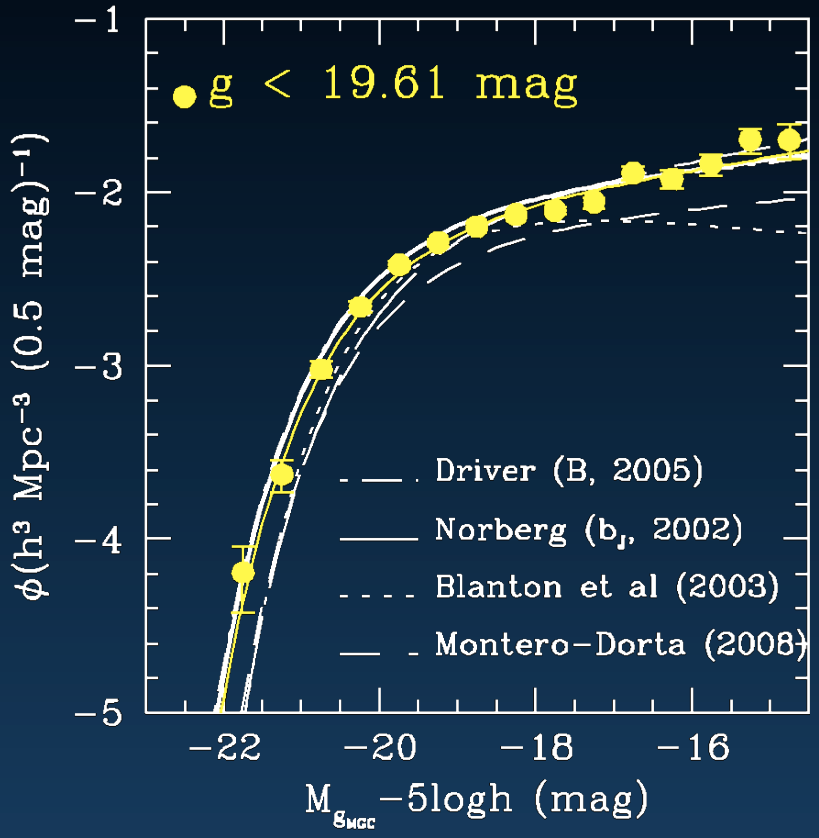
Talk summary

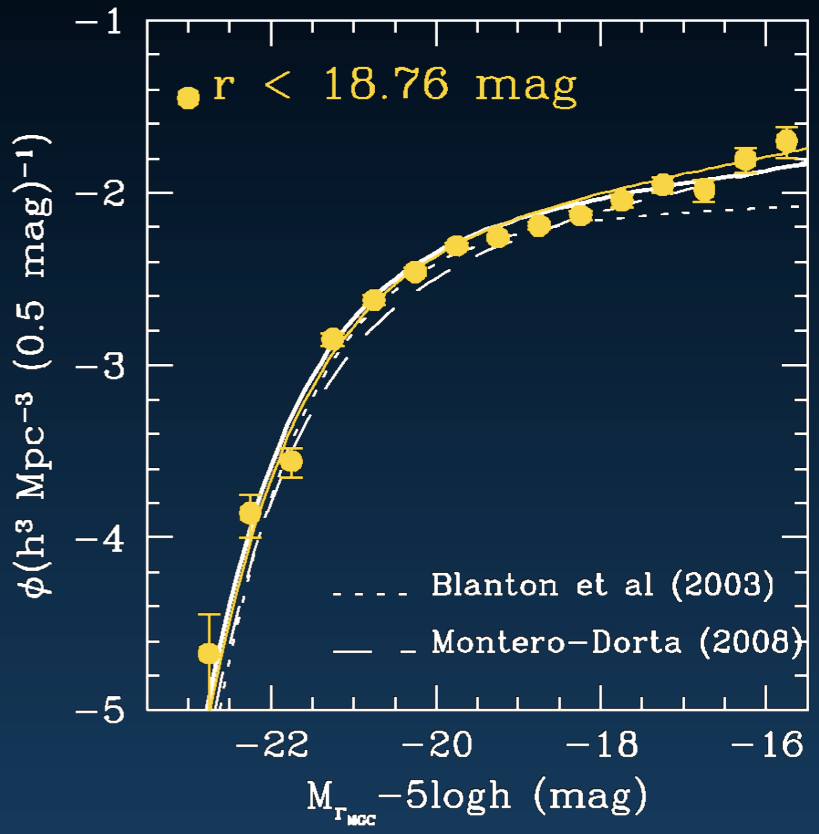
- Introduction to CSED (Hill at al 2010a)
- GAMA photometric pipeline (Hill et al 2010b, in prep)
- Early CSED results using GAMA data (Driver, Robotham et al 2010, in prep)

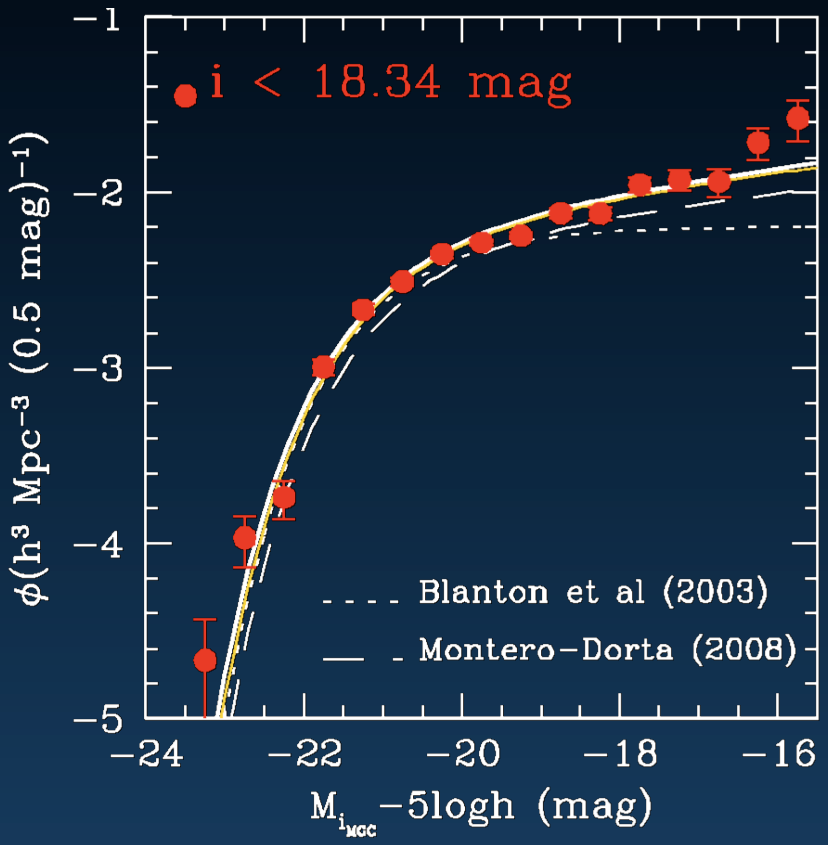
Luminosity function of galaxies

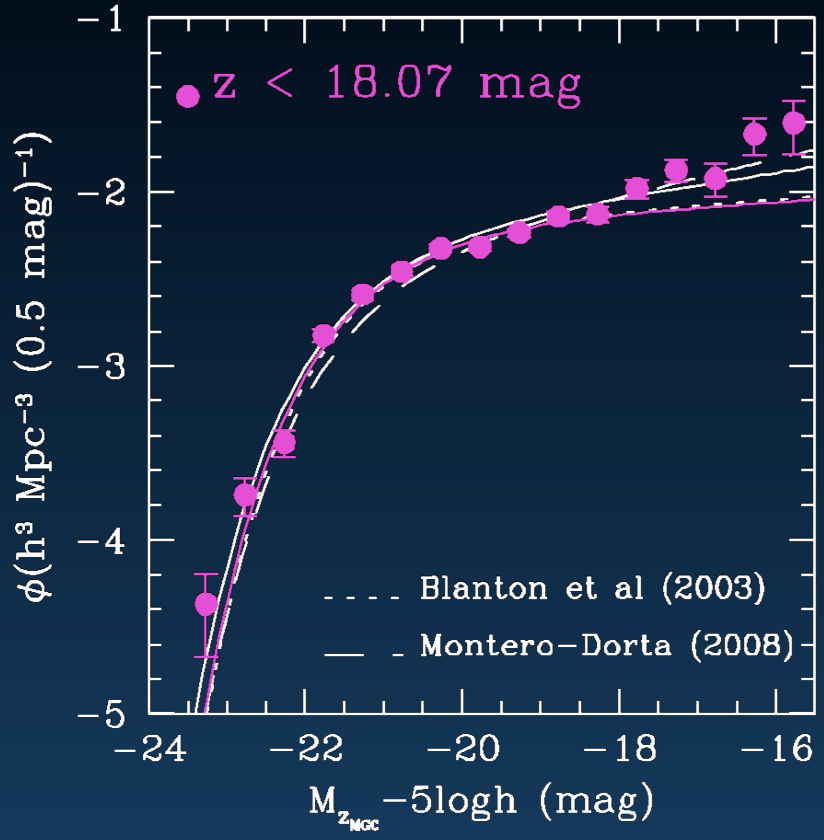


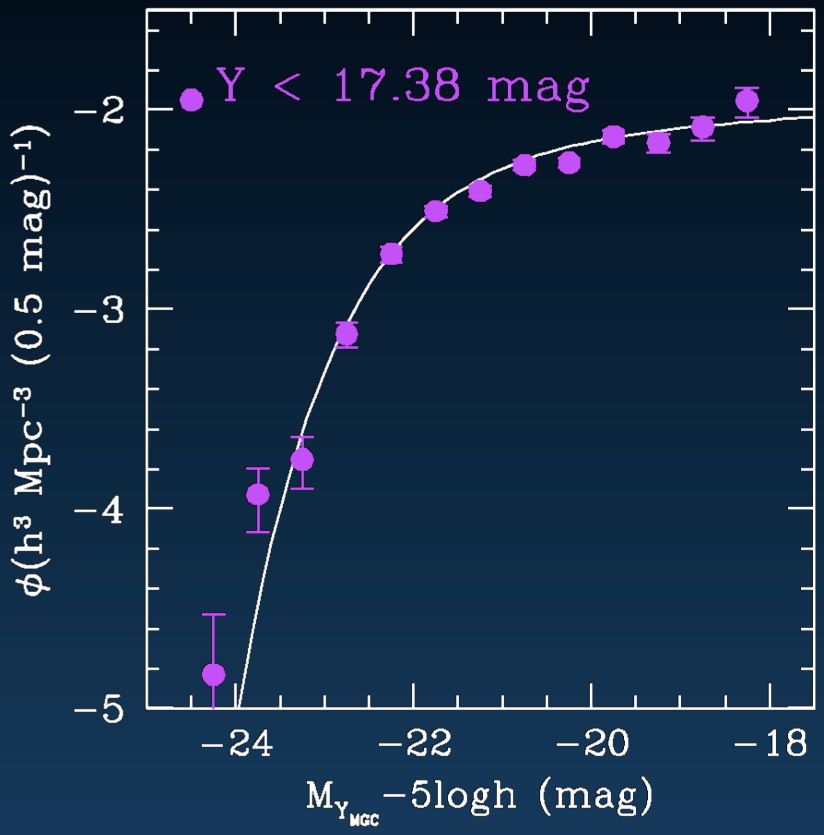
$$\phi(M) = 0.4 \ln 10 \phi^* \frac{(10^{0.4(M_* - M)})^{\alpha+1}}{e^{10^{0.4(M_* - M)}}}$$

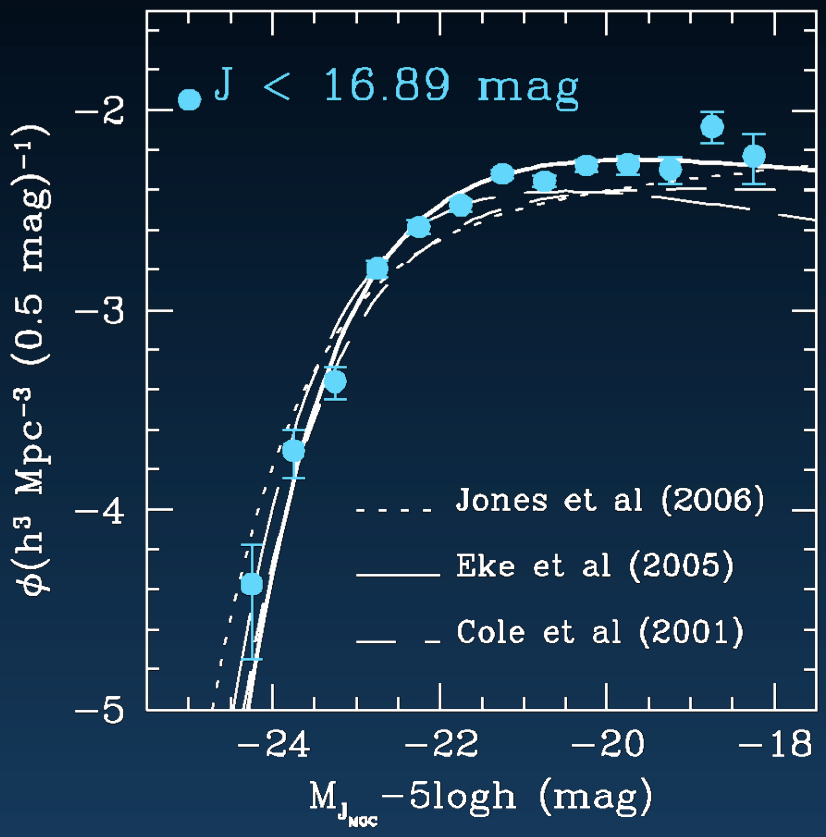

g < 19.61 mag
Driver (B, 2005)
Norberg (b$_J$, 2002)
Blanton et al (2003)
Montero-Dorta (2008)
$\phi(h^3\ Mpc^{-3}\ (0.5\ mag)^{-1})$
$M_{g_{MGC}} - 5\log h$ (mag)
−1
−2
−3
−4
−5
−22
−20
−18
−16

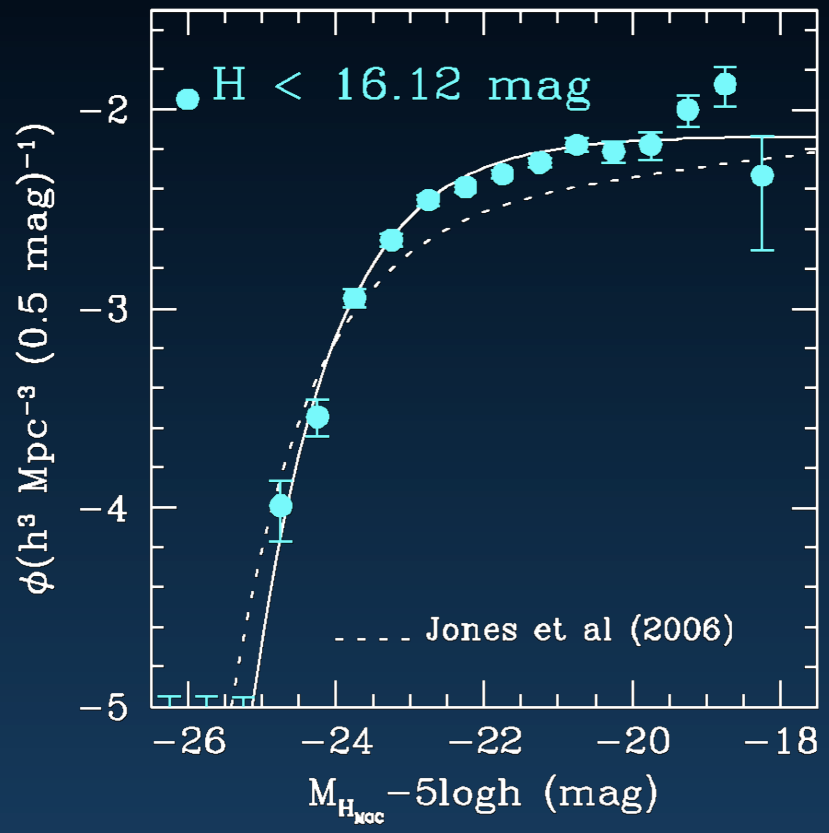

r < 18.76 mag
Blanton et al (2003)
Montero-Dorta (2008)
$\phi(h^3\ Mpc^{-3}\ (0.5\ mag)^{-1})$
$M_{r_{MGC}} - 5\log h$ (mag)
−1
−2
−3
−4
−5
−22
−20
−18
−16

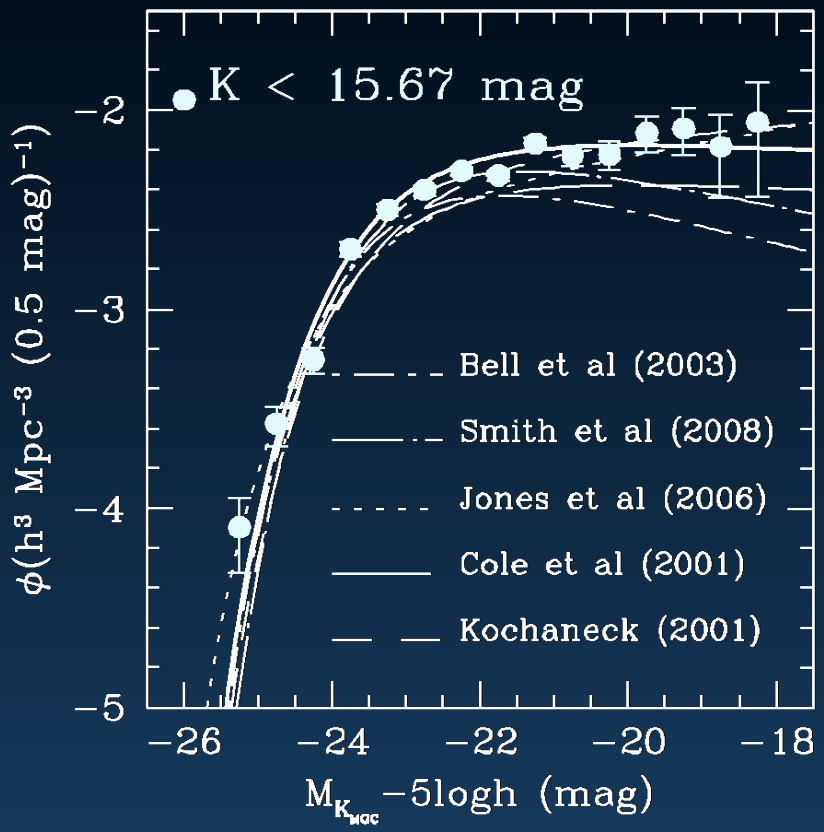

i < 18.34 mag
Blanton et al (2003)
Montero-Dorta (2008)
$\phi(h^3\ Mpc^{-3}\ (0.5\ mag)^{-1})$
$M_{i_{MGC}} - 5\log h$ (mag)
−1
−2
−3
−4
−5
−24
−22
−20
−18
−16


z < 18.07 mag
Blanton et al (2003)
Montero-Dorta (2008)
$\phi(h^3\ Mpc^{-3}\ (0.5\ mag)^{-1})$
$M_{z_{MGC}} - 5\log h$ (mag)
−1
−2
−3
−4
−5
−24
−22
−20
−18
−16

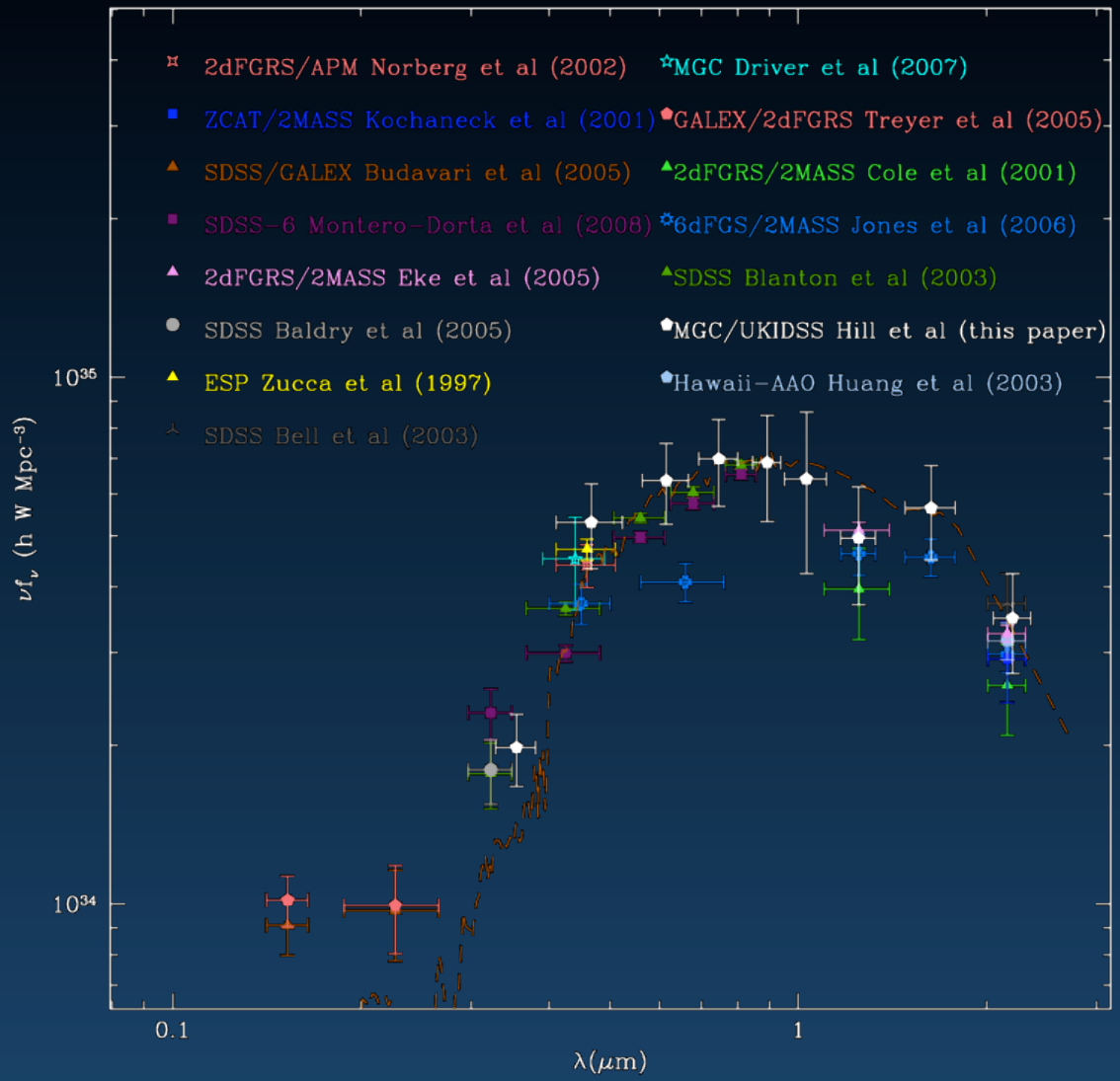

Y < 17.38 mag
−2
−3
−4
−5
−24
−22
−20
−18
$\phi(h^3\ Mpc^{-3}\ (0.5\ mag)^{-1})$
$M_{Y_{MGC}} - 5\log h$ (mag)


J < 16.89 mag
Jones et al (2006)
Eke et al (2005)
Cole et al (2001)
$\phi(h^3\ Mpc^{-3}\ (0.5\ mag)^{-1})$
$M_{J_{MGC}} - 5\log h$ (mag)
−2
−3
−4
−5
−24
−22
−20
−18


H < 16.12 mag
Jones et al (2006)
$\phi(h^3\ Mpc^{-3}\ (0.5\ mag)^{-1})$
$M_{H_{NOC}} - 5\log h$ (mag)
−2
−3
−4
−5
−26
−24
−22
−20
−18


K < 15.67 mag
Bell et al (2003)
Smith et al (2008)
Jones et al (2006)
Cole et al (2001)
Kochaneck (2001)
−2
−3
−4
−5
−26
−24
−22
−20
−18
$\phi(h^3\ Mpc^{-3}\ (0.5\ mag)^{-1})$
$M_{K_{vac}} - 5\log h$ (mag)

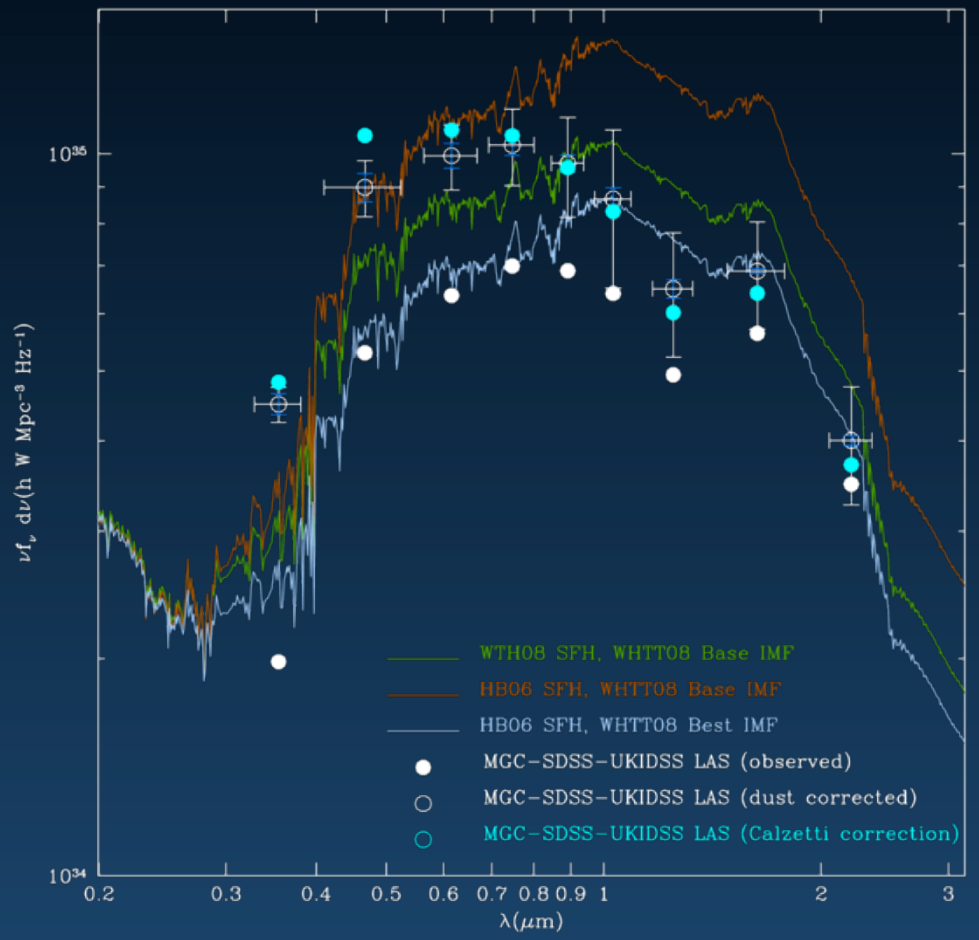
Total luminosity density of galaxies



vf(v) vs wavelength in the UV to NIR

Dust correction and model fitting

- Effects of dust change with wavelength
- Correct for dust, compare to IMF+SFH models



Brief GAMA summary

- Multi-wavelength spectroscopic survey of 144 sq deg, with photometric coverage from UV to radio.
- 3 years of observations using AAT, producing spectra for >100 thousand sources
- Complete SDSS coverage, mostly complete UKIDSS and GALEX coverage.

Why do we need to redo the existing photometry?

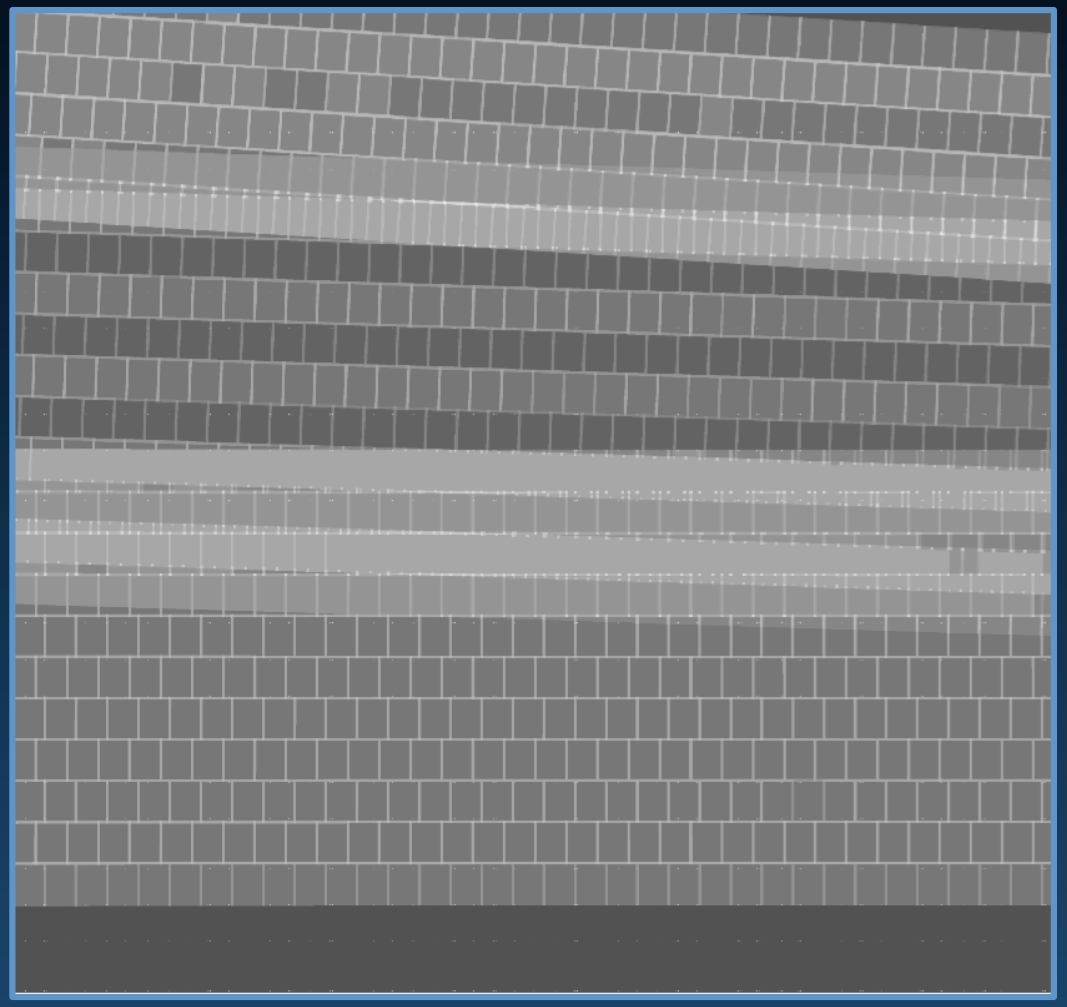
- Inconsistencies in aperture size calculations
- Inconsistencies in deblending choices
- Inconsistencies in magnitude systems (AB or Vega)
- Elliptical apertures

urK colour images of 5 GAMA galaxies (taken from the GAMA mosaics)

The GAMA imaging pipeline

- Download all SDSS and UKIDSS images inside GAMA.
- Renormalise all images to a standard zeropoint and onto the AB magnitude system. Zpt(AB) = 30mag.
- Degrade images to 2” seeing where necessary
- Use SWARP – Emmanuel Bertin's mosaicing program – to produce mosaics of the GAMA regions.

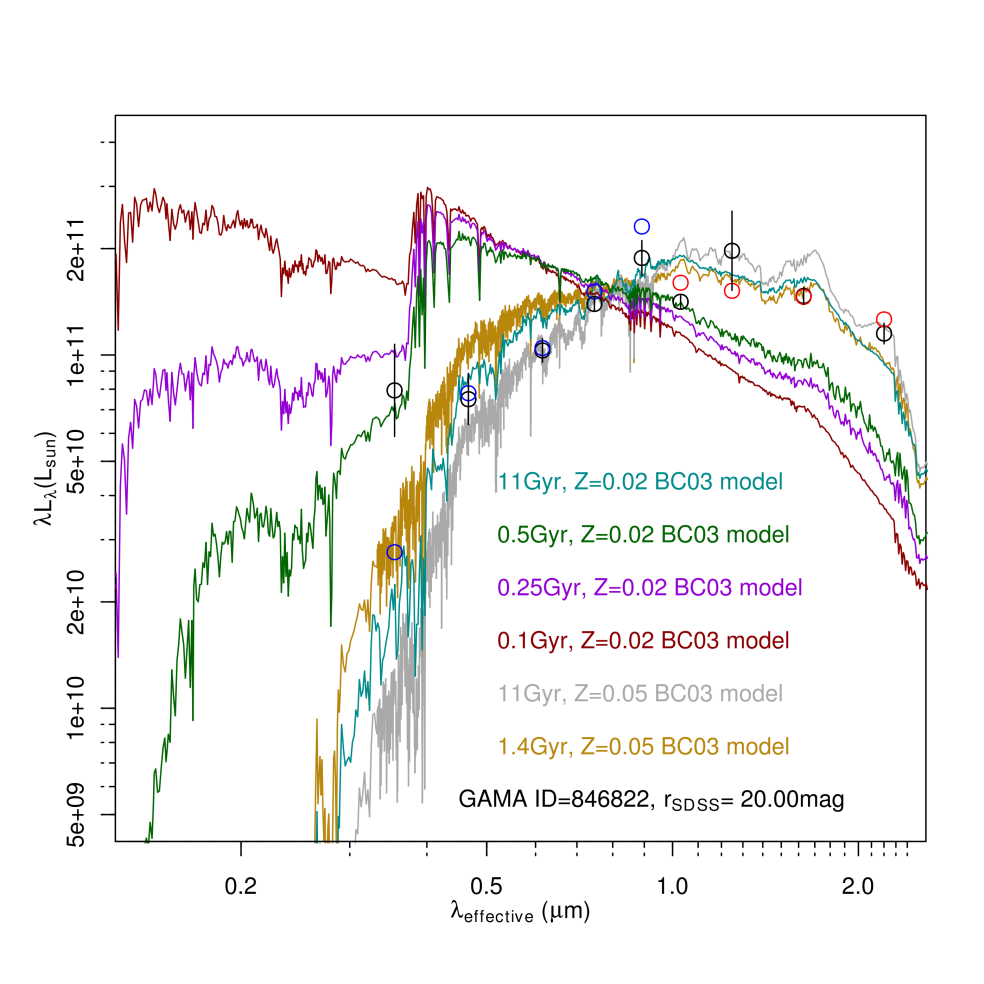
The r band weight map of a 25sq deg subset of the GAMA9 region (approx a half of the GAMA 9 mosaic)

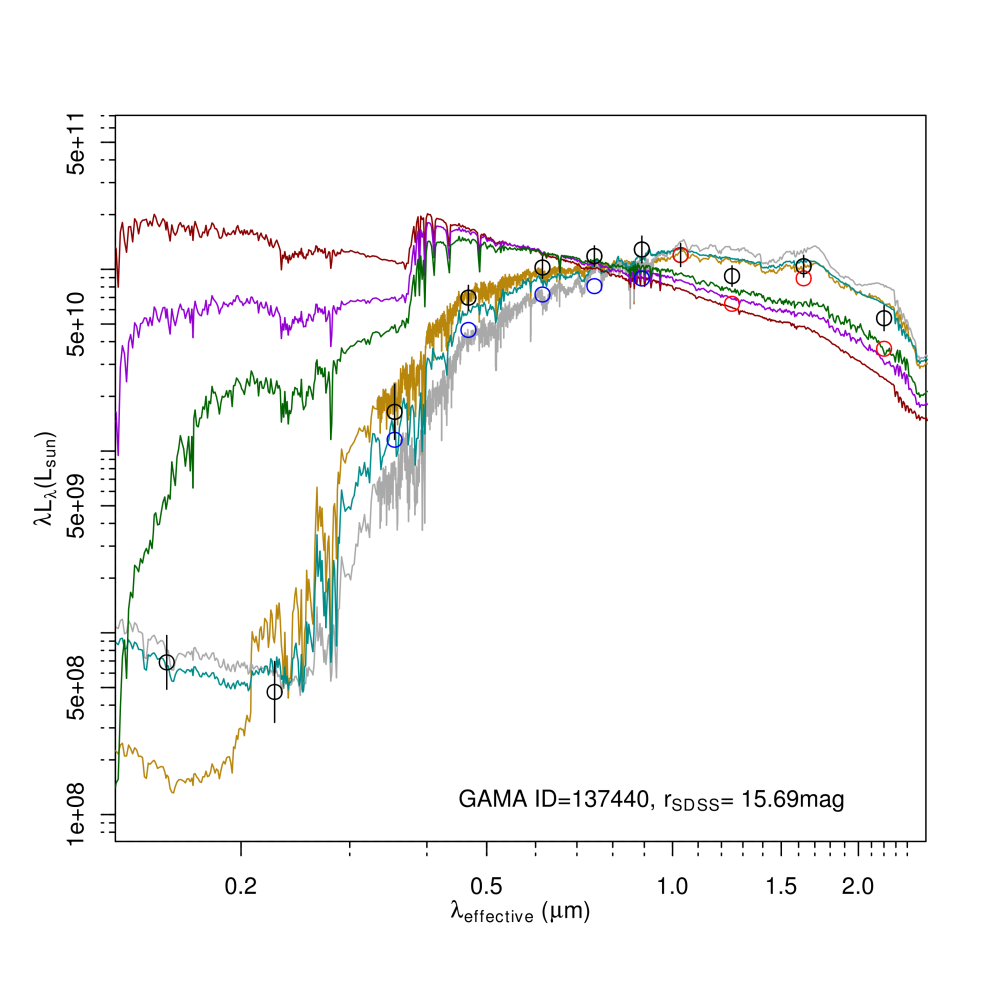


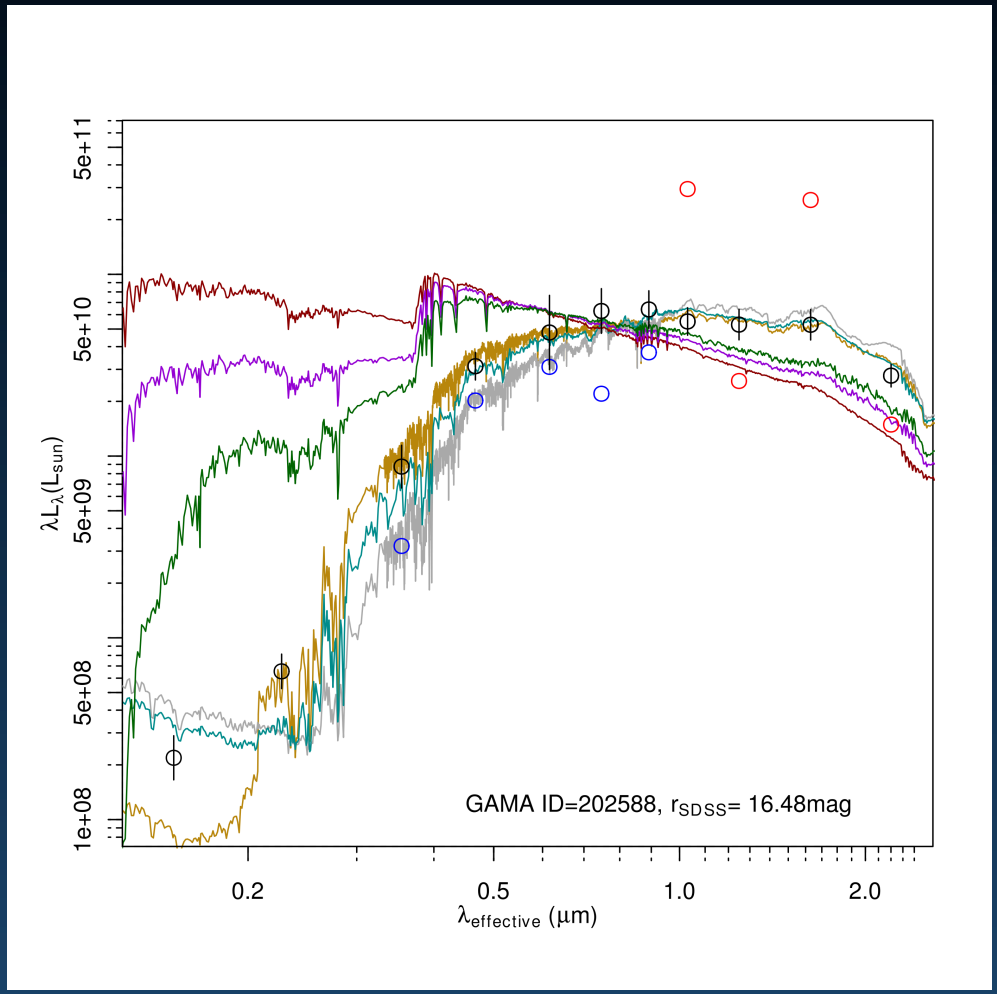
The GAMA photometric catalogues

- Run Sextractor in dual-image mode to produce source catalogues that have ugrizYJHK magnitudes, from apertures defined internally, or using the r or K band mosaics.
- Recombine with the GAMA source catalogue
- + Sersic magnitudes (see Lee Kelvin's poster)

An improvement?

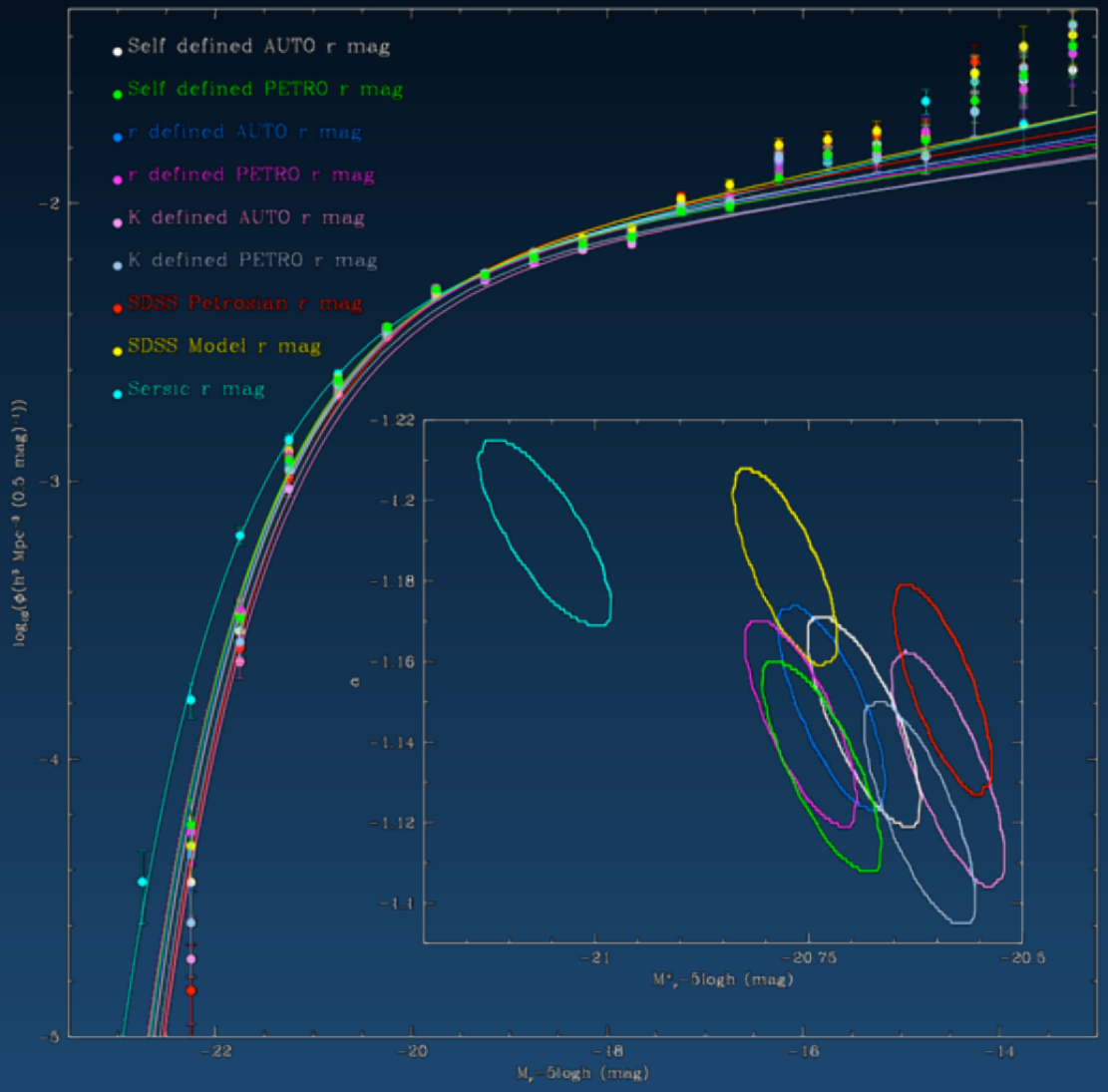



5e+11
5e+10
5e+09
5e+08
1e+08
λL_λ(L_sun)
GAMA ID=137440, r_SDSS= 15.69mag
0.2
0.5
1.0
1.5
2.0
λ_effective (μm)

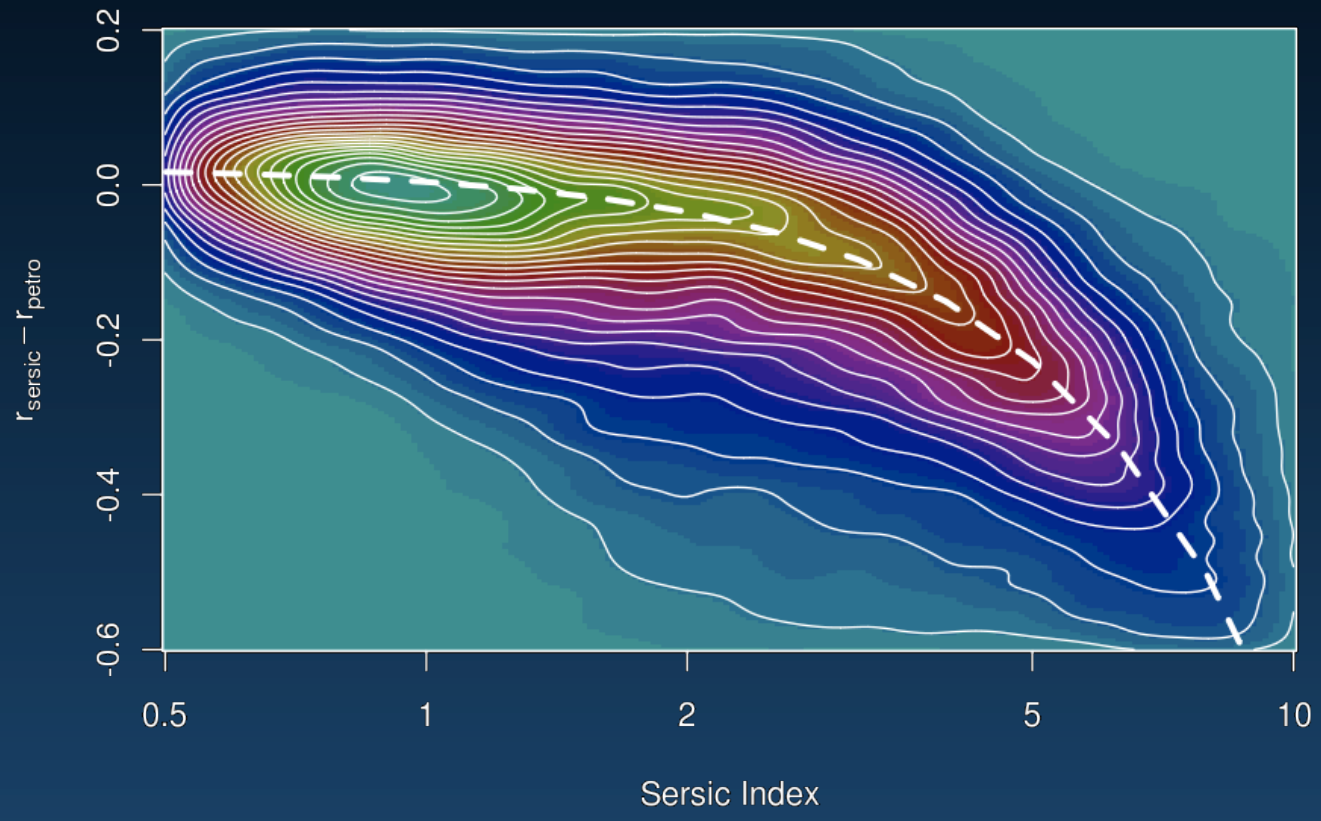

5e+11
5e+10
5e+09
5e+08
1e+08
λL_λ(L_sun)
GAMA ID=202588, r_SDSS= 16.48mag
0.2
0.5
1.0
2.0
λ_effective (μm)

LFs created using different photometric methods

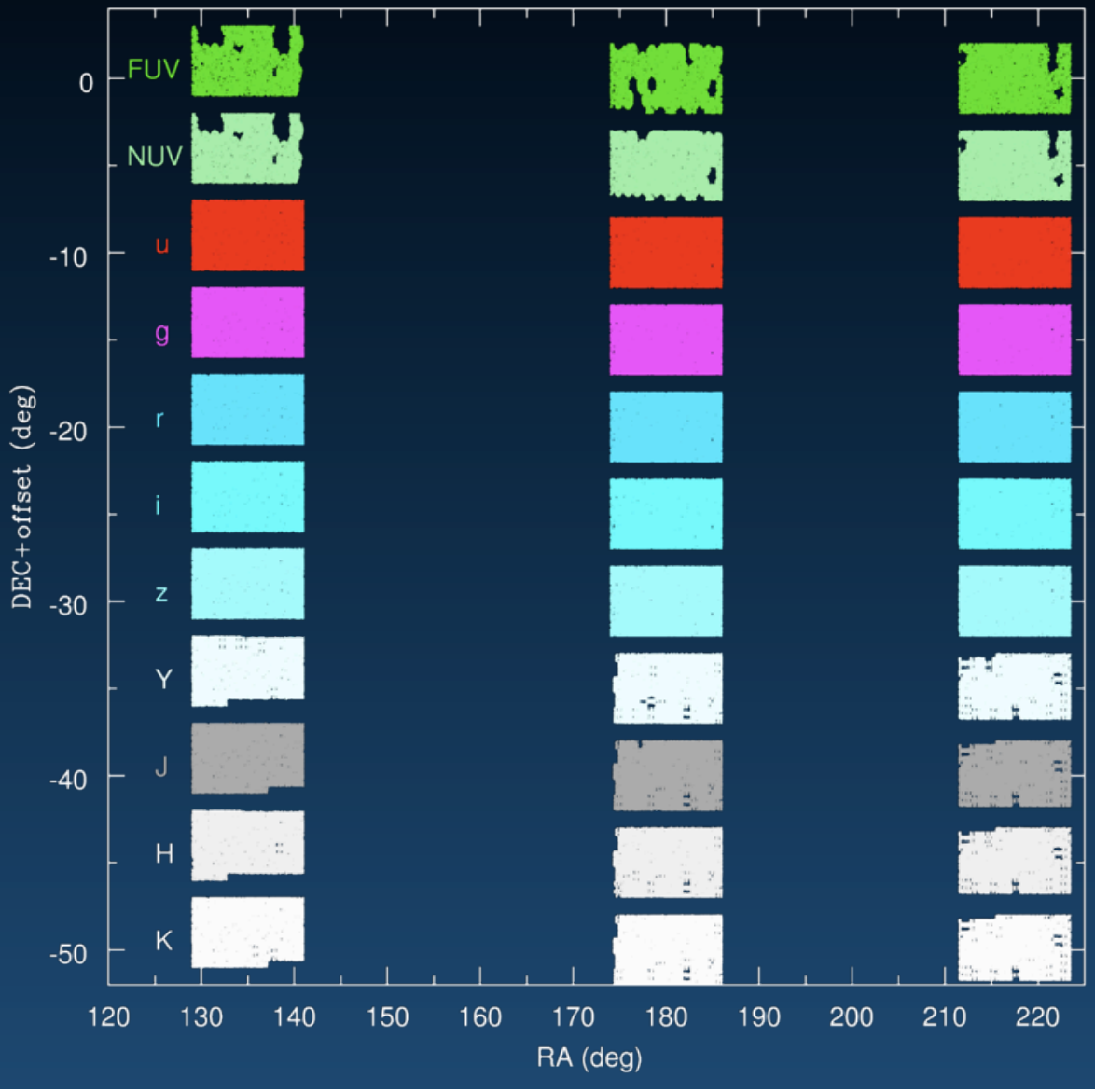
- r band LFs showing faint end upturn?
- Consistent discrepancy between Kron and Petrosian magnitudes
- Total magnitude samples have higher alpha parameter
- Sersic sample overdense at bright end



Sersic-Petrosian offset with n



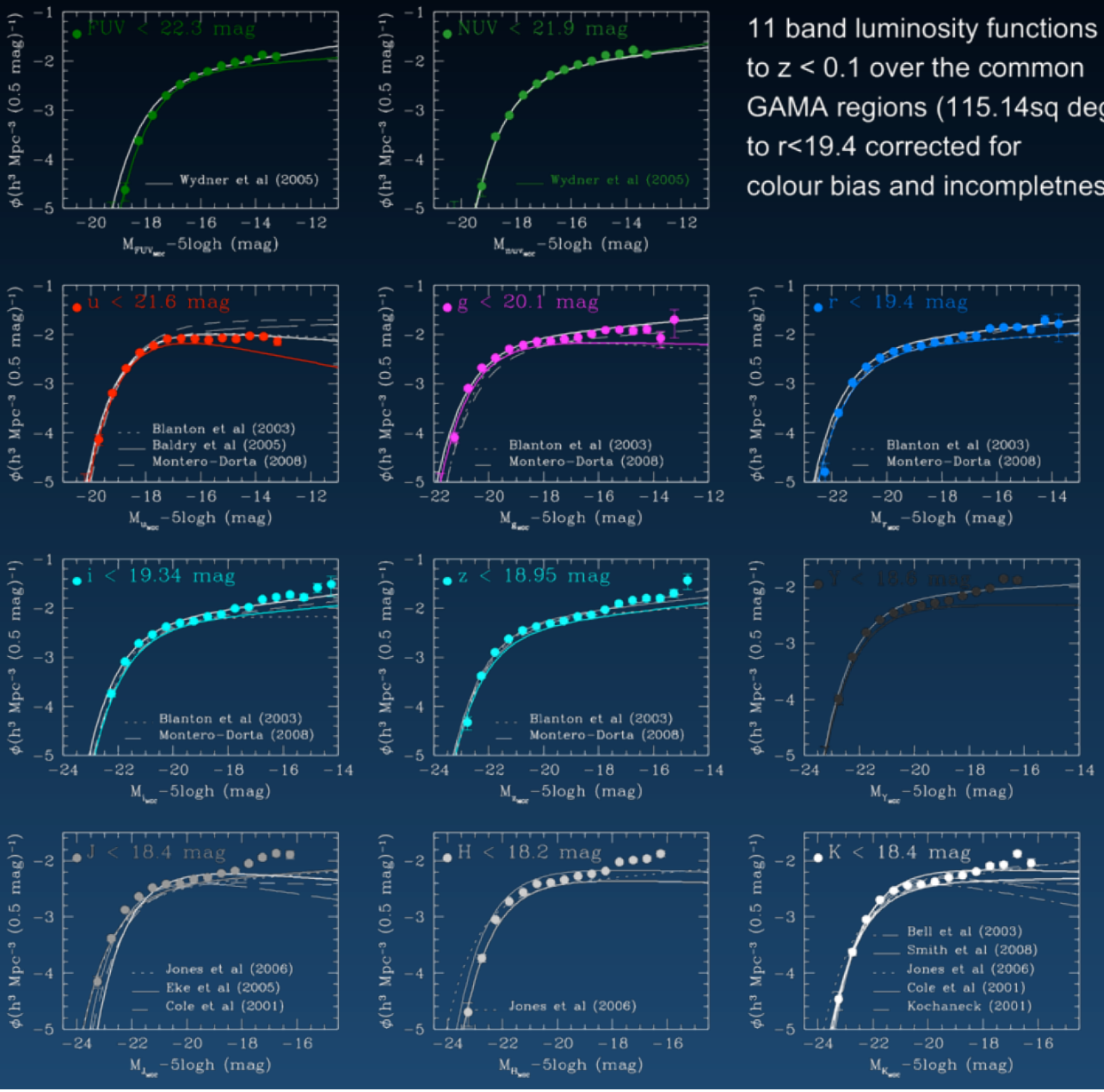
GAMA CSED creation - coverage



Sky coverage of 11 UV-NIR bands used to create the GAMA CSED

Courtesy Simon Driver

Early LFs using GAMA photometry

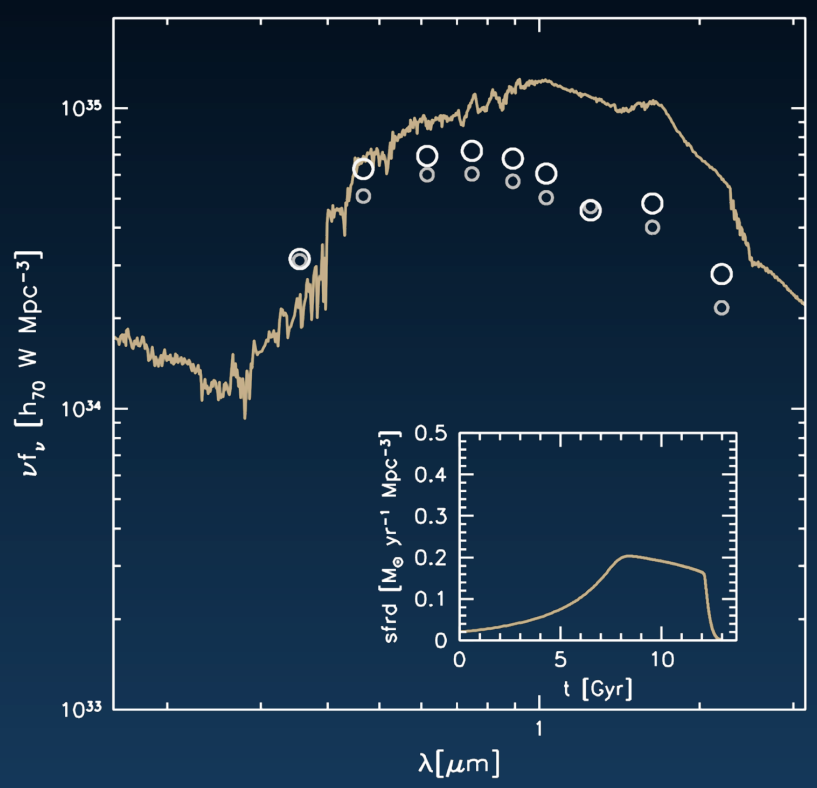


11 band luminosity functions to z < 0.1 over the common GAMA regions (115.14sq deg) to r<19.4 corrected for colour bias and incompletness.

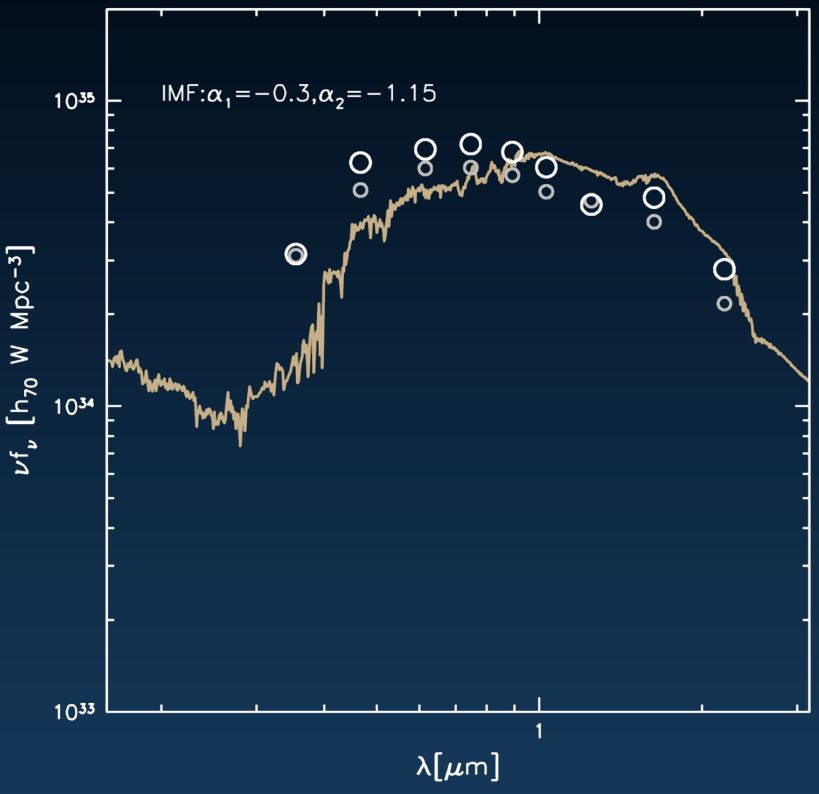
Created from a combination of Sersic r band photometry and r-defined Kron aperture colours

Courtesy Simon Driver

Early GAMA CSED model fits



Hopkins & Beacom (2006) CSFH with Salpeter IMF evolved using PEGASE 2 synthesis model



The result when converted to a Wilkins, Hopkins & Trentham (2008) IMF

Courtesy Steve Wilkins

Conclusions

- Calculating the CSED is subject to a number of systematic biases.
- The GAMA imaging pipeline circumvents many of them.
- GAMA has produced consistent elliptical aperture photometry for ugrizYJH and K filters. Elliptical GALEX photometry is also available.
- This data is already available to GAMA team members, and will be released to the public in the future.
- Work is underway to find a combination of SFH and IMF that fit the GAMA CSED observations