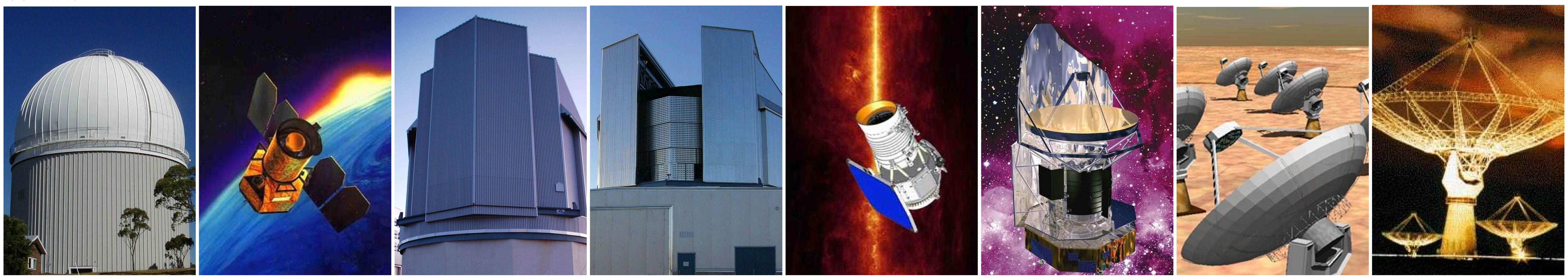
GALAXY AND MASS ASSEMBLY

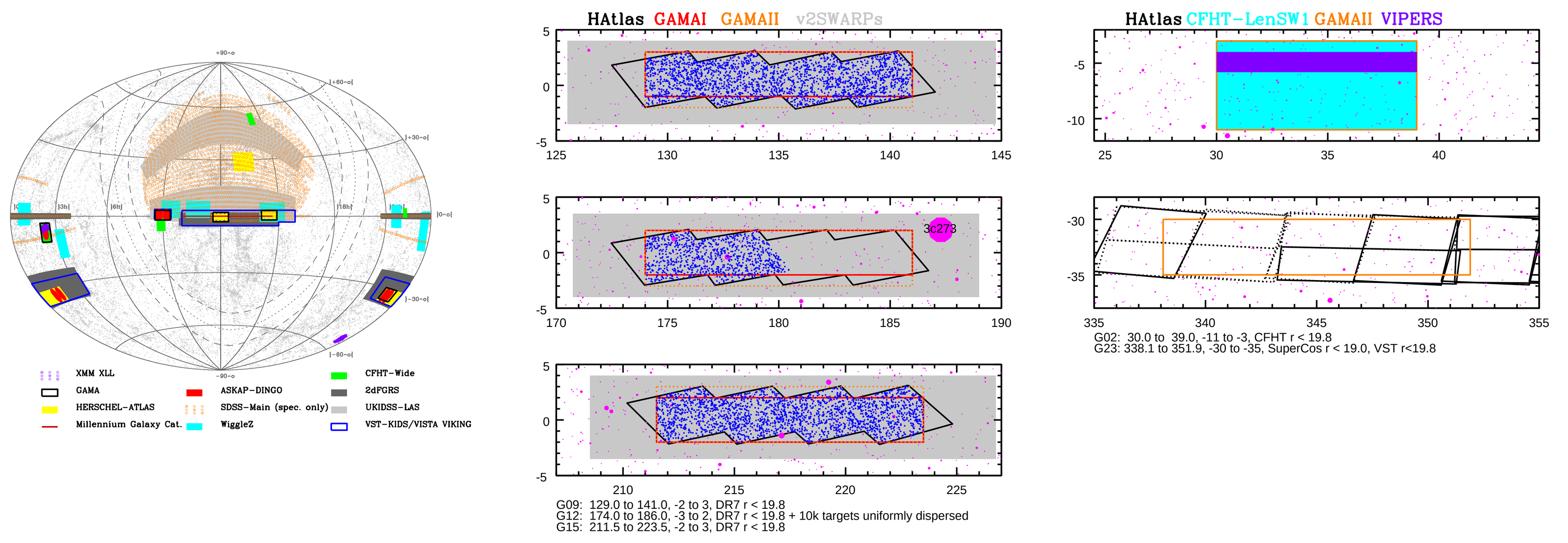
Simon P. Driver (UWA/ICRAR), Andrew Hopkins (AAO), Joe Liske (ESO),
Sarah Brough (AAO), Aaron Robotham (St Andrews) and the GAMA team
gama@gama-survey.org, http://www.gama-survey.org/

What:



The images above show the telescopes currently surveying, or planning to survey, the GAMA regions. From left-to-right the facilities are: the AAT, GALEX, VST, VISTA, WISE, Herschel, ASKAP, GMRT. Once combined these data will sample over 27 wavelengths from the FUV through to the radio. The generic aim is to study the spectral energy distribution from 0.1 micron to 1m for over 350,000 galaxies to enable a consistent and combined study of the stellar, dust and gas contents. In addition the spatial resolution in the optical and near-IR wavebands will also allow for resolved studies on 1kpc scales out to a redshift of 0.1. This will enable a thorough investigation of structure on 1kpc to 10Mpc scales — the interface between the Dark Matter and baryonic regimes.

Where:

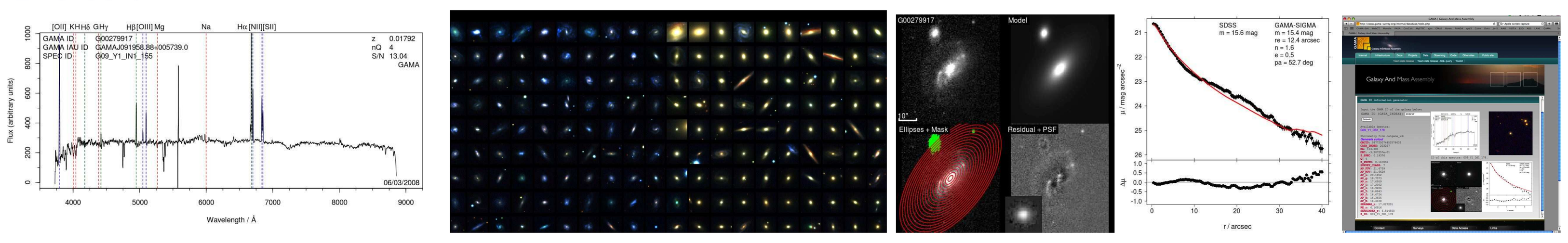


The images above show the five GAMA survey regions (left, black boxes) and the zoomed in GAMA regions (centre and right, red rectangles). Also shown are the overlap regions from a number of complimentary private and public surveys as indicated. The blue data points show the currently available Herschel-Atlas sources. For each GAMA region we construct single image SWARPs at 0.339 arcsecond resolution in each band to facilitate matched aperture photometry, and other complex algorithms, to ensure flux is measured consistently across all wavelengths. This becomes significantly harder as one stretches into radio wavelengths as the emission processes emanate from fundamentally different components (e.g., the gas disc is generally much larger than the stellar disc).

Who:

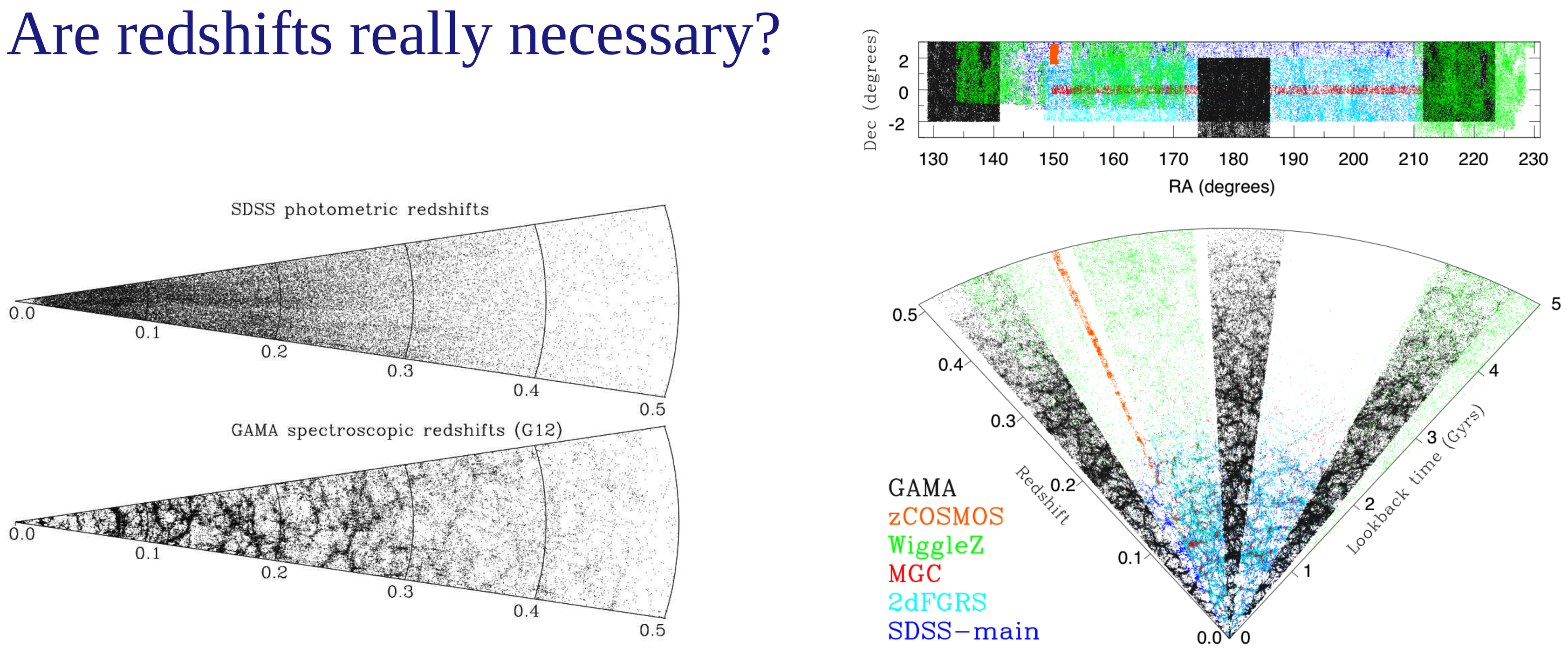
The GAMA team is an international collaboration involving over 50 scientists spread across 20 institutions and distributed mainly across Australia, Europe, and the US. The collaboration partners from the associated imaging teams stretches into the many hundreds and includes: the GALEX MIS, VST KIDs, VISTA VIKING, UKIDSS LAS, WISE, Herschel-Atlas, and the ASKAP DINGO teams.

Data:



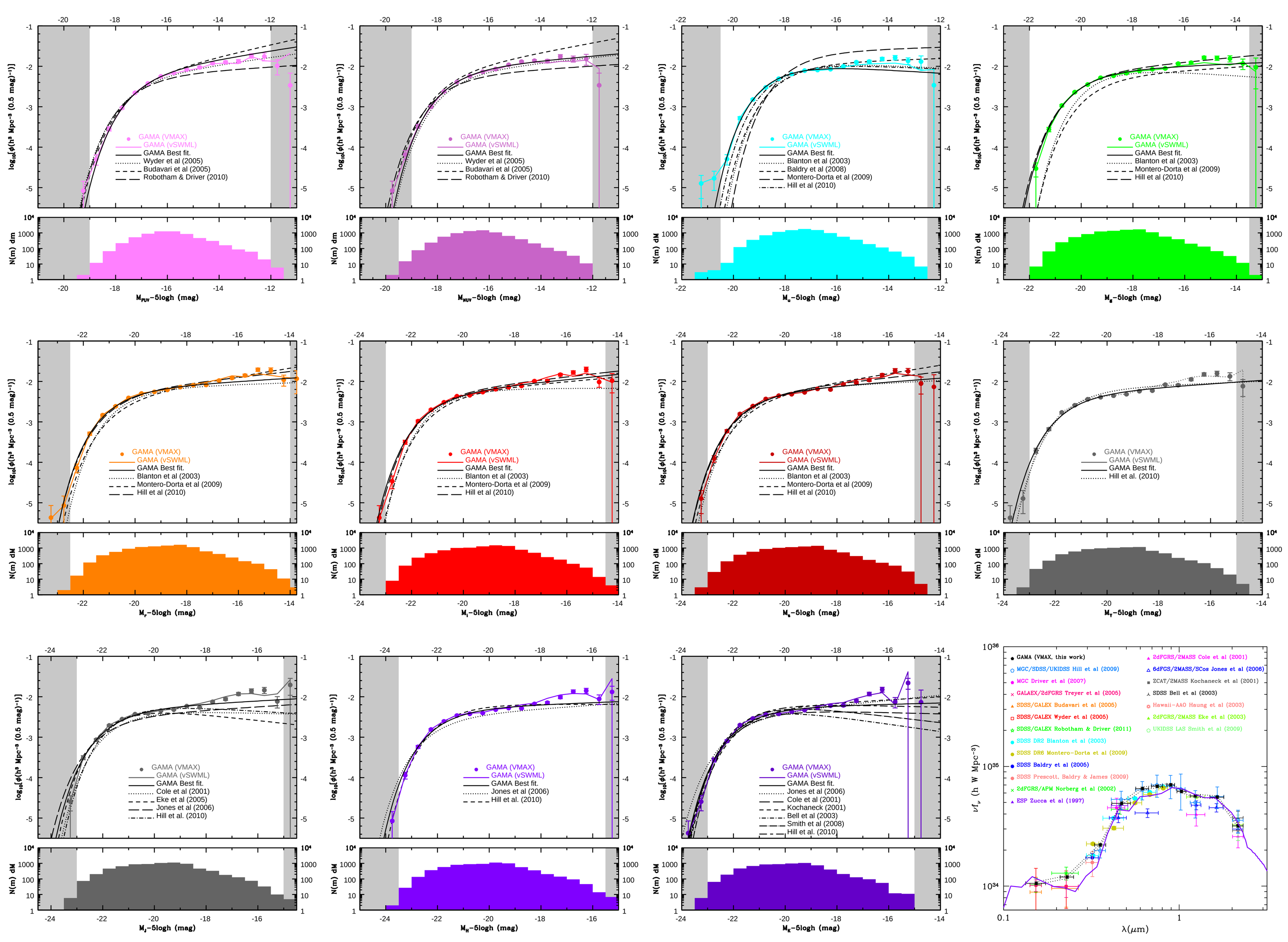
When complete data products available will consist of flux calibrated spectra (far left) with spectral line measurements using GANDALF, astrometrically and flux calibrated images/maps and photometry in 27 bands (FUV,NUV,ugriz,YJHK,mid-IR,far-IR,radio), surface brightness profiles (near right) in all optical and near-IR bands including structural decomposition using GALFIT3, group, filament & supercluster catalogues, and stellar, baryonic, dynamical and halo mass measurements. Data and catalogue access will be via an online MySQL database with VO compliant data inspection tools (far right).

Are redshifts really necessary?



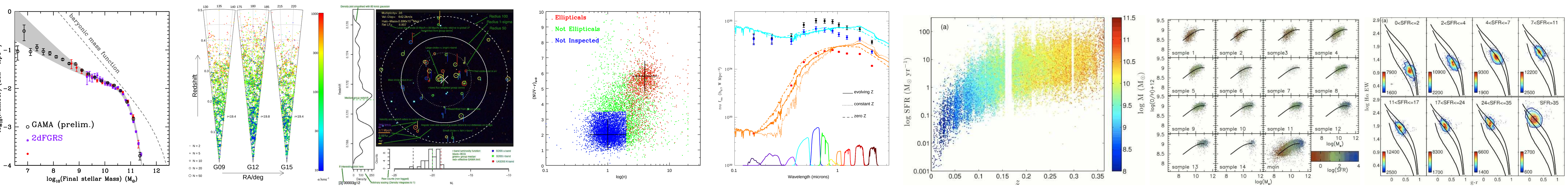
The fist figure (left) shows the GAMA G12 cone-plot using photometric (upper) or spectroscopic redshifts (lower). The gain of spectroscopic redshifts over photometric redshifts, particularly at low redshift for group finding and mapping large scale structure, is self-evident. GAMA will ultimately collect 350,000 redshifts at a surface density of 1000 galaxies per sq deg. This compares to ~80 galaxies per sq deg for SDSS Main Survey and ~125 redshifts per square degree for the 2dFGRS. The second plot (right) shows the lookback-cone compared to other leading surveys indicating GAMA's ability to trace large scale structure to redshift 0.5.

The energy output of the nearby Universe:



The galaxy luminosity functions shown above have been derived from a single unified volume with complete multi-wavelength coverage from within the GAMA survey regions using reprocessed SDSS and UKIRT matched aperture photometry from $u-K$ and dedicated GALEX data. From the luminosity functions one can derive the luminosity density of the nearby Universe (final figure). Combining the data over the full wavelength range we are building up a picture of the energy output of the Universe which is robust to cosmic variance and suitable for use in constraining models. At the moment we are only sampling the stars but we are currently assimilating the WISE and Herschel data which will sample the warm and cold dust (mid & far-IR) and looking forward to ASKAP coming online to enable us to sample the neutral gas to obtain HI masses, dynamical masses and velocity profiles.

GAMA Science showcase:



From left-to-right: Fig. 1 The most recent measurement of the galaxy stellar mass function (Baldry et al. in prep.) extending significantly deeper than previous studies; Fig. 2 the distribution of GAMA groups within the GAMA volume showing group multiplicity number.; Fig. 3 a group image from the GAMA group catalogue which includes over 20,000 groups detected and analysed in a systematic way (Robotham et al 2011, in press); Fig. 4 galaxy bimodality demonstrating that structure is a better separator than colour (Kelvin et al, in prep.), in fact the reddest galaxies in the Universe are edge-on dusty spirals; Fig. 5 using the Cosmic spectral energy distribution constructed above one can start to constrain the metallicity evolution of elliptical galaxies (Driver et al., in prep.); Fig. 6 shows the star-formation rate versus redshift for our sample, the gaps are caused by Hα passing through regions in the spectra where there are prominent night sky lines; Fig. 7 the mass-metallicity relation for various sub-samples extending out in redshift, the solid line shows the z=0 measurement found by Kewley & Ellison (2008) which appears to hold out to z=0.35 (over 3 Gyrs); Fig. 8 the data indicate that systems with higher star-formation rate exhibit flatter IMF slopes as indicated by the solid lines which vary from Salpeter (central line, $\alpha=-2.35$) to $\alpha=-2$ (higher line), and $\alpha=-3$ (lower line) (Gunawardhana et al., 2011).

Data available on request from gama@gama-survey.org
or downloadable via http://www.gama-survey.org/