GAMA-SIGMA

Single and Multi-Component Galaxy Modelling

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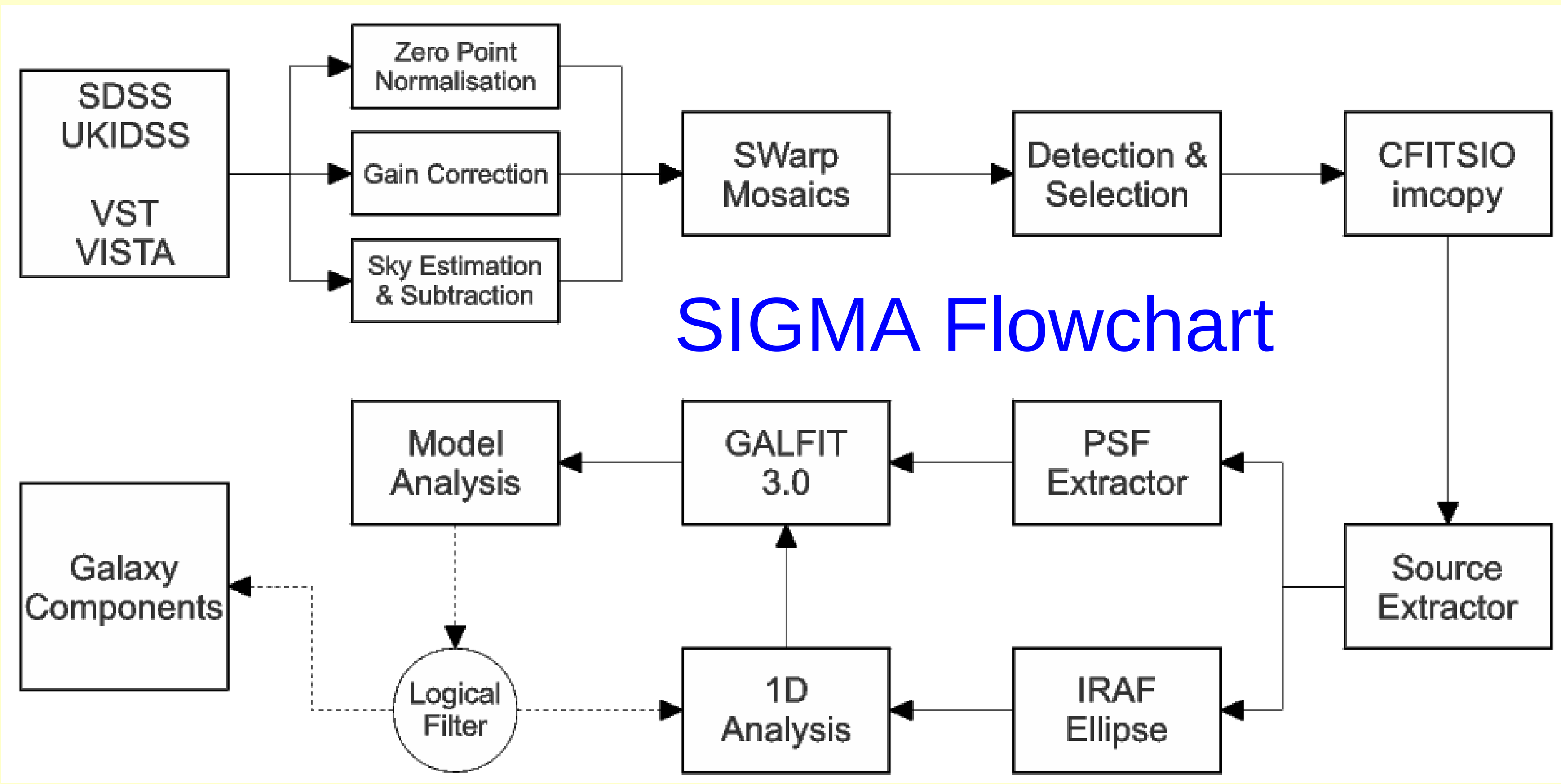
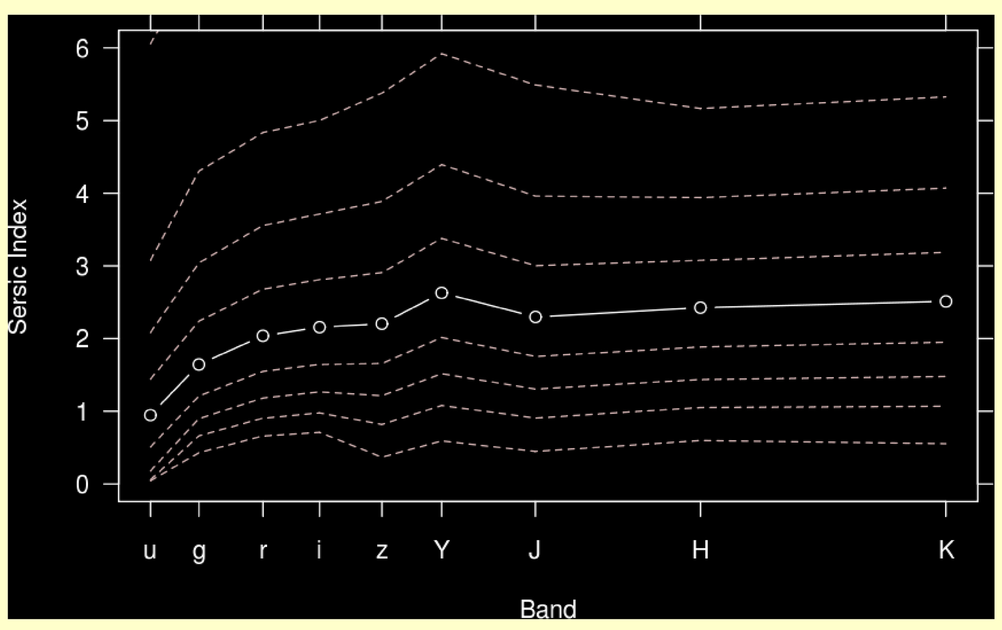
Preliminary results from the GAMA structural decomposition pipeline GAMA-SIGMA show that fitting a Single-Sérsic component to a galaxy returns a more accurate measure of total galaxy flux and effective radius than traditional photometric methods. Furthermore, we find that modelling at low wavelengths severely restricts the recoverability of these galactic properties, in part due to lower emitted flux but also the effect of dust at low wavelengths. Consequently, we find that high-fidelity Sérsic fits are only possible when modelling at wavelengths longer than the i-band (747.1nm).

We also demonstrate the full structural-decomposition capability of SIGMA, based around GALFIT 3.0 (Peng et al. 2002), providing an exciting insight into the formation and evolution of galaxies by mapping the structure of galaxies to z=0.1. Eventually this method will be applied to ~12,000 nearby galaxies in the forthcoming high-resolution/deep VST & VISTA imaging of the GAMA fields.

Data is taken from optical-to-near-IR imaging across 9 bands from the SDSS (ugriz) & UKIDSS-LAS (YJHK) surveys.





GAMA-SIGMA

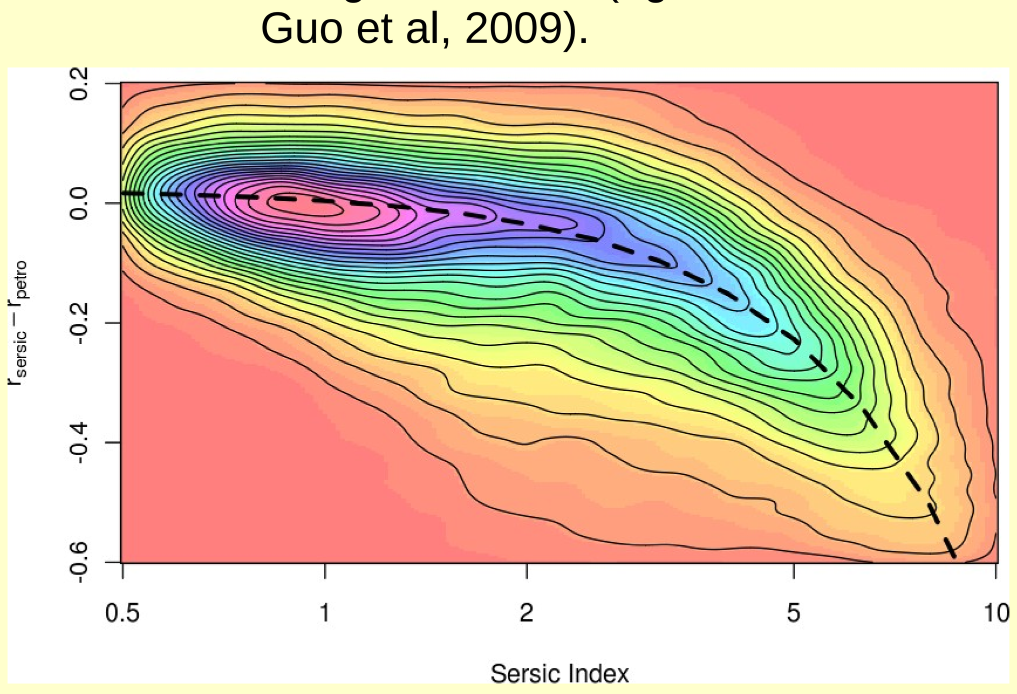
The flowchart above shows how the SIGMA pipeline works. SIGMA makes use of several contemporary astronomy tools, including Source Extractor (Bertin & Arnouts, 1996), the IRAF STSDAS Ellipse package, PSF Extractor (Bertain, priv. comm.) and GALFIT 3.0 (Peng et al, 2002). Additional code is written in the programming/scripting language R.

SIGMA generates all of its inputs automatically (radii, PSF, etc), as opposed to other automated galaxy fitting software (eg; GALAPAGOS, Guo et al, 2009).

Early Results

Above: A clear turn off in recovered Sérsic index with wavelength is observed, limiting the reliability of fits at shorter wavelengths.

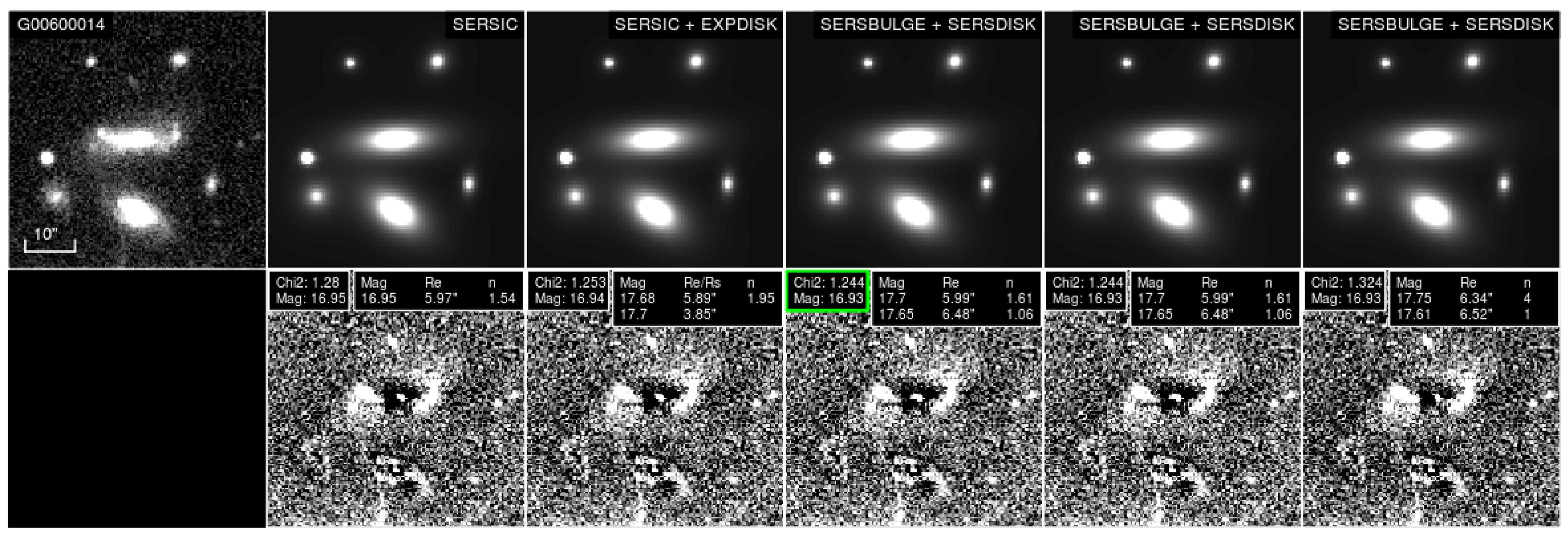
Right: A comparison between recovered Source Extractor petrosian magnitudes and Sérsic magnitudes as a function of Sérsic index. As expected, high-Sérsic index objects recover more flux for n > 4.



Bertin E., Arnouts S., 1996, A&AS, 117, 393
Driver S. et al., 2008, A&G, 50, 050000
Guo Y. et al. 2009, MNRAS, 398.1129G
Peng C., Ho L., Impey C., Rix H., 2002, AJ, 124, 266P

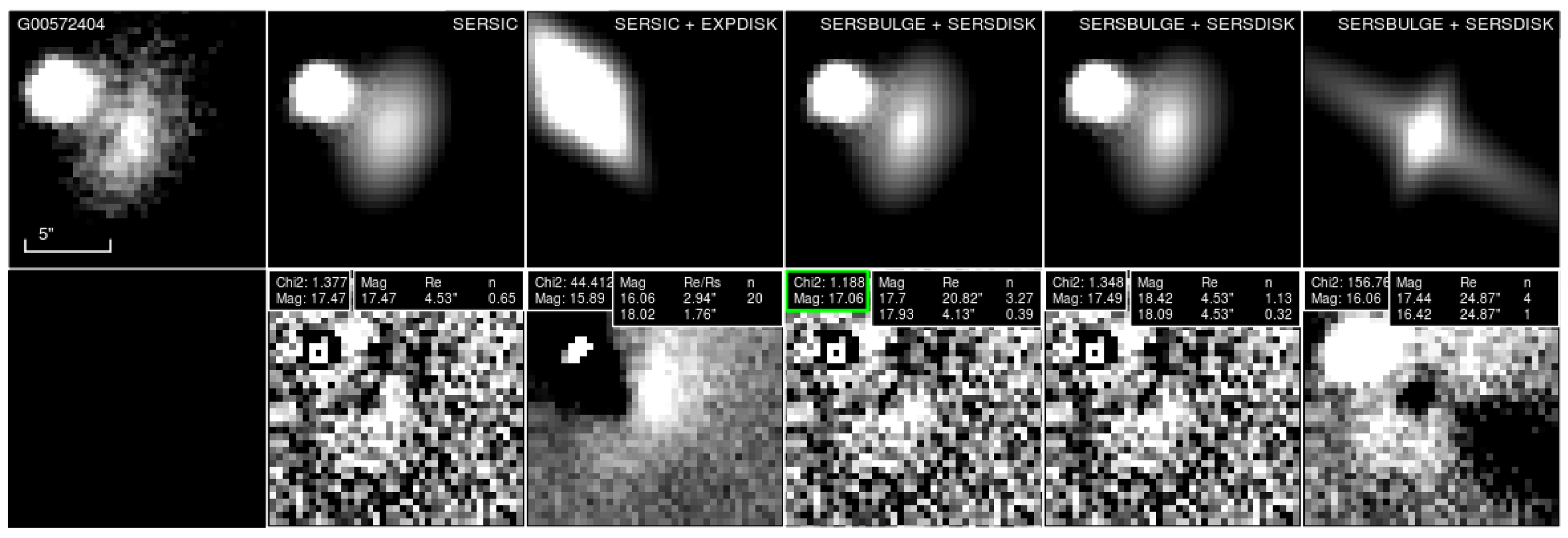
The Good, The Bad and The Ugly

Here I show 3 casestudies showing the best and the worst of fitting with SIGMA. The model types are given at the top of each column, briefly: (1) Single Sérsic, (2) Sérsic + Exponential, (3) free double-Sérsic, (4) double-Sérsic (bulge/disk Re < 1, bulge/disk n > 1), (5) de Vaucouleurs bulge, exponential disk (bulge/disk Re < 1).



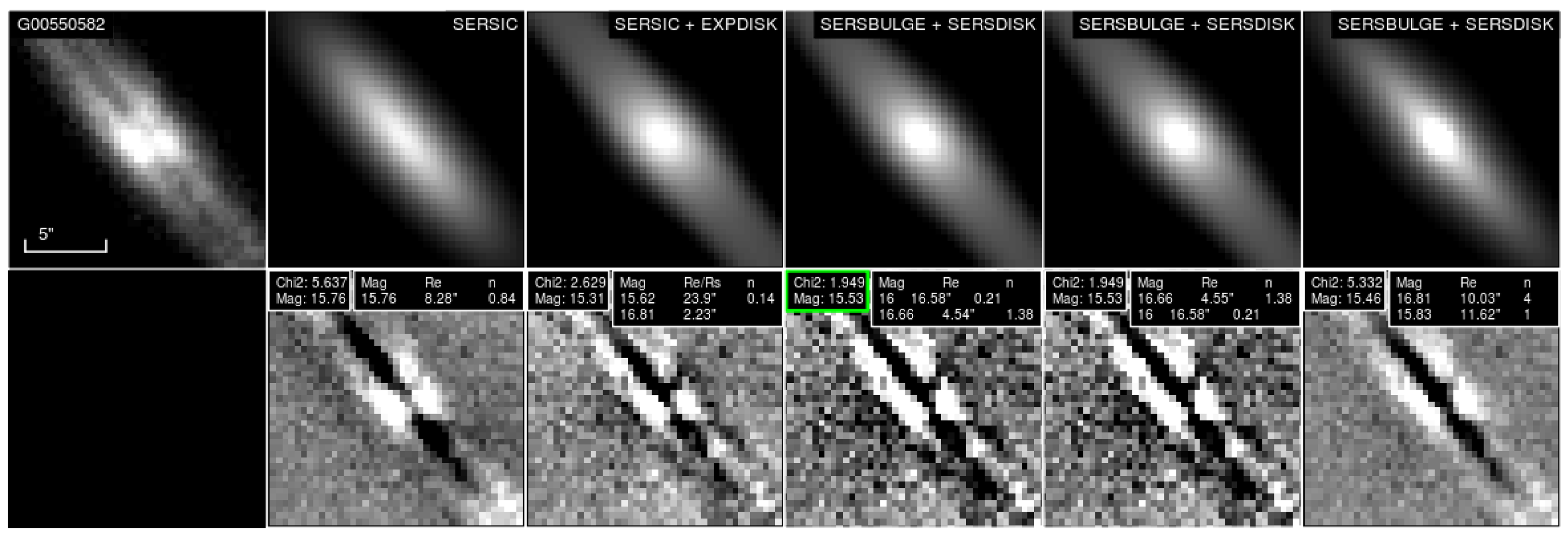
G00600014

Fitting to the main central object and 6 secondary objects. This field showcases the simultaneous fitting capability of GALFIT, a significant improvement over masking secondary objects. Here however a single-Sérsic may be preferable.



G00572404

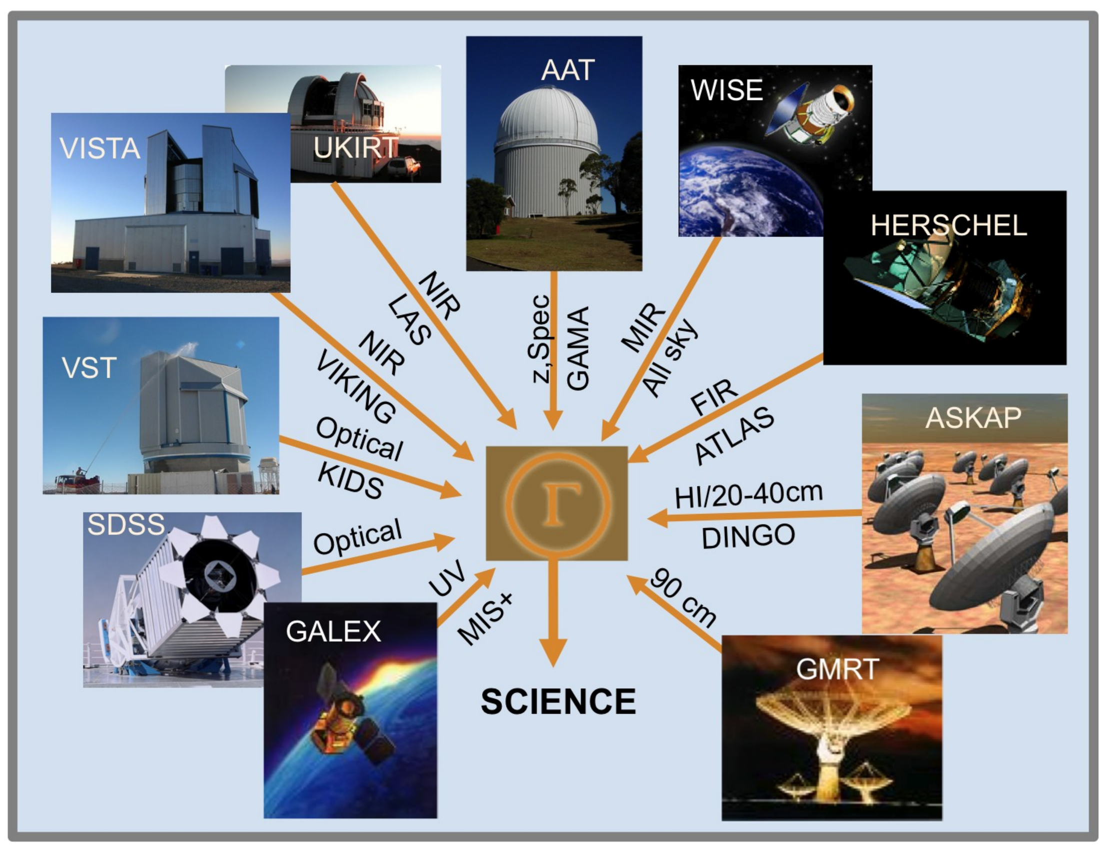
Depending on the model combinations chosen, the resultant fit can be a success or a failure. This galaxy has a nearby star overlapping close to its center, which causes problems for some models. A double free Sérsic fit however appears to model the field well.



G00550582

The effect of dust cannot be ignored, with this edge-on galaxy exhibiting a dust lane which interferes with the model. Work ongoing with Richard Tuffs (Max Planck, Heidelberg), Christina Popescu (UCLAN), John MacLachlan (St Andrews) and Kenny Wood (St Andrews) aims to address this problem.

Galaxy And Mass Assembly (GAMA)



The GAMA project is a large-scale 'survey-of-surveys', aiming to collect and present data from several leading astronomical facilities and complimented by ~100,000 redshifts (with ~130,000 expected 3Q 2010).

GAMA consists of three 50 sq deg fields centered on 9h, 12h and 14.5h (G09, G12 and G15 respectively) chosen for the study of galaxy formation and evolution on scales of 1kpc to 1Mpc.