SLACS
with
COLORS

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The SLACS Lens Factory

SLACS Survey: Sloan Lens ACS Survey
SLACS Update

- Multi-band HST imaging
  - Program started on ACS to get F555W and F814W (V and I) data
  - Moved to WFPC2 and F606W/F814W
  - Additional programs to obtain F160W imaging with NICMOS (29 remaining targets will be observed with WFC3)
- Structural fits using GALFIT
  - All WFPC2 and NICMOS images have bulge and bulge+disk models
  - de Vaucouleurs models from Bolton et al (Paper V)
- WFPC2-based SIE models for new lens
SLACCS Update

- 85 Grade `A' lenses
  - 20% increase to the sample
  - 79 have at least two bands of HST imaging, 51 with NICMOS H-band
  - Span approximately one decade in mass, approximately 5 Gyr in lookback time

- 13 Grade `B' lenses

- Stellar population analysis for all lenses
85 Confirmed + 13 Probable = 100 LENSES!!!
SLACS lenses appear to be **NORMAL** early-type galaxies

- Lie on the fundamental plane, other scaling relations
- Comparable to SDSS twins
  - Environments
  - Stellar Masses
  - Ellipticities
Stellar Masses

Magnitude vs. redshift

Einstein Radius vs. redshift

Stellar mass fraction within half the effective radius

Stellar Masses
Stellar population analysis code!

NEW!!

USED BY

SLACS!

Arbitrary Priors!

Probe the full Posterior!

TRY IT

TODAY!!!
A Bayesian Approach to Stellar Population Analysis

Standard Approach:

- Create a set of synthetic templates (or colors) from a Composite Stellar Population (CSP) code, including a range of:
  - star formation histories (\textit{`tau-models'} -> star formation rate exponentially declines)
  - metallicity
  - reddening/dust
  - ages

- Infer the mass to light ratio (M/L) and other parameters by fitting observed photometry to the synthetic photometry of the grid/space of models

- Pathological or illogical choice of priors on the CSP parameters (ie. the prior is the grid)
A Bayesian Approach to Stellar Population Analysis

SLACS Approach:

- Create a grid of synthetic templates from a Composite Stellar Population (CSP) code, including a well-sampled range of:
  - star formation histories (‘tau-models’ -> star formation rate exponentially declines)
  - metallicity
  - reddening/dust
  - ages

- Build an interpolation model of this grid so that all parameters can be sampled within the bounds of the grid

- Construct meaningful priors for the model parameters and performance inference

Advantages: Meaningful priors
  Probe the full posterior
  Model selection via the Bayesian evidence
Luminosity Evolution

- Consistent with Fundamental Plane Evolution found in Paper II
- Slight trend with mass, but large errors
M/L Trends

Red line – relation found by Tortora et al using dynamical masses; SLACS lenses are slightly shallower but consistent
M/L Trends

Quadratic `Fit'

Zaritsky et al 2006
Dark Matter Fraction

\[ f_{\text{DM}} = 1 - \frac{M^*}{M_{\text{Lens}}} \]
Conclusions

SLACS has found
- 85 grade `A' lenses
- 13 grade `B' lenses

Multi-band HST imaging -> Precise stellar mass estimates

Quantification of how increasing M/L with mass results from increasing dark matter fraction

Other Hot Stuff: IMF constraints, Fundamental Planes (Surface Brightness, Total Mass, Stellar Mass), other mass-structural relations