

Non-DE science with DESpec

DARK ENERGY SURVEY



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- Galaxy evolution in large volumes
- DESpec legacy (flavour of)
 - Galaxy populations
 - Galaxy physics
 - Dark matter content

<u>_</u> ...



Galaxies in a cold, dark universe



Galaxies grow out of primordial density fluctuations amplified by gravitational instability acting on dark matter

Galaxies





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Millennium simulations (Springel et al 2005)



Beating cosmic variance





Driver et al 2011

Bigger & deeper with DESpec

- SDSS: z ~ 0.1
- GAMA: z ~ 0.3



Galaxy evolution with DESpec



Using spectroscopic redshifts

- Several Evolution of mass/luminosity functions
- Second text Evolution of galaxy sizes
- Galaxy merger fractions
- Photometric stellar ages, metallicities and galaxy masses

Using spectra

- Detailed star formation histories
- Chemical element abundance ratios
- Stellar kinematics and dynamical galaxy masses
- Stellar winds and feedback
- Emission line characteristics AGN vs SF activity
- Mass profiles through galaxy lenses
- ..



Evolution of the galaxy mass function



Maraston et al 2012



- ♀ Constrain high-mass end of the mass function
- Evolution with redshift
- Discrepancy with galaxy formation models
- Beyond z=1?

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Galaxy physics with spectroscopy



Schawinski, Thomas et al 2007 1036 Maraston 2005 1034 ⁻lux (erg/cm²/s²-1/A) 1032 1030 1028 1026 10 1000 1000 velength (A) 0.8 0.6 0.4 0.2 3800 4000 4200 4400 4600 4800 5000 5200 5400 λ [Å] Puzia et al 2004

- Stars in galaxies keep the fossil record over formation history and dynamical matter content
- Stellar population models to derive parameters
- Multi-band photometry over large wavelength base or medium-resolution spectroscopy

Emission line spectrum

Gas ionisation stage, star formation/black hole activity, gas kinematics, galactic outflows, gas accretion

Absorption line spectrum

stellar kinematics, dynamical stellar masses, dark matter, stellar populations, star formation histories, metal content, element ratios

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4000

 $\lambda_{rest-frame}$ [Ang]

z~

0.5

0.0

3000

6000

5000



Gas physics with DESpec





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Precision spectroscopy at $z \approx 0.5$





- Star forminggalaxies @z=0.6
- Detection of galactic outflows

Chisholm et al 2012

Thomas et al 2012

- Ohemical element ratios
- Chemical enrichment since z=0.5
- Constrain formation histories





Dark matter in the past



- Extension of SLACS/BELLS survey to higher redshift
- Velocity shift in emission line spectrum
- Dark matter profiles of distant galaxies

Bolton et al 2012; Brownstein et al 2012





- Redshift evolution of dynamical to stellar mass ratio
- Dark matter fraction increases with time
- \bigcirc With DESpec up to z=1

Beifiori et al 2012

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Wish list



How about including constraints on cosmology?

- Medium spectral resolution R~2000
- 🗹 Red CCD
- ✓ LRG target selection
- Dense targeting around z=1
- ☑ High S/N (maybe not...)
- Enough spectra for stacking...

Emission line spectrum

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