Summer Semester 2018:

Master course Astrophysics II: Galaxies and Cosmology

# Lecture 4, 08 May 2018: Galaxy distribution functions and clustering

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### Galaxies in the Hubble Ultra Deep Field



### Transverse angular to linear distances in cosmology



### The large-scale distribution of galaxies in projection



### Sloan Digital Sky Survey: Telescope & fibre plates





### A flux-limited galaxy sample (example): Apparent magnitudes and redshifts



data from SDSS DR7

### A flux-limited galaxy sample (example): Luminosity distances and absolute magnitudes



data from SDSS DR7

#### The luminosity function of galaxies



#### The stellar mass function of galaxies



**Figure 13.** GSMF with a double Schechter fit to data at  $\mathcal{M} > 10^8 \,\mathrm{M}_{\odot}$ . The data points represent the GAMA-fitted stellar mass results. The solid line represents the fit to the data with extrapolation shown by the dashed line. The fit parameters are shown with their  $1\sigma$  errors. Also shown is a fit to zCOSMOS data from Pozzetti et al. (2010).

The galaxy luminosity function and the mass function of dark matter haloes



#### Galaxy clustering: Early redshift surveys



L'Apparent, Geller & Huchra 1986



The (real space) two-point correlation functions of galaxies



#### Redshift space distortions: Kaiser effect





### Baryonic acoustic oscillations in the galaxy correlation function



### Galaxy redshift surveys: The next generation

Class	Facility / Instrument	First light (anticipated)	Aperture (M1 in m)	Field of View (sq. deg)	Etendue	Multiplexing	Wavelength coverage (um)	Spectral resolution (approx)	IFU	Dedicated facility
Comparison	SDSS I - IV	Existing	2.5	1.54	7.6	640	0.38 - 0.92	1800	Yes	Yes
4-m	Guo Shoujing / LAMOST	Existing	4	19.6	246	4000	0.37 - 0.90	1000 - 10000	No	Yes
	AAT / HERMES	2015	3.9	3.14	37.5	392	windows	28000, 50000	No	No
	WHT / WEAVE	2017	4	3.14	39.5	1000	0.37 - 1.00	5000	Yes	Yes
							windows	20000		
	VISTA / 4MOST	2017	4	2.5	31.4	2400	0.39 - 0.95	5000	No	Yes
							windows	18000		
	Mayall / DESI	2018	4	7.1	89.2	5000	0.36 - 0.98	4000	No	Yes
8-m	VLT / MOONS	2018	8.2	0.14	7.4	1000	0.8 - 1.8	4000	No	No
							windows	20000		
	Subaru / PFS	2019	8.2	1.25	66	2400	0.38 - 1.26	2000	No	No
							0.71 - 0.89	5000		
10-m	MSE	2024	11.25	1.5	149	3468	0.36 - 1.8	3000	Second generation	Yes
							0.36 - 0.95	6500		
							50% coverage			
							windows	40000		

## Galaxy redshift surveys: The 4MOST instrument built at AIP



## Galaxy redshift surveys: "Echidna" prototype fibre positioner for 4MOST

