VIDEO

:The VISTA Deep Extragalactic Observations Survey

PI Matt Jarvis

Rebecca Bowler

VIDEO: The VISTA Deep Extragalactic Observations Survey

- Galaxy formation/evolution over the **epoch of activity** (1<z<4)
- Statistical studies of the **most massive galaxies at z > 5**
- The **evolution of clusters** from the formation epoch to now
- The **peak of accretion activity**: studying AGN in detail
- The **first accreting black holes** at z > 6.5
- Near-infrared observations of **Type Ia supernovae**

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UltraVISTA	~1 deg^2	mAB ~ 26
VIDEO	12 deg^2	mAB ~ 24.5
VIKING	1500 deg^2	mAB ~ 22

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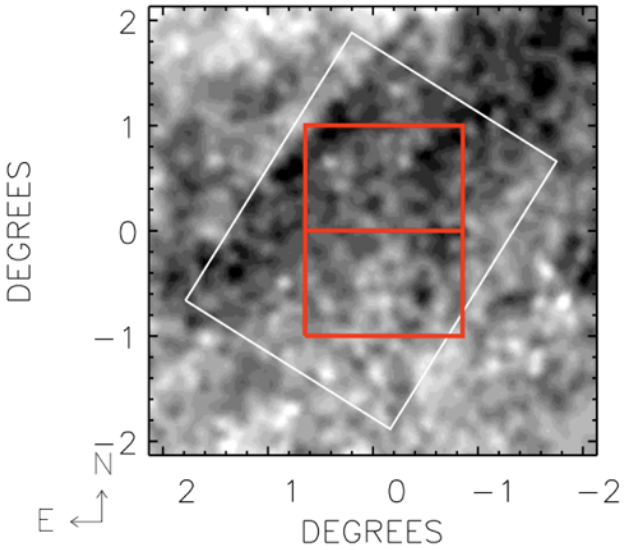
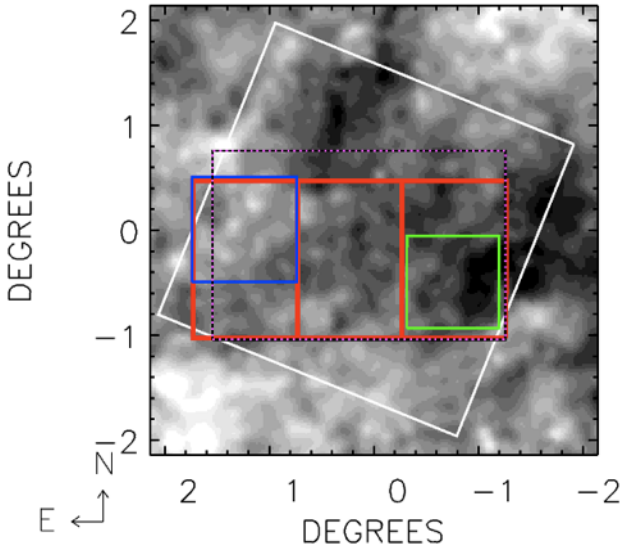
Elais-S1



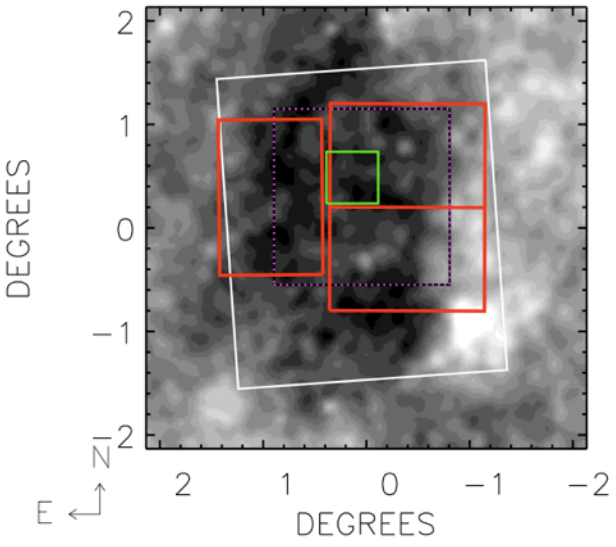
VIDEO = 3 deg^2

XMM-LSS



4.5 deg^2
UKIDSS UDS
CFHT Legacy Survey D1

ECDFS



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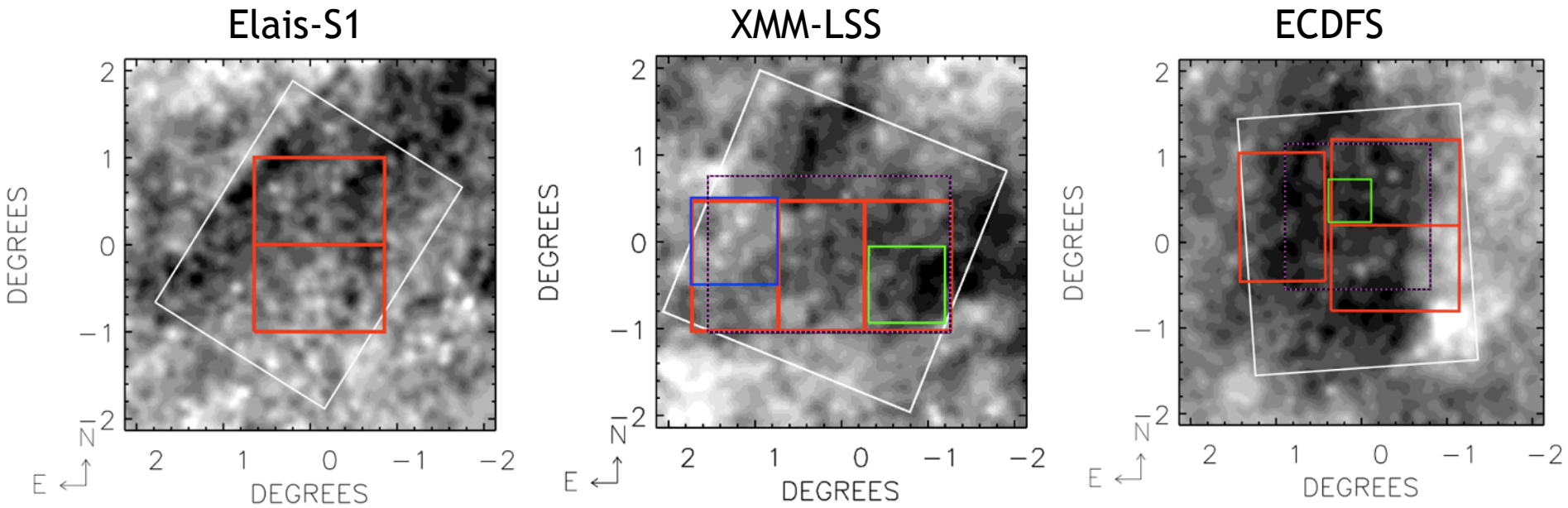

Filter	Time (per source)	Time (full survey)	5σ AB	5σ Vega	UKIDSS-DXS	Seeing	Moon
Z	17.5 hours	456 hours	25.7	25.2	-	0.8	D
Y	6.7 hours	175 hours	24.6	24.0	-	0.8	G
J	8.0 hours	209 hours	24.5	23.7	22.3	0.8	G
H	8.0 hours	221 hours	24.0	22.7	22	0.8	B
K_s	6.7 hours	180 hours	23.5	21.7	20.8	0.8	B

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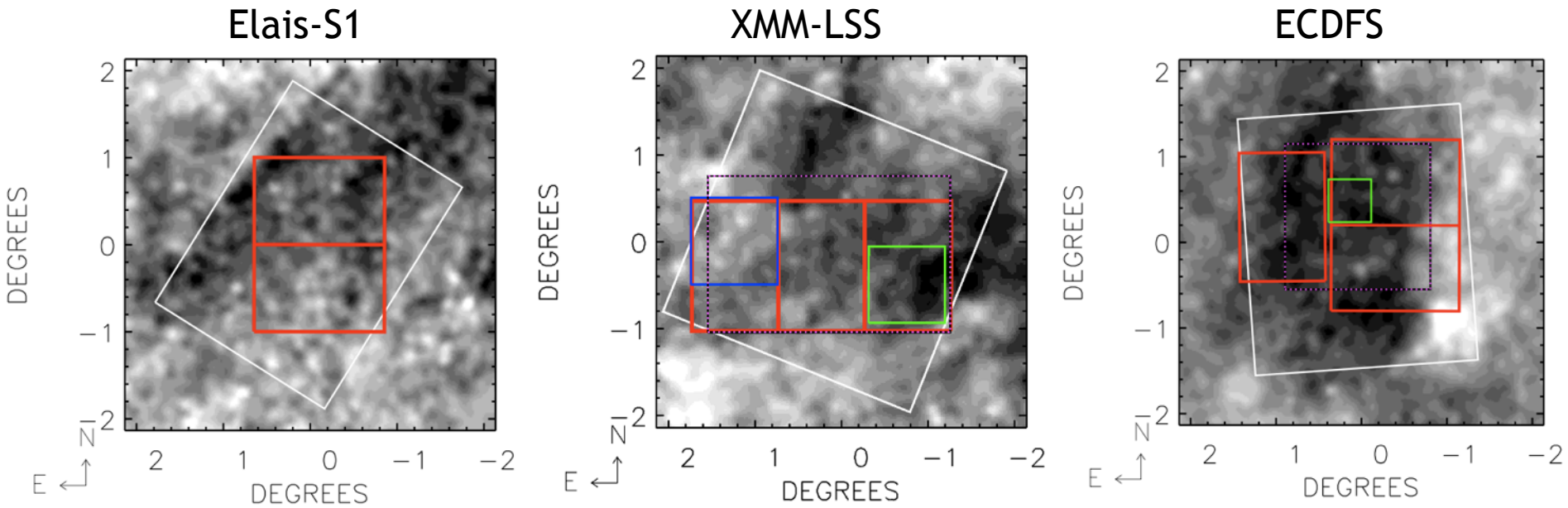

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Filter	Time (h) (per pixel)	1″ (5σ)	2″. (5σ)	3″ (5σ)	4″ (5σ)	5″ (5σ)
Z	17.13	26.89	25.66	24.87	24.33	23.83
Y	6.05	25.60	24.51	23.74	23.18	22.73
J	9.65	25.59	24.44	23.70	23.11	22.63
H	8.13	25.25	24.12	23.42	22.87	22.40
K_s	9.03	24.86	23.77	23.10	22.53	22.13

Jarvis et al. 2013, MNRAS, 428, 1281

100th of The VIDEO Survey

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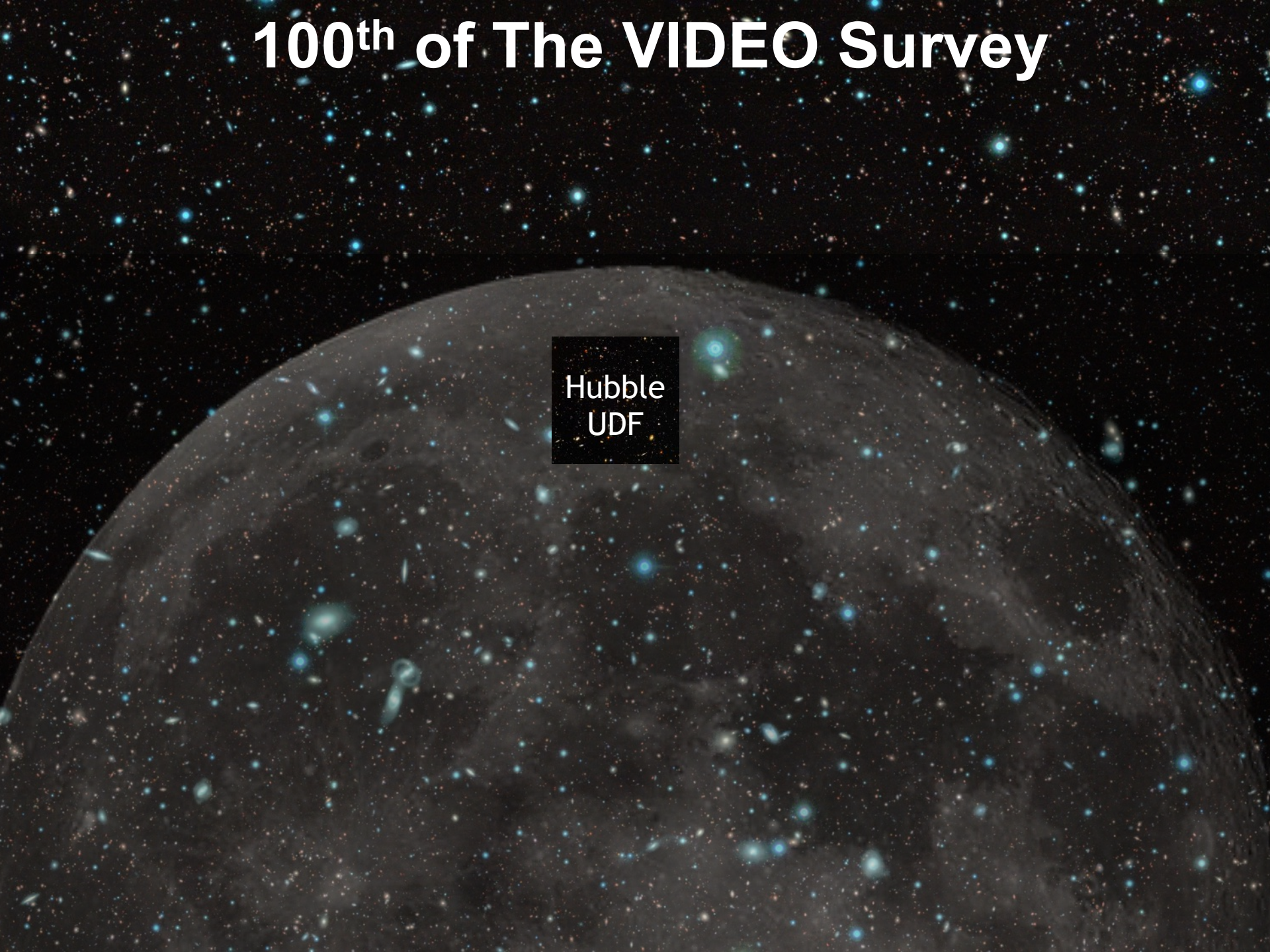
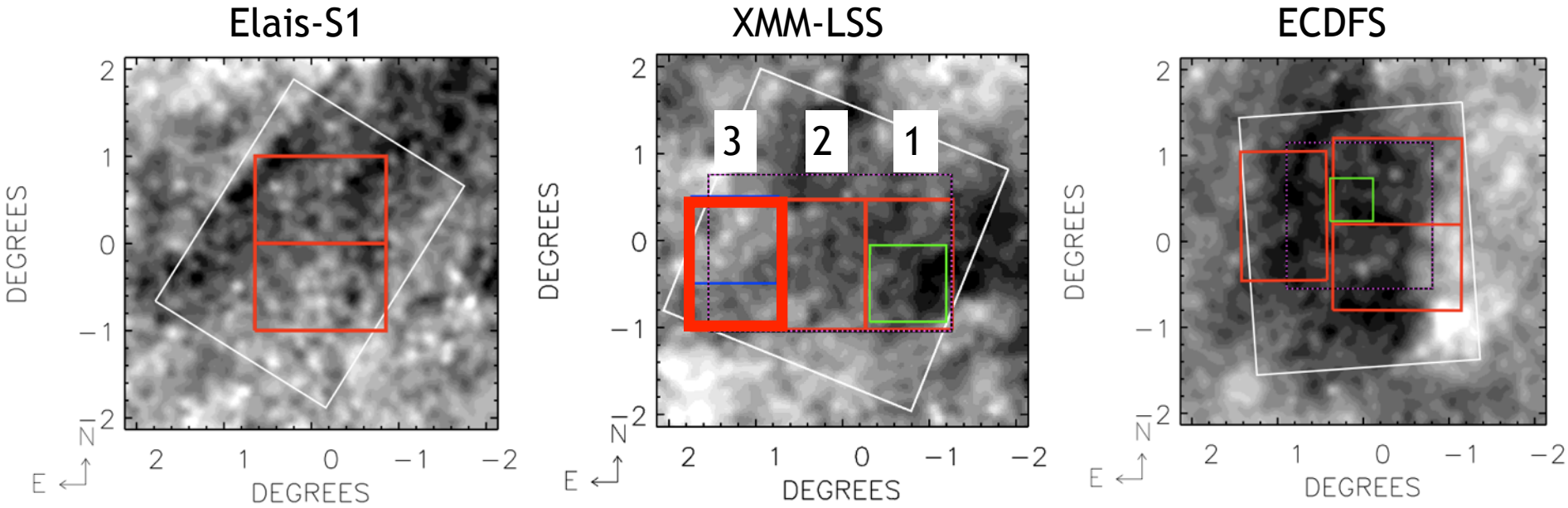


Multi-wavelength data in the VIDEO fields

- Spitzer Representative Volume Survey (SERVS) (1400 hours). Provides 3.6 and 4.5um data to VIDEO depths (L* at z~5)
- VIDEO entered data sharing agreement with the Dark Energy Survey. *griz* photometry to depths of AB~27 (5sigma)
- Covered by VST-VOICE in optical
- Covered by Herschel-HerMES survey (100-500um)
- ACTPol deep field over VIDEO-XMM-LSS footprint
- ECDFS field is also the LADUMA field (Deep HI survey with MeerKAT)
- All fields covered by MeerKAT's MIGHTEE Survey for HI and radio continuum (co-PI Jarvis)
- XMMLSS covered by HSC and new JVLA observations
- VIDEO fields fully covered by LSST Deep Drilling fields

VIDEO: What is happening?

- VIDEO Science has been mainly done over the single XMM-3 field (therefore very similar in scale to UltraVISTA/COSMOS)
- Now have 3sq.deg contiguous field – will provide the first real niche science for VIDEO in XMMLSS (~4sq.deg with UKIDSS-UDS field)



VIDEO = 3 deg^2

4.5 deg^2
UKIDSS UDS
CFHT Legacy Survey D1

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- ELAIS-S1 (minus J-band) also has 3sq.deg coverage

- CDFS needs to catch up (competes with XMMLSS for time on sky)

VIDEO: What is happening?

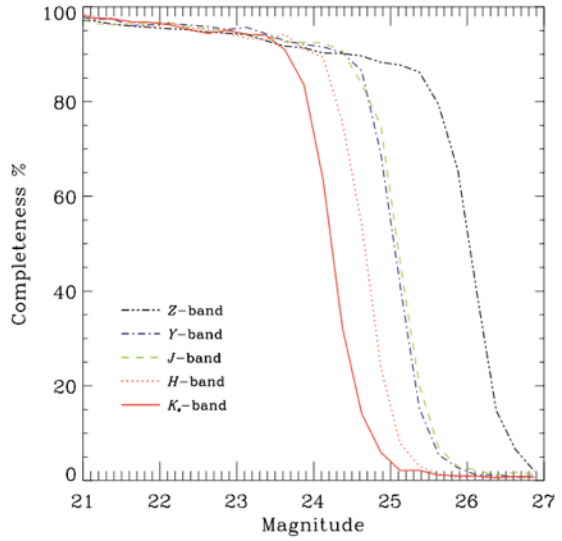
DR1 released 25/7/2011 – XMM3 source lists and tiles

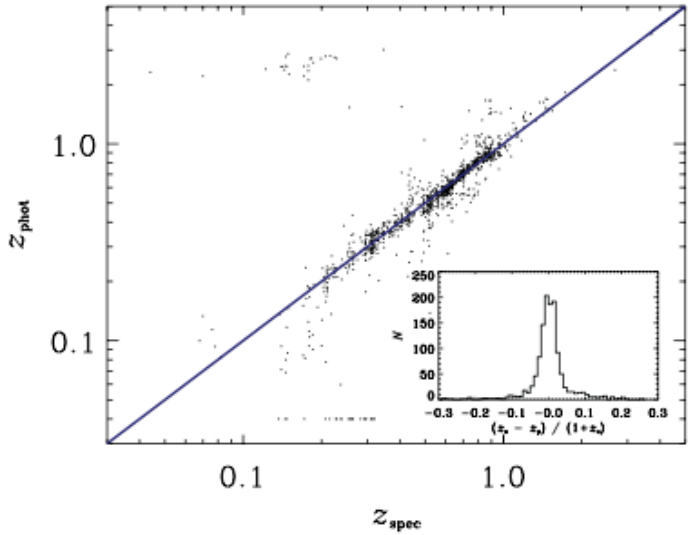
DR2 released Jan-Apr 2014 – CDFS/ES1/XMM source lists in all tiles
- Deep Stack and band-merged catalogues in XMM3

DR3 in preparation – will contain data to the end of Dec 2014. Can access stacked images and catalogues through VIDEO web site now at http://www-astro.physics.ox.ac.uk/~video/public/Home.html

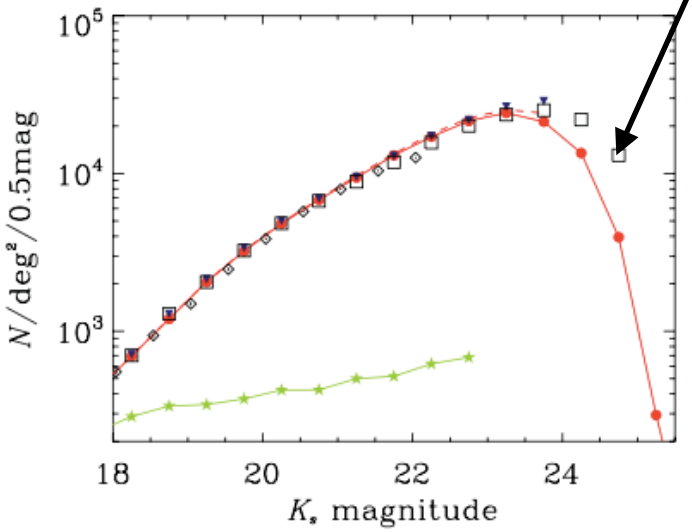
	Z	Y	J	H	Ks
Total for Completion	*68**	*70*	*36*	*39*	*42*
XMM1	*68*	*70*	*36*	*39*	*42*
XMM2	*---*	*70*	*36*	*39*	*42*
XMM3	*68*	*70*	*36*	*39*	*42*
CDFS1	*51*	*70*	*36*	*39*	*42*
CDFS2	*---*	*70*	*7*	*6*	*42*
CDFS3	*---*	*7*	*20*	*0*	*9*
ES1-N	*68*	*70*	*17*	*39*	*42*
ES1-S	*32*	*70*	*17*	*39*	*42*

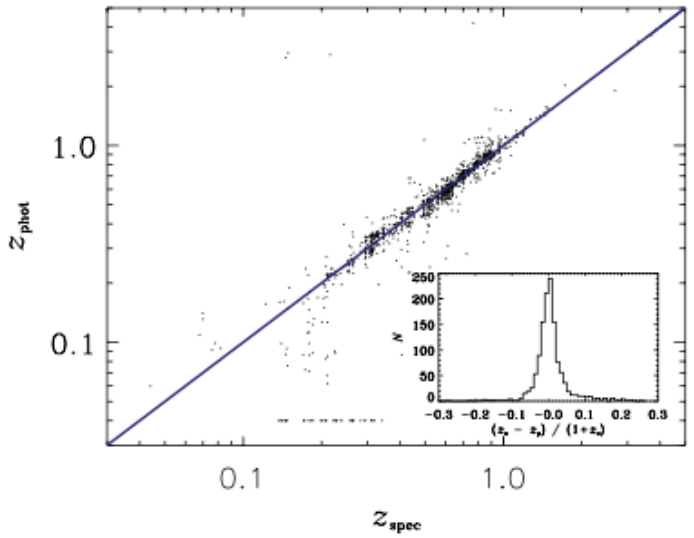
VIDEO: First results from XMMLSS Tile 3





UltraVISTA





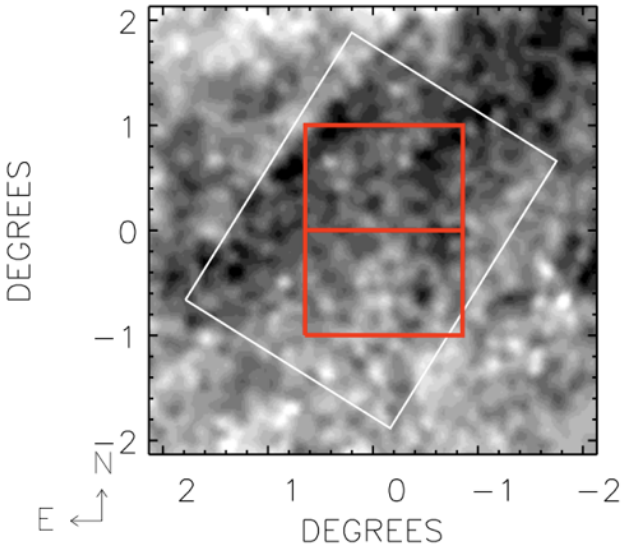
Jarvis et al. 2013, MNRAS, 428, 1281

VIDEO: What is happening?

- DES data now providing optical data that is complementary in depth to VIDEO in *griz*
- VST-VOICE also providing ugr data
- VIDEO team putting VIDEO data on the same pixel scale as complementary optical data (and matching PSF)
- Plans to incorporate VIDEO data into (Radio)GalaxyZoo

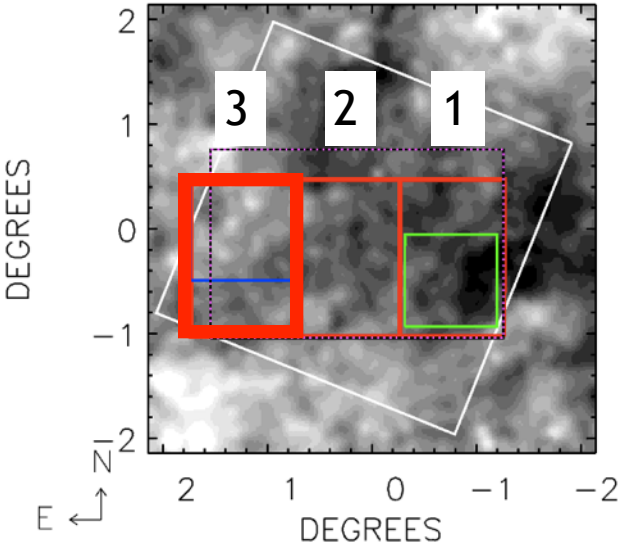
VIDEO
Science Highlights

Elais-S1



VIDEO = 3 deg^2

XMM-LSS



4.5 deg^2

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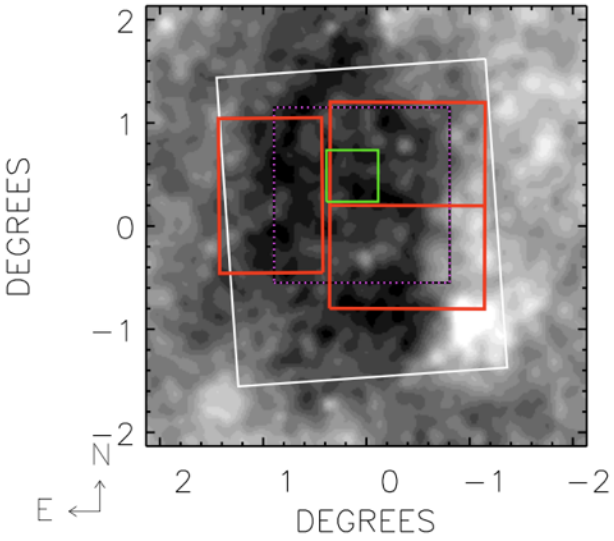

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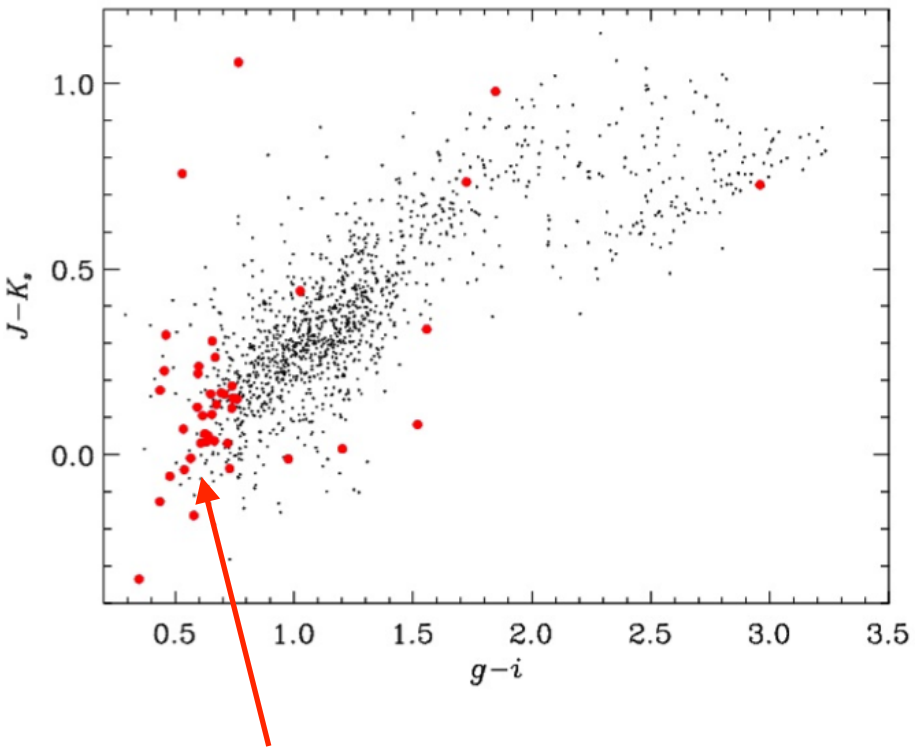
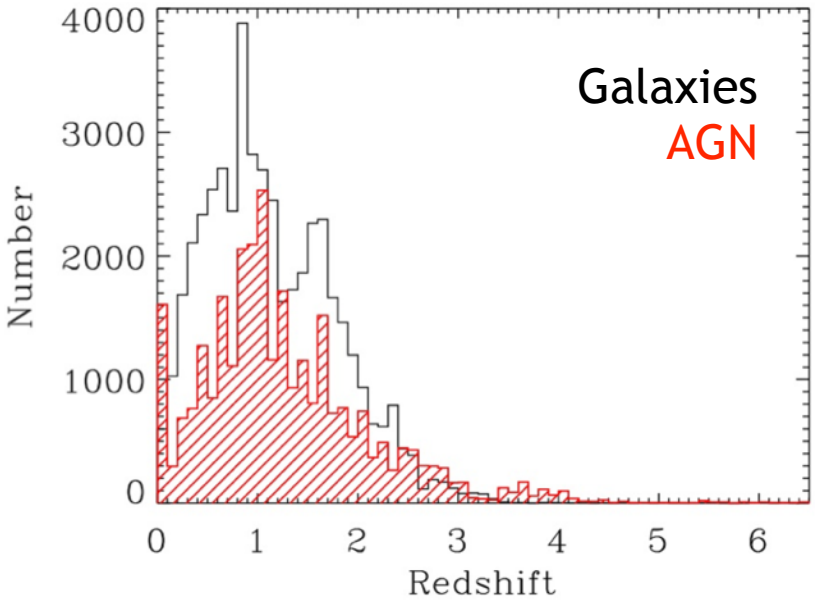
VIDEO: Survey paper



The photometric redshift outliers tend to be blue and have emission lines indicative of an AGN

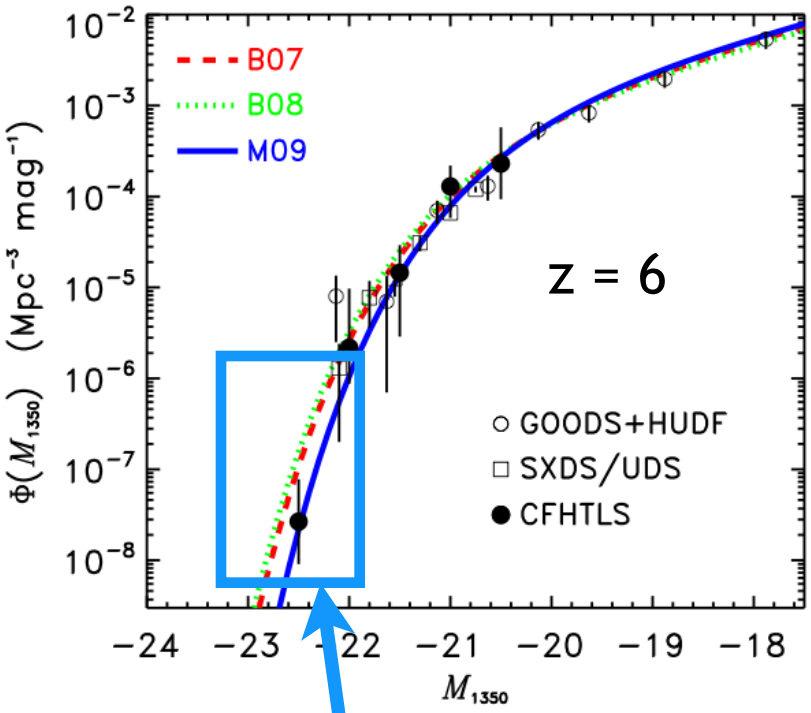
0.3% outlier rate found if we remove galaxies with a best fit AGN template!

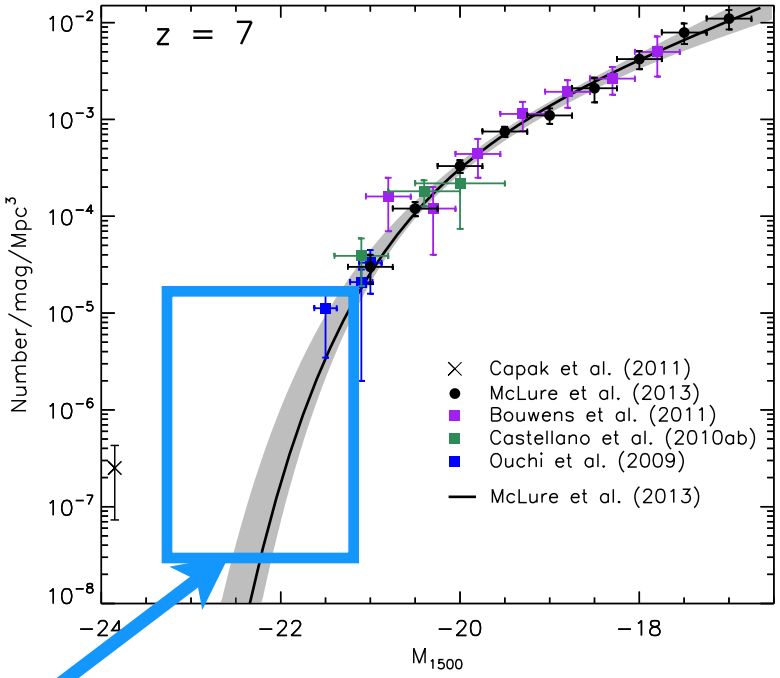


Photometric redshift distribution peaks at z~1 and extends all the way to z~6 (see later)

Jarvis et al. 2013, MNRAS, 428, 1281

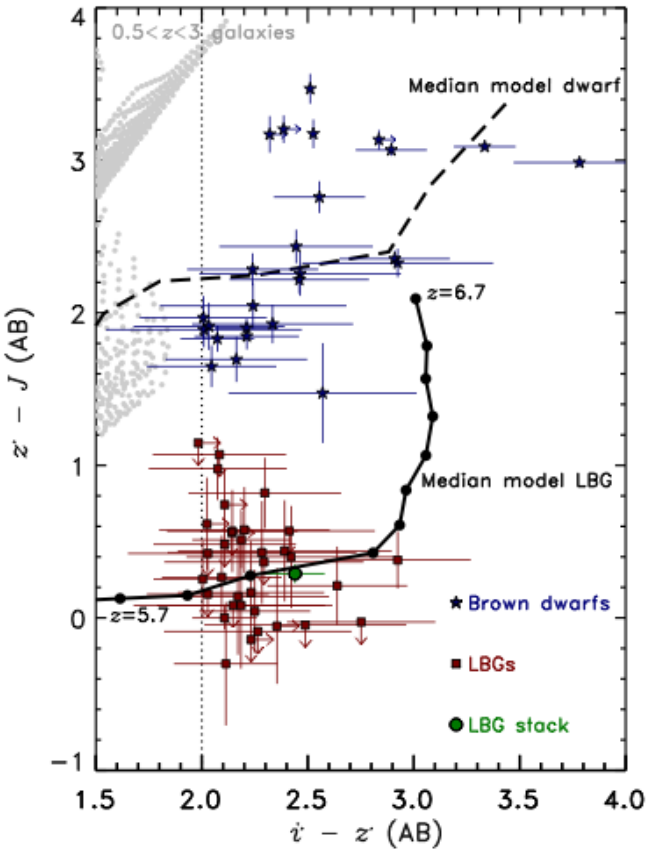
VIDEO: Lyman-break galaxies at z ~ 6/7

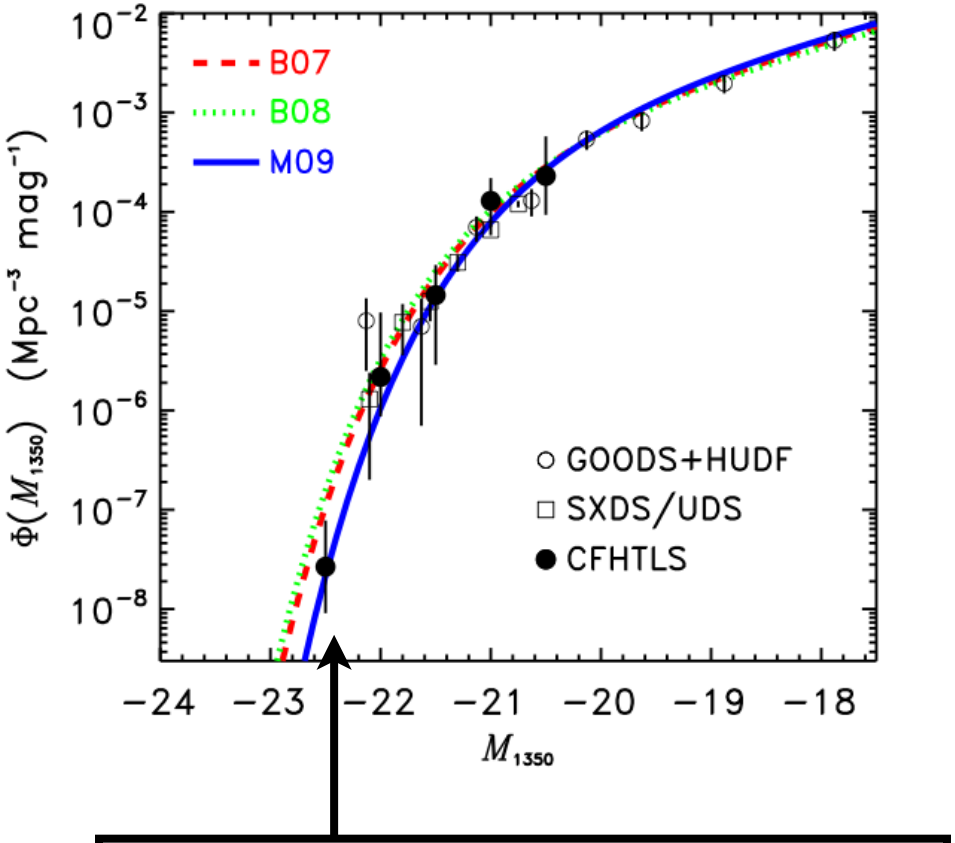




Need degree-scale, deep, near-infrared surveys to probe the bright-end of rest-frame UV LF

VIDEO: Lyman-break galaxies at z ~ 6





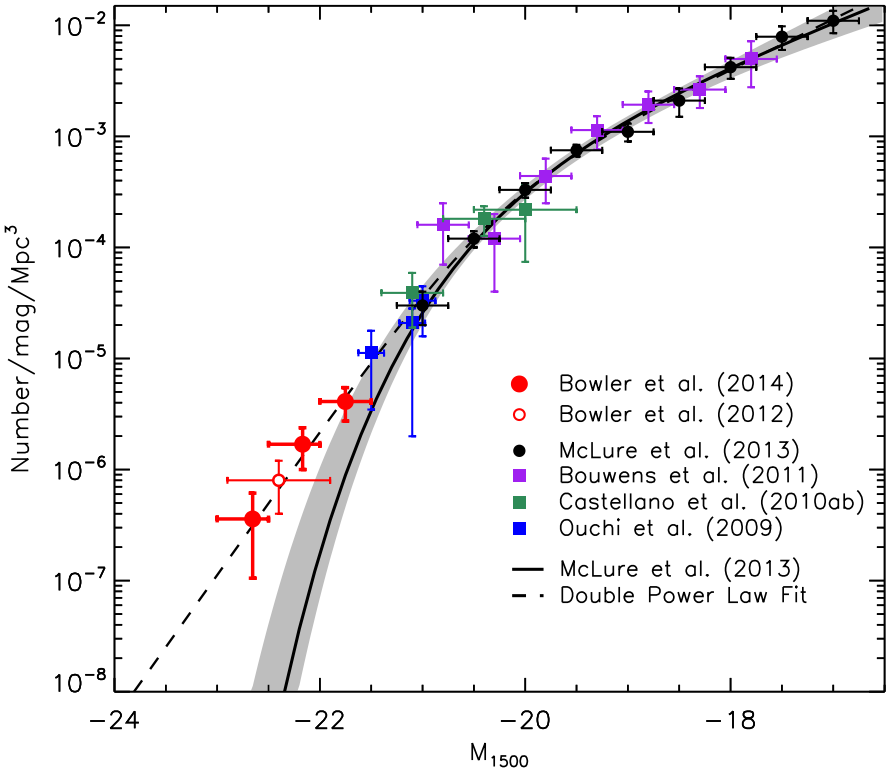
Using 4 CFHT Legacy Survey fields
D1 overlaps with VIDEO
D2 overlaps with UltraVISTA/COSMOS

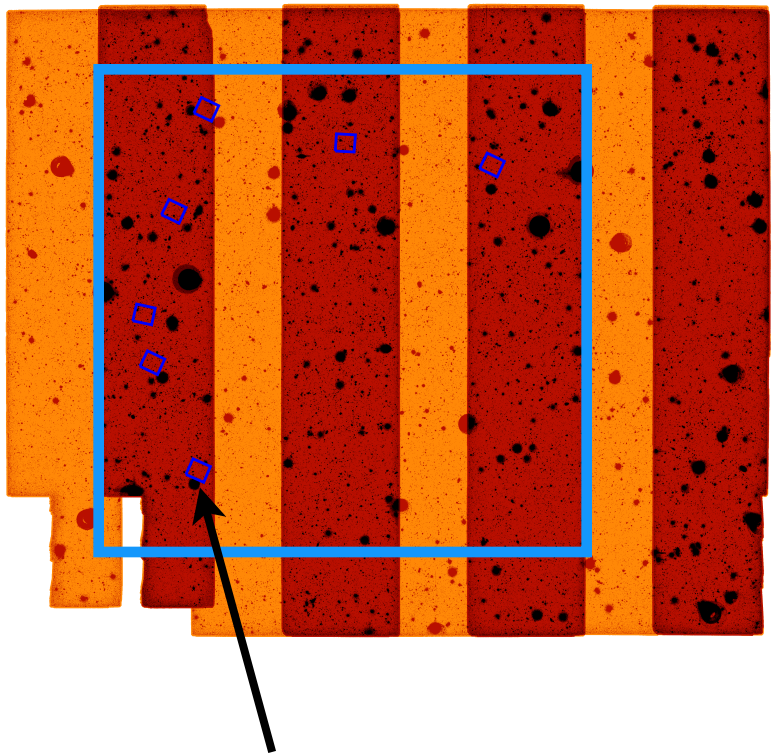
Key aspect is the constraint at the bright end, which are only accessible with ~degree scale surveys

Selecting z~6 galaxies with VIDEO + CFHT (Willott et al., 2013, AJ, 145, 4)

VIDEO: Lyman-break galaxies at z ~ 7

Using UltraVISTA/COSMOS + UKIDSS-UDS/VIDEO



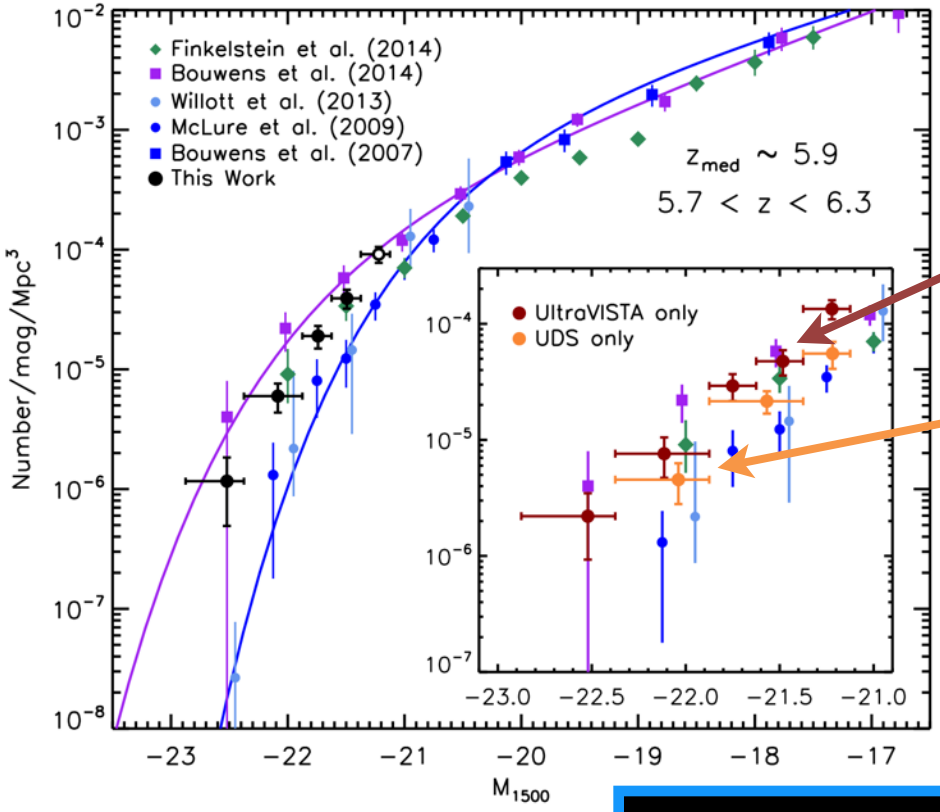


HST/WFC3 pointings

Bowler et al. 2014,
MNRAS, 440, 2810

VIDEO: Lyman-break galaxies at z ~ 6

Using UltraVISTA/COSMOS + UKIDSS-UDS/VIDEO

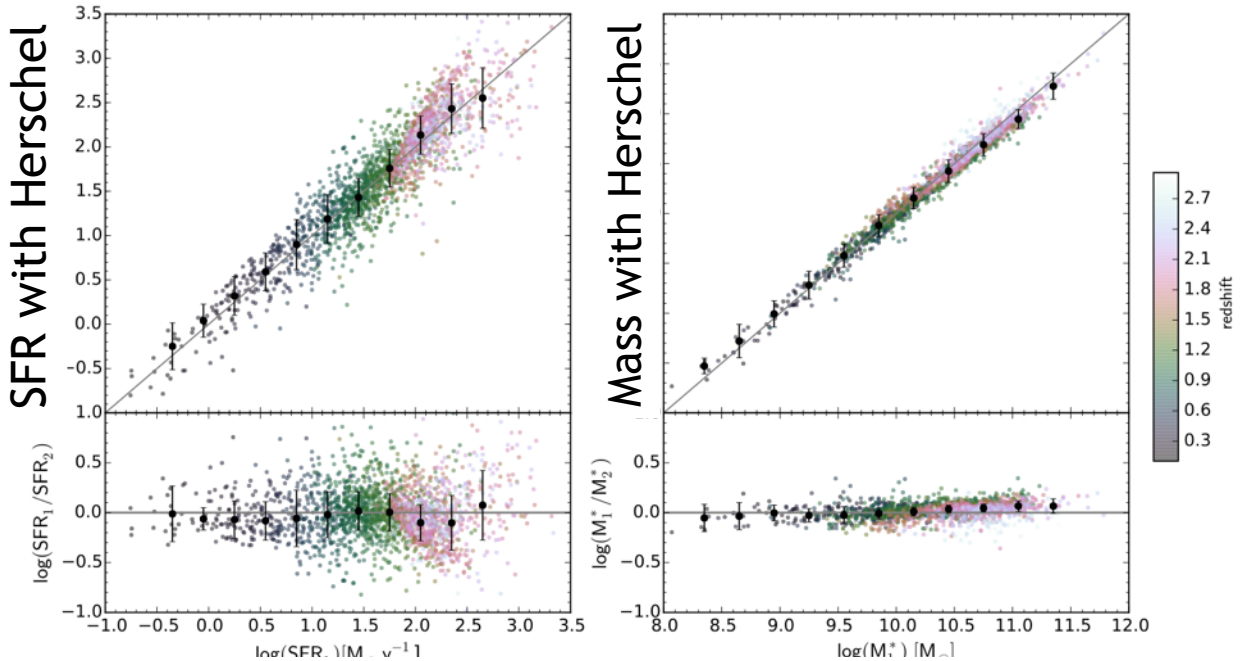


~ 2 x the number density of bright galaxies in UltraVISTA/COSMOS compared to the UDS/SXDS

independent, degree-scale+ fields are essential to constrain the number density of bright galaxies

Bowler et al. 2015, MNRAS, 452, 1817

VIDEO: SFR-mass relation to z ~ 3

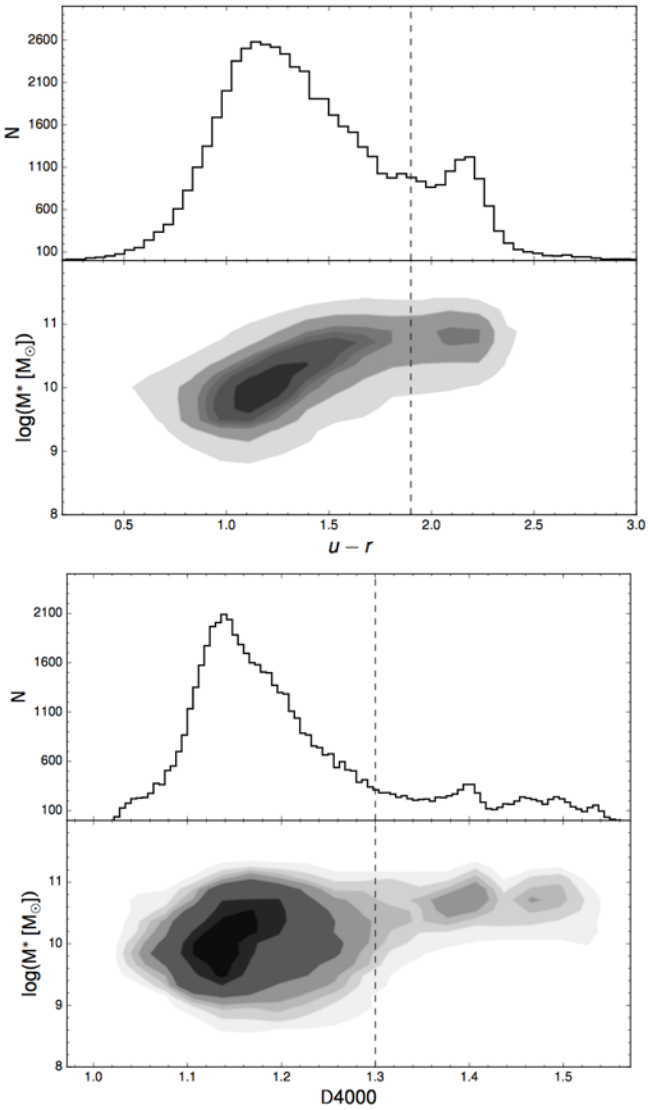


- Using CFHTLS + VIDEO + Spitzer + Herschel data
- With CIGALE code used to model full SED from rest-frame UV to FIR
- Propagating P(z) uncertainties through to M/SFR determination

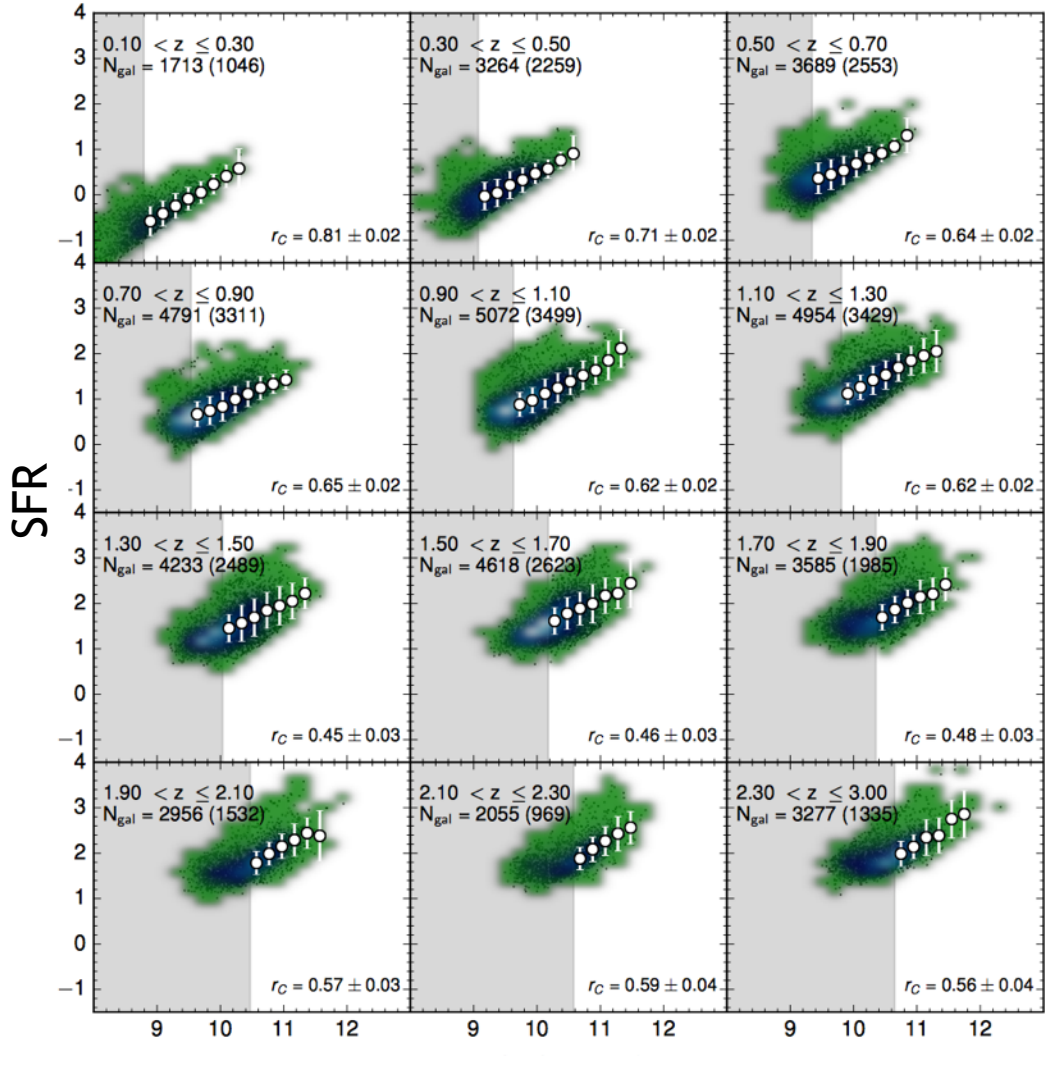
Johnston et al. 2015, MNRAS, 453, 2540

VIDEO: SFR-mass relation to z ~ 3

Selecting SFGs



Star formation main sequence to z~3



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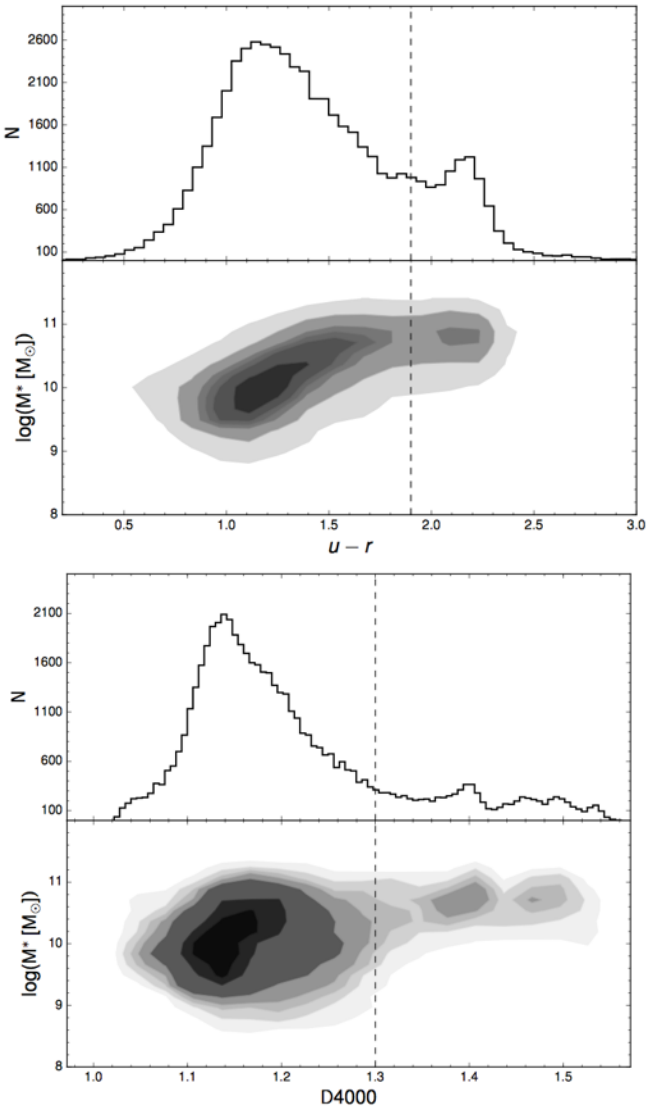

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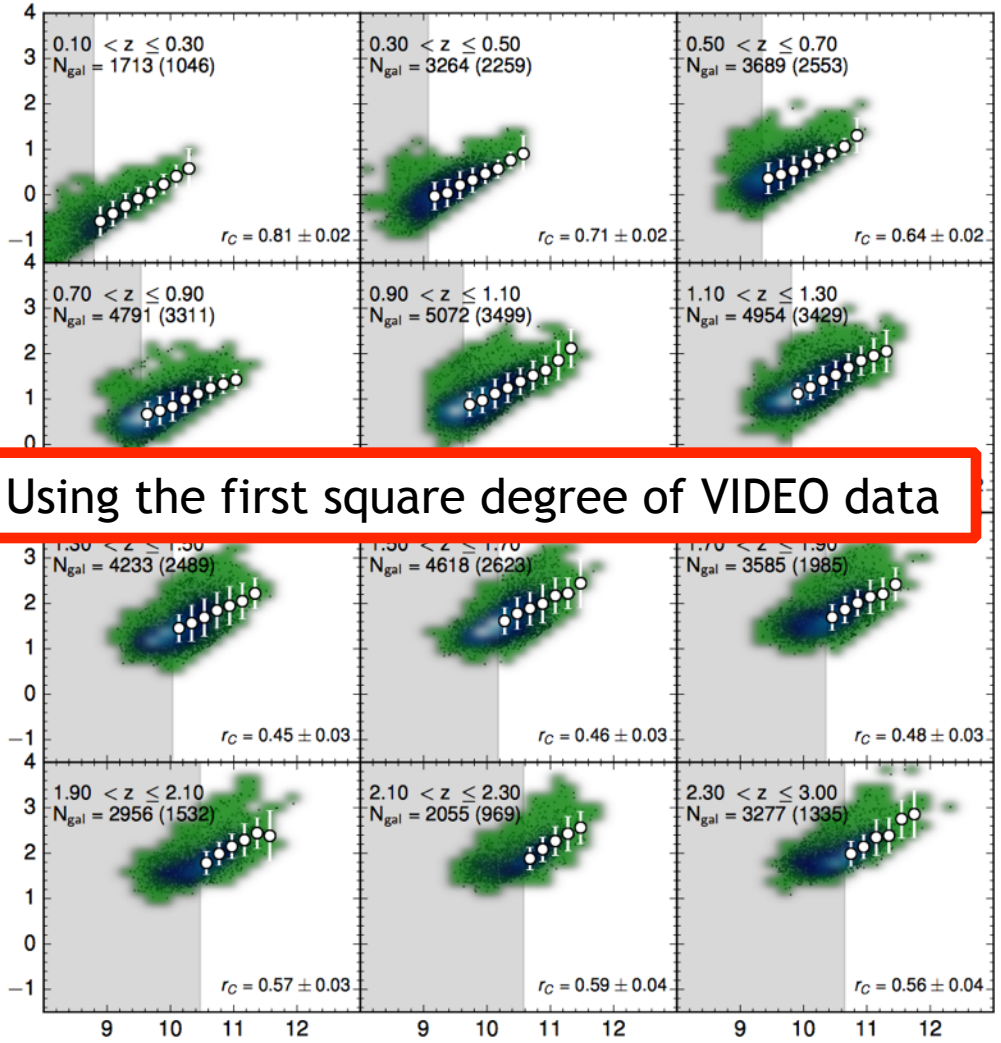
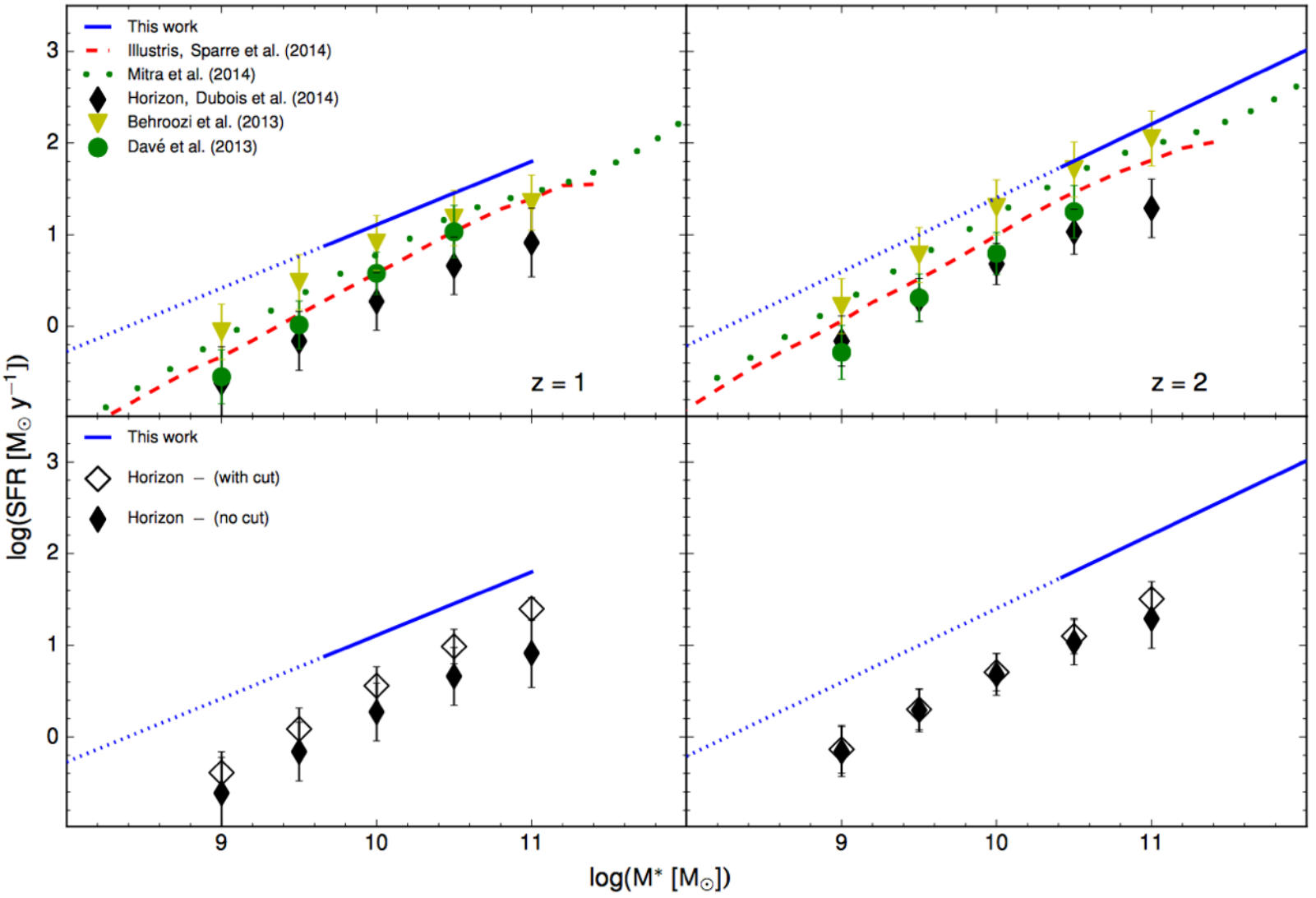


Using the first square degree of VIDEO data

Johnston et al. 2015, MNRAS, 453, 2540

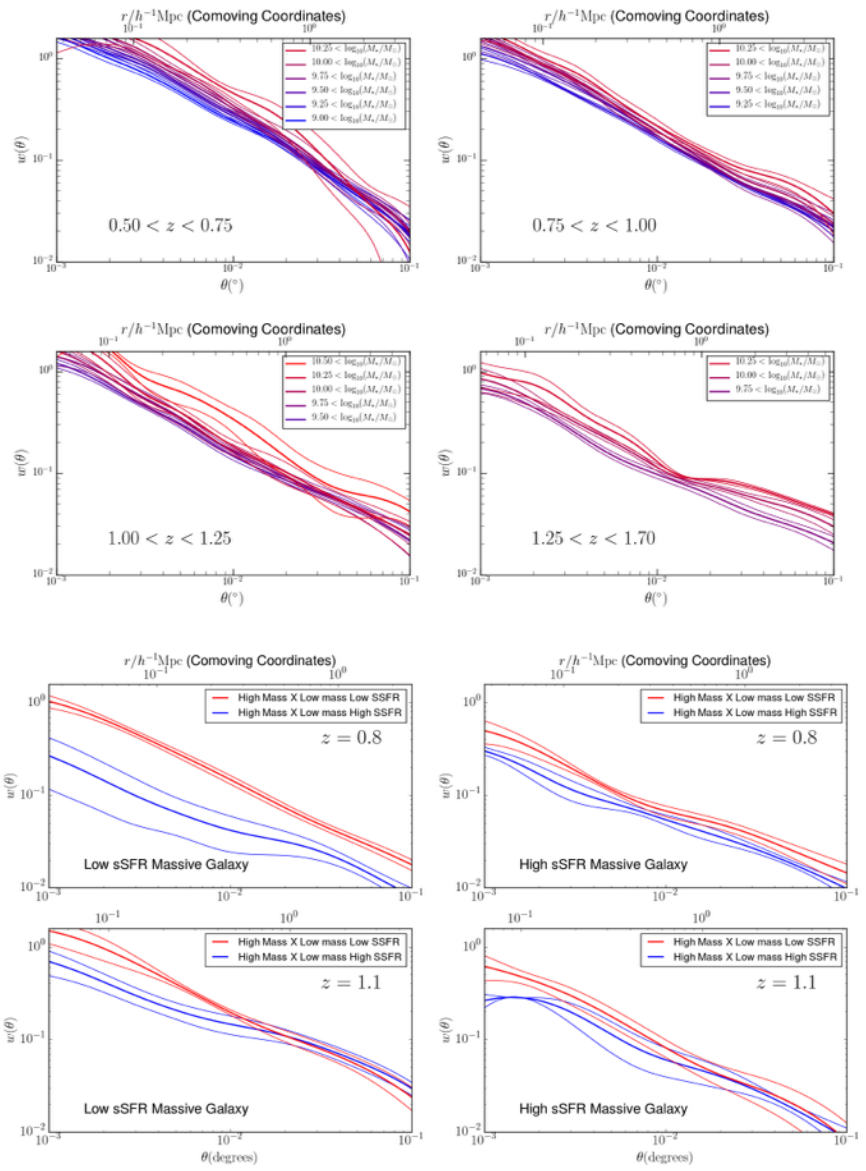
VIDEO: SFR-mass relation to z ~ 3



Johnston et al. 2015, MNRAS, 453, 2540

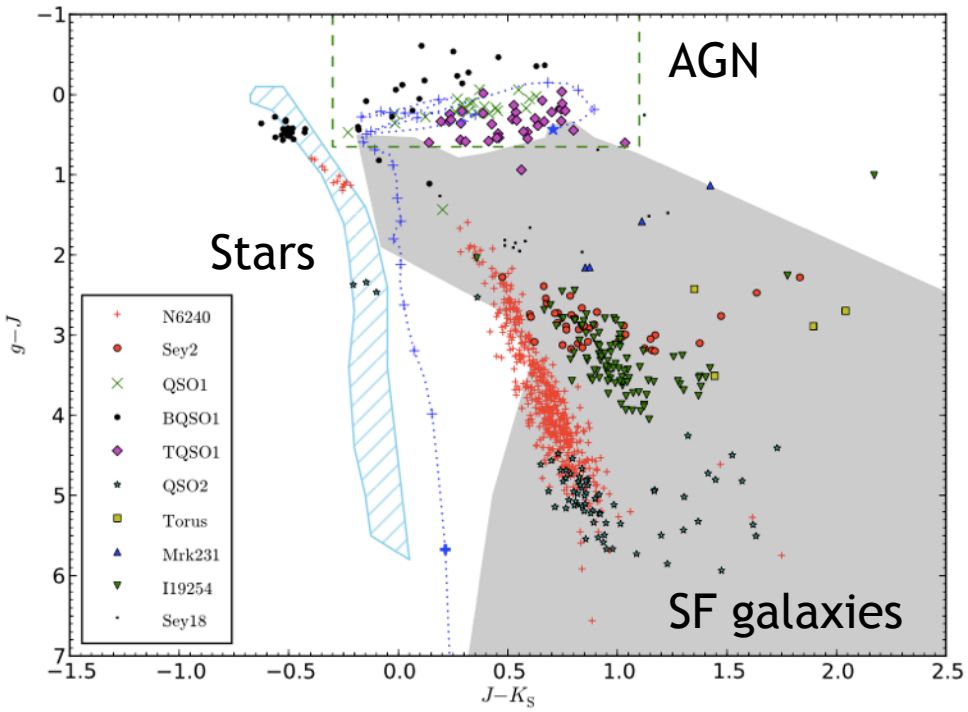
VIDEO: galaxy-halo connection

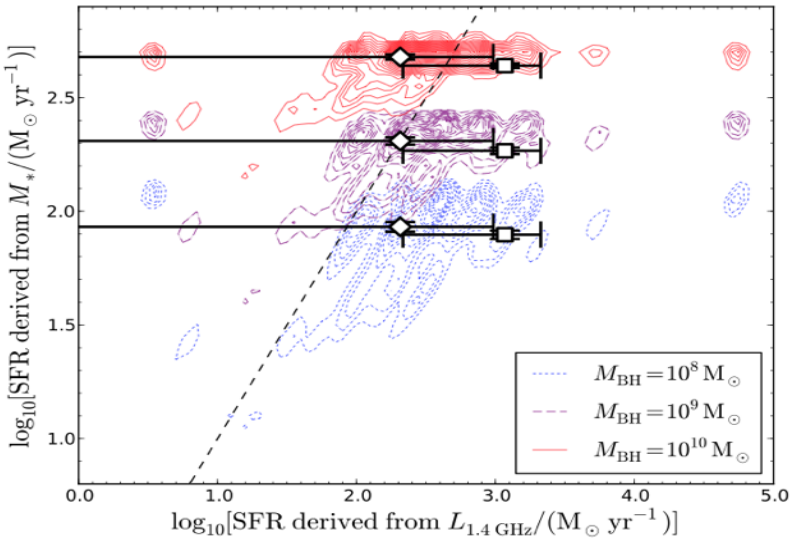
- Galaxy clustering analysis over 1 sq. deg -> proof of concept for full survey
- Halo Occupation Distribution modelling of the angular two-point correlation function
- Cross-correlation functions of different mass galaxies probes galactic conformity



Hatfield et al. in prep.

VIDEO: Radio-quiet quasars





- Probing the radio emission from sample of unobscured quasars selected from optical/near-IR colours
- Using VLA-VIRMOS deep field data at 1.4 GHz to look at origin of radio emission at low radio fluxes - star-formation or accretion?

White et al. 2015, MNRAS, 448, 2665

Summary

- VIDEO is progressing well
- The whole survey should be finished in 2017
- Up to now science has been restricted by optical-data, this is now changing with DES, VST and also HSC
- VIDEO is now entering the key period for unique science that cannot be done with UltraVISTA
- Lots of activity both within the VIDEO team and from the wider community using VISTA data
- 26 papers that use VIDEO data directly thus far, and many more to come

See Jarvis et al. 2013, MNRAS, 428, 1281 for more details or the website:
http://www-astro.physics.ox.ac.uk/~video/public/Home.html