FUTURE GROUND-BASED SPECTROSCOPIC SURVEYS

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Ground-based heritage

Existing and planned ground-based facilities

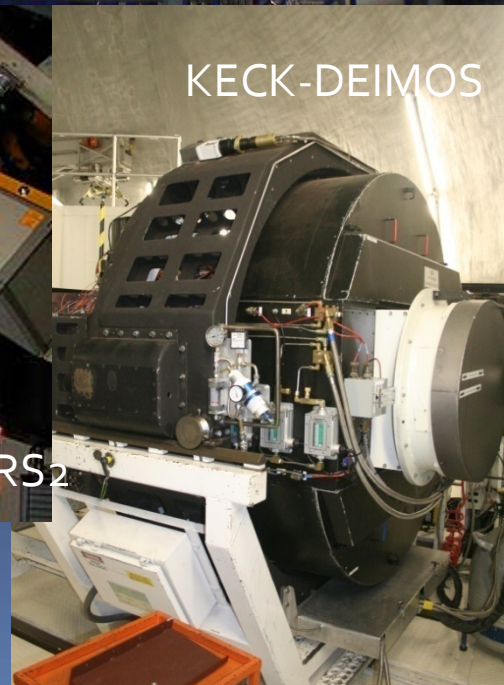
Is ground competitive with space ?

EUCLID-NIS has a ground-based heritage: MOS

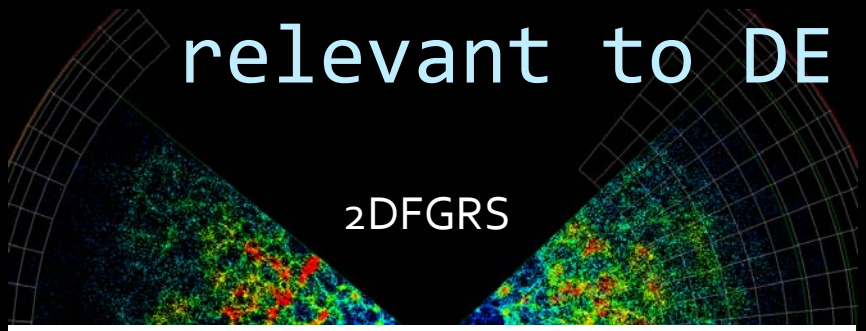
- Multi-object spectroscopy is a mature technology on most major ground-based telescopes
- It allows a very high survey efficiency
  - At low redshifts z<1: multi-fiber
  - At high redshifts z>1: multi-slit

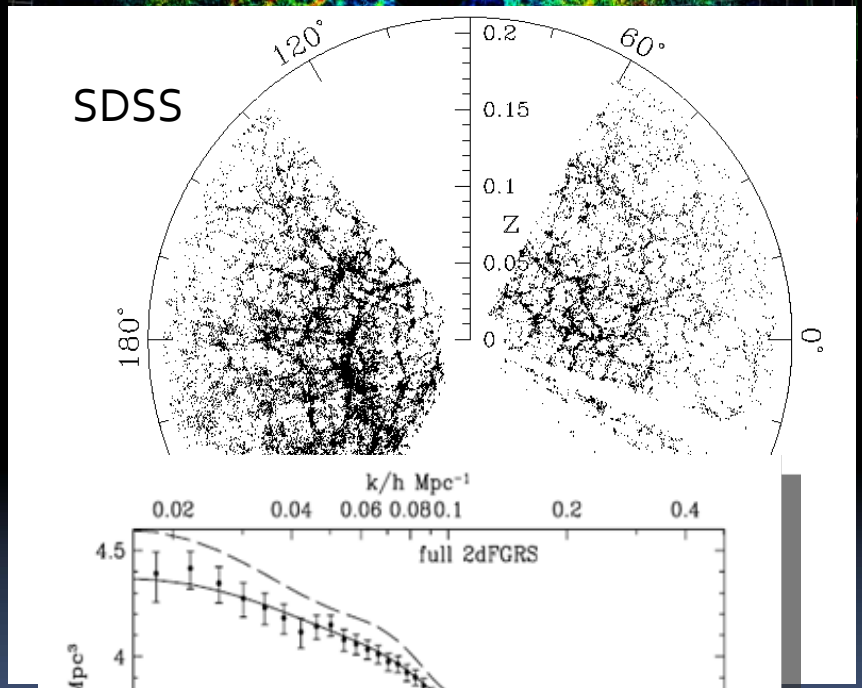
The power of MOS

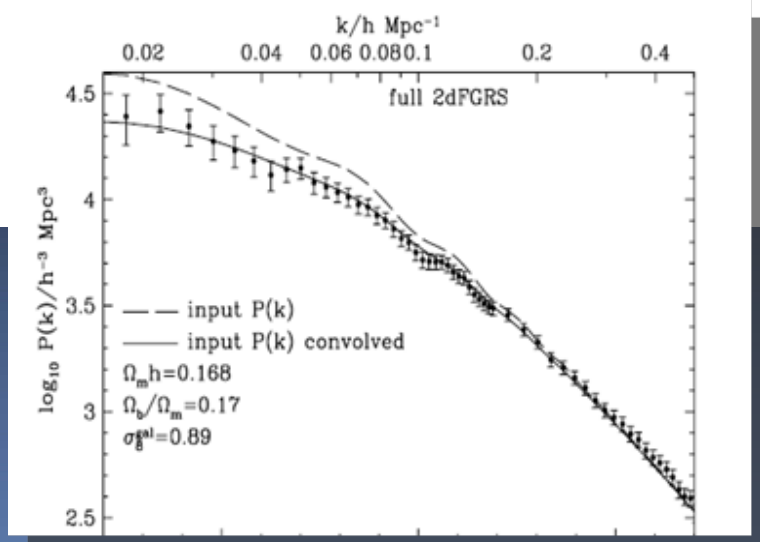
- Get spectra of many objects over a large field of view
- For cosmology:
  - Get redshifts AND spectral properties
  - 3D mapping of large scale structures

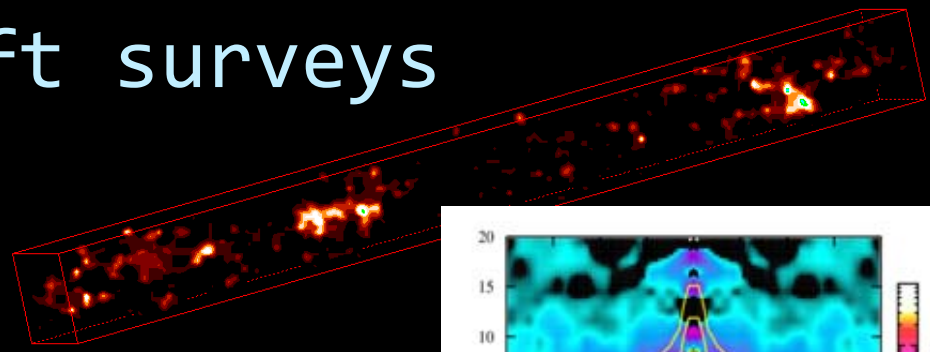


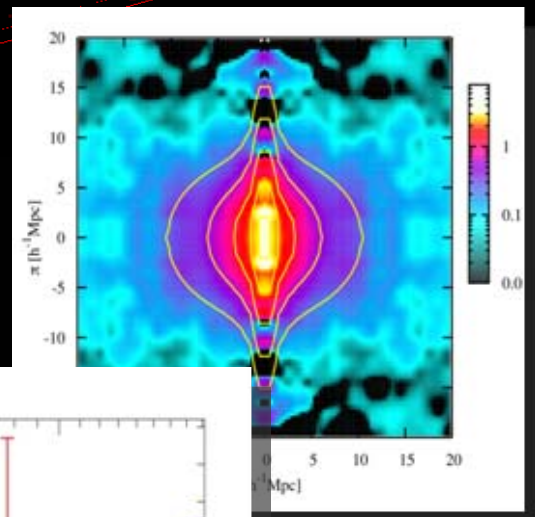
Existing redshift surveys relevant to DE

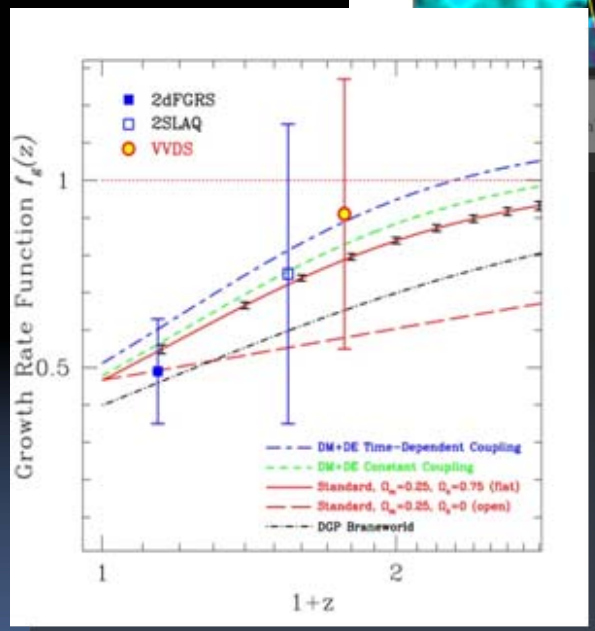












BAO from Low-z SDSS

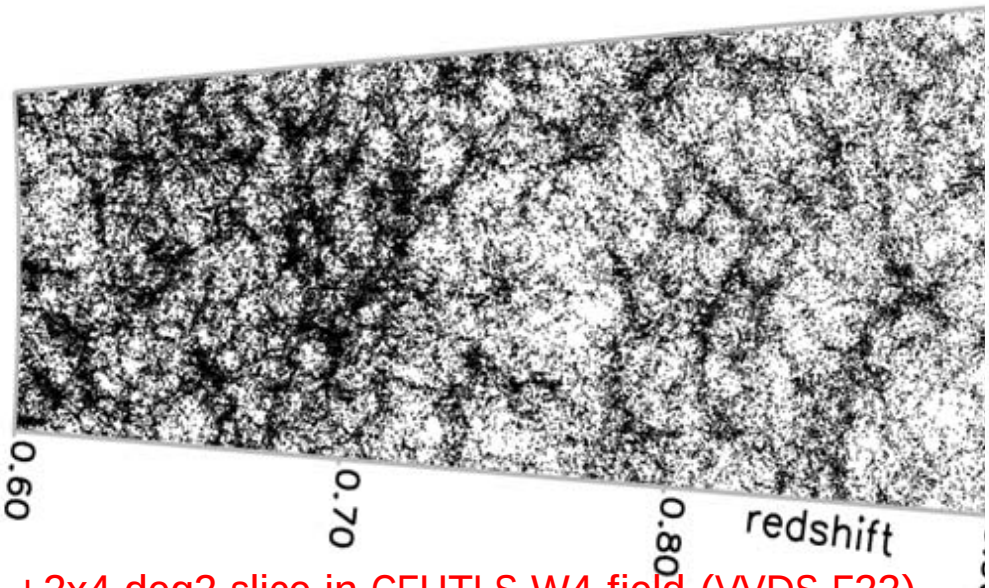
Growth rate to z~1 from galaxy distribution in VVDS (VLT-VIMOS) Guzzo et al., 2008

On-going surveys

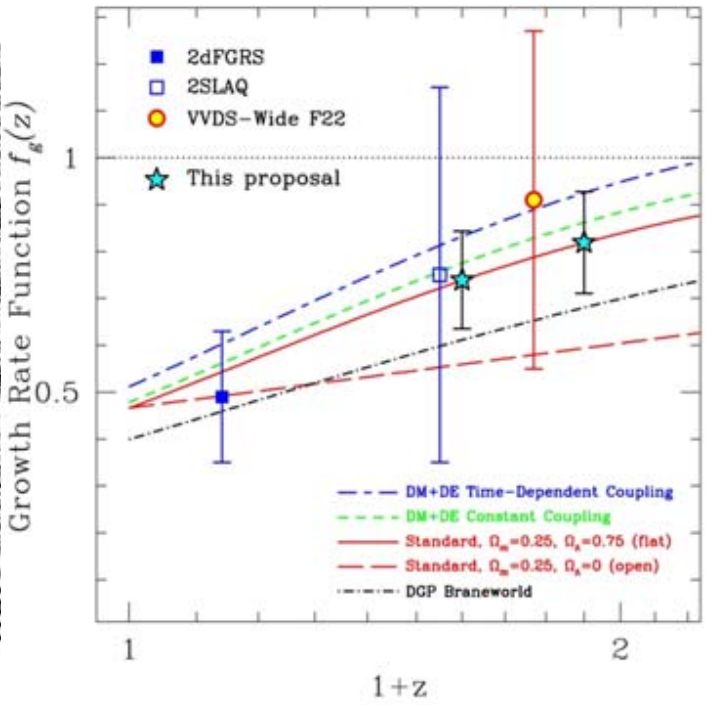
- SDSSIII – Boss: 1 million z, z~0.6
- VIMOS-VIPERS: 100,000 z, z~0.8-1
- Wiggle-z

VIPERS: VLT-VIMOS
100,000 spectroscopic z
~450 h of VLT time

2x8 deg2 slice in CFHTLS W1 field



+2x4 deg2 slice in CFHTLS W4 field (VVDS F22)



Ground-based surveys: competitive with EUCLID-NIS?

- Key parameters:
  - Sensitivity: tel. diameter, background, throughput
  - Wavelength range ➡ redshift range
  - Field of view
  - Multiplex: number of simultaneous spectra
  - Number of effective hours (integrating) available

Existing facilities

Telescope	Diameter / Field	Wavelength / # objects
VLT-VIMOS	8m / 0.06deg²	0.37-1 μm 800
VLT-FLAMES	8m / 0.2deg²	0.4-0.9 μm 100
SDSS-3	2.5m / 2.5deg²	0.36-1 μm 1000
Keck-DEIMOS	10m / 0.03deg²	0.4-1 μm 120
Magellan-IMACS	6.5m/ 0.12deg²	0.37-1 μm 1000
FMOS-Subaru	8m / 0.1 deg²	1-1.8 μm 100

Planned facilities

Telescope	Diameter / Field	Wavelength / # objects
VLT-VIMOS upgrade	8m / 0.06deg²	Gain x2 in efficiency
VLT-new FLAMES	8m / 0.2deg²	0.4-1.2 μm 500
WFMOS-? (Subaru ?)	8m / 1.2deg²	0.36-1 μm 3000
BigBoss	4m / 5deg²	0.34-1.13 μm 5000
XMS	3.6m/1deg²	0.4-0.92 μm 4000
LBT	8m/5deg²	0.37-1 μm 5000
JWST	6.5m/0.0025deg²	1-5 μm 100
TMT	30m / 0.03 deg²	0.37-1.6 μm 400
EELT	42m / 0.015 deg²	0.37-1.6 μm 400

Proposed ground-based survey instruments: best contenders

- WFMOS
  - On an 8m, 1.2deg^2, >3000 fibers, not funded
- XMS
  - On a 4m (CAHA), 1deg^2, >4000 slits, not funded
- Big Boss

Other being discussed/studied:
-5 deg^2 multi-slit spectrograph on LBT
- ?

Big Boss, the instrument

- 4m telescope,
- KPNO for 5years
- then CTIO for 5y
- FOV: 5 deg^2
- 5000 fibers
- 0.34-1.13 microns

Big Boss, the proposed survey

- 24,000 deg^2: 14,000 on the KPNO 4m, 10,000 on CTIO
- 10 years survey
  - 180 nights, 50% efficiency, 8h/night = 7200h total
  - Targets
  - LRGs 0.2<z<1
  - Star forming galaxies: [OII]3727Å, 0.7<z<2
    - Efficiency of pre-selection TBD
  - QSOs: 2<z<3.5
- Input imaging: Griz Pan-Starrs, u CFHT
- 45 million galaxies, 1 million QSOs

Big Boss, realistic performances vs. ENIS

- Critical review of assumptions on BigBoss
- Vary key parameters from pessimistic to optimistic (spreadsheet)

Parameter	Big Boss	ENIS slitless	ENIS DMD
Total field	13,000 to 16,000	20,000	20,000
Duration	10y	5y	5y
Redshift range (galaxies)	0.7-2 ([OII])	0.5-2 (Hα)	0.5-2 (Hα) Up to z~4 ([OII])
Depth $erg.s^{-1}.cm^{-2}$ (7 σ, 1.6 microns)	$2.5x10^{-17}$	$4x10^{-16}$	$1x10^{-18}$
Resolution	2000	500	200-400
Number of galaxies	15 million (pessimistic) 45 million (optimistic)	70 million	200 million

Conclusion

- Main limitation from ground: sky background
- Ground based spectroscopic surveys will not reach the performances of space, even after 10 years
  - They will be an intermediate step towards the best space experiments
  - Should not oppose ground and space experiments, both are needed
- ENIS = 3 to 10x more galaxy redshifts than best ground experiments, with larger redshift coverage
- DMD spectroscopy offers the best « safety margin »