

Development of a mock galaxy catalogue for DESI survey validation

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DEX 2019

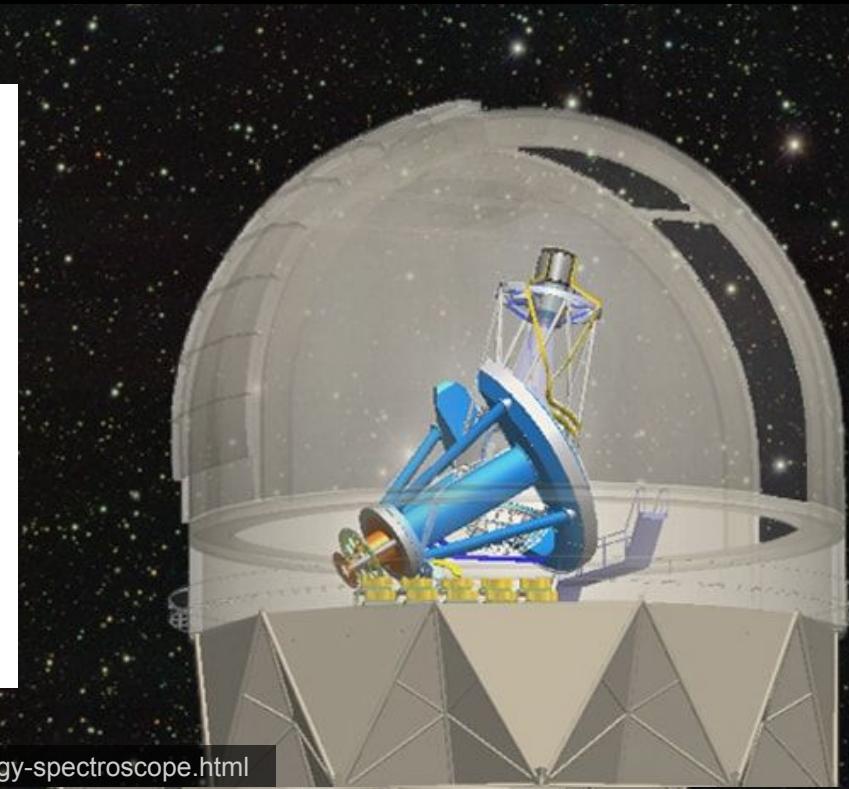
Royal Observatory of Edinburgh

Dark Energy Spectroscopic Instrument (DESI)

Will take spectra of 35 million objects out to redshift 2.5

Innovative spectrograph with 5000 fibre positioning robots

Survey validation to commence in late 2019



Aim of this project

Create a mock catalogue that
resembles the data
to be observed during DESI

Motivation behind this DESI mock

Training set for a future set of mocks
Systematics testing

The P-Millennium Simulation

125 Mpc/h

542 Mpc h^{-1} box side

1.4 x the original Millennium volume

Cosmological parameters from Planck

$5040^3 \ 10^8 M_\odot h^{-1}$ particles

Algorithm for populating subhalos

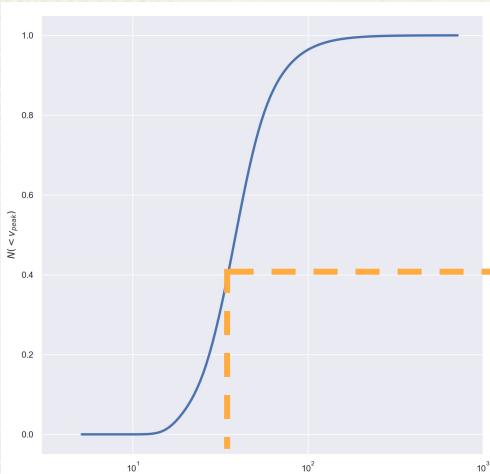
Subhalo abundance
matching (SHAM)

Colour assignment

Subhalo abundance matching

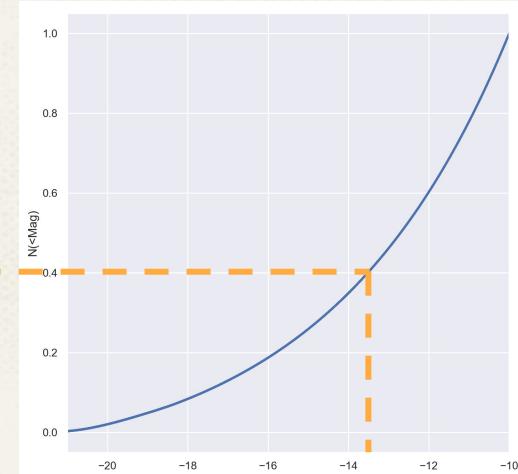
P-Millennium

Number of galaxies



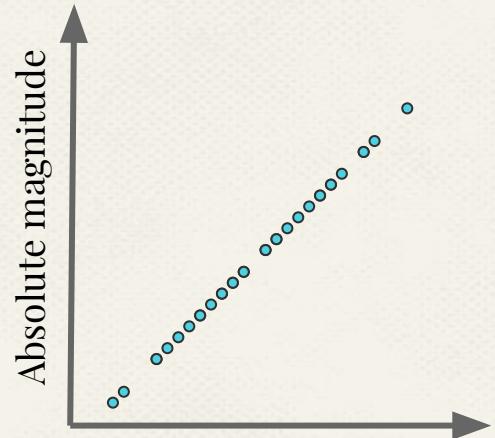
Peak velocity

SDSS data



Absolute magnitude

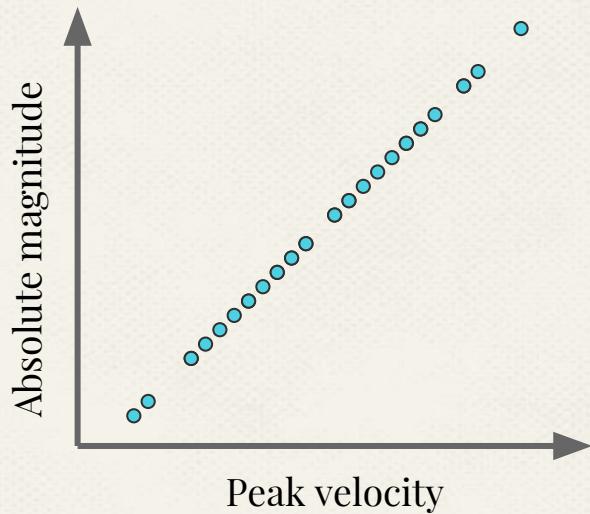
Matched set



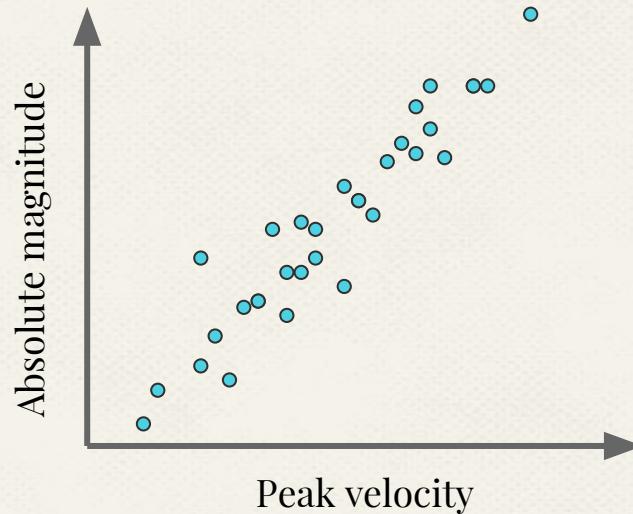
Peak velocity

Subhalo abundance matching

Matched set



Matched set with scatter



Algorithm for populating subhalos

Subhalo abundance matching

Peak circular
velocities for
subhalos in
P-Millennium

GAMA & SDSS
luminosity
function

(Smith et al 2017)*

Colour assignment

r-band
luminosities

* (Smith et al 2017, arxiv/1701.06581)

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Subhalo formation
redshifts in
P-Millennium

(g-r) as a function
of luminosity and
redshift

(Smith et al 2017)*

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Subhalo formation redshifts in P-Millennium

Cumulative distribution of subhalo formation redshifts

(g-r) as a function of luminosity and redshift

(Smith et al 2017)*

Cumulative distribution of (g-r) values

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(Smith et al 2017)*

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Subhalo formation redshifts in P-Millennium

($g-r$) as a function of luminosity and redshift
(Smith et al 2017)*

Cumulative distribution of subhalo formation redshifts

Cumulative distribution of ($g-r$) values

Mock catalogue:
 $(g-r)$ values
r-band magnitudes

Conclusion

DESI Survey validation begins in 2019
and requires mock data for testing
and interpretation

We create a mock catalogue with
r-band luminosities and colours

Our algorithm combines SHAM and
data-motivated colour assignment



Image courtesy of NOAO https://www.noao.edu/image_gallery/images/d7/KittPeak-1500.jpg