Clustering analysis using MultiDark halo abundance

F. Prada (IAA), S. Nuza (AIP), A. Klypin (NMSU), A. Sánchez (MPE) & S. Gottloeber (AIP)

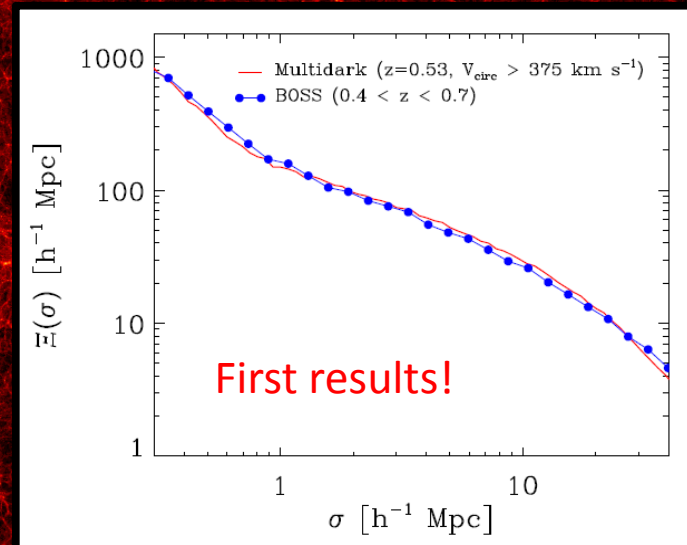*BOSS clustering WG Project 73*

1Gpc/h

First results!

www.multidark.org
DR1 on April 5th!

MultiDark Run 1

Cloudcroft BOSS coll. Meeting 03/11

MULTIDARK suite of simulations for BOSS studies

Mass function

1.5 10^{15} h^{-1}M$_{sun}$

MultiDark Run 1, Prada et al. 2011
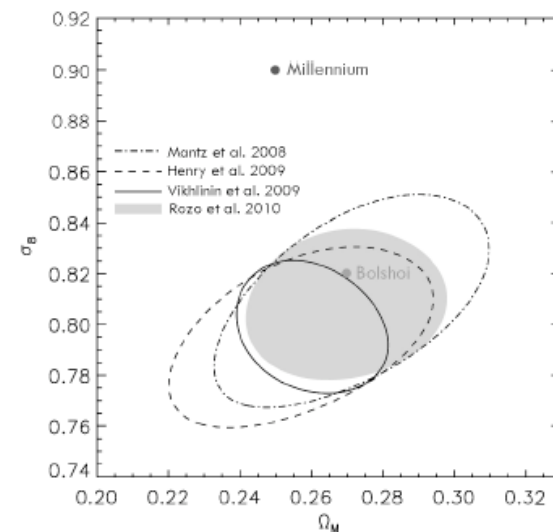
Run with ART code by A. Klypin

1Gpc/h

L_{box}= 1000 h^{-1} Mpc

N_{part}= 2048^3

Force res.= 4kpc comov.

M_{part}=8.77 10^9 h^{-1} M$_{sun}$

Velocity functions

The maximum of the halo circular velocity profile

$$V^2_{max} = max[GM(<r)/r]$$

is a measure of the depth of the dark matter halo potential well and it is expected to correlate well with the baryonic component of galaxies such as the luminosity or stellar mass as followed from the Tully-Fisher relation. The maximum circular velocity at present, for dominant halos, and at the time of accretion, in the case of subhalos, gives a better match to model the observed luminosity dependence and evolution of galaxy clustering from high-z to the present (e.g. Conroy et al. 2006). Another example is the recent work by Trujillo-Gomez et al. 2010 where they provide LCDM predictions for basic statistics of galaxies: Luminosity-- and Baryonic Mass--Velocity Relations, and Velocity Functions.
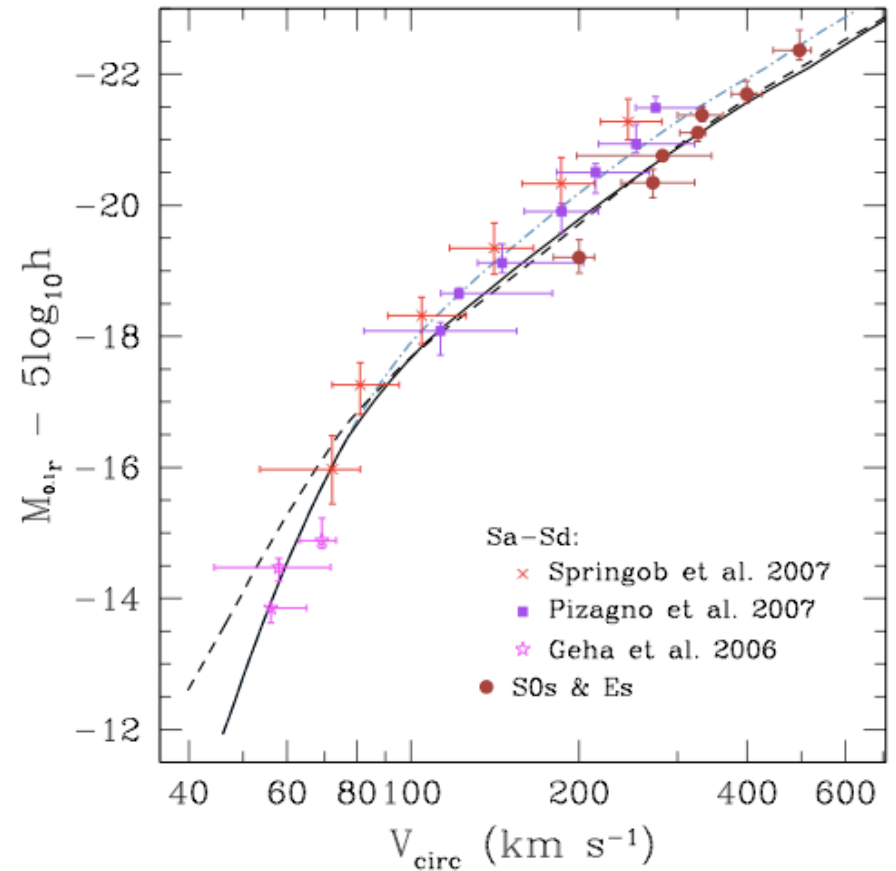
Comparison of the observed Luminosity-Velocity relati with the predictions of the LCDM model (Trujillo-Gomez et a

Velocity functions for Subhalos and Distinct Halos

MD @ z=0

Results from
BDM halo finder
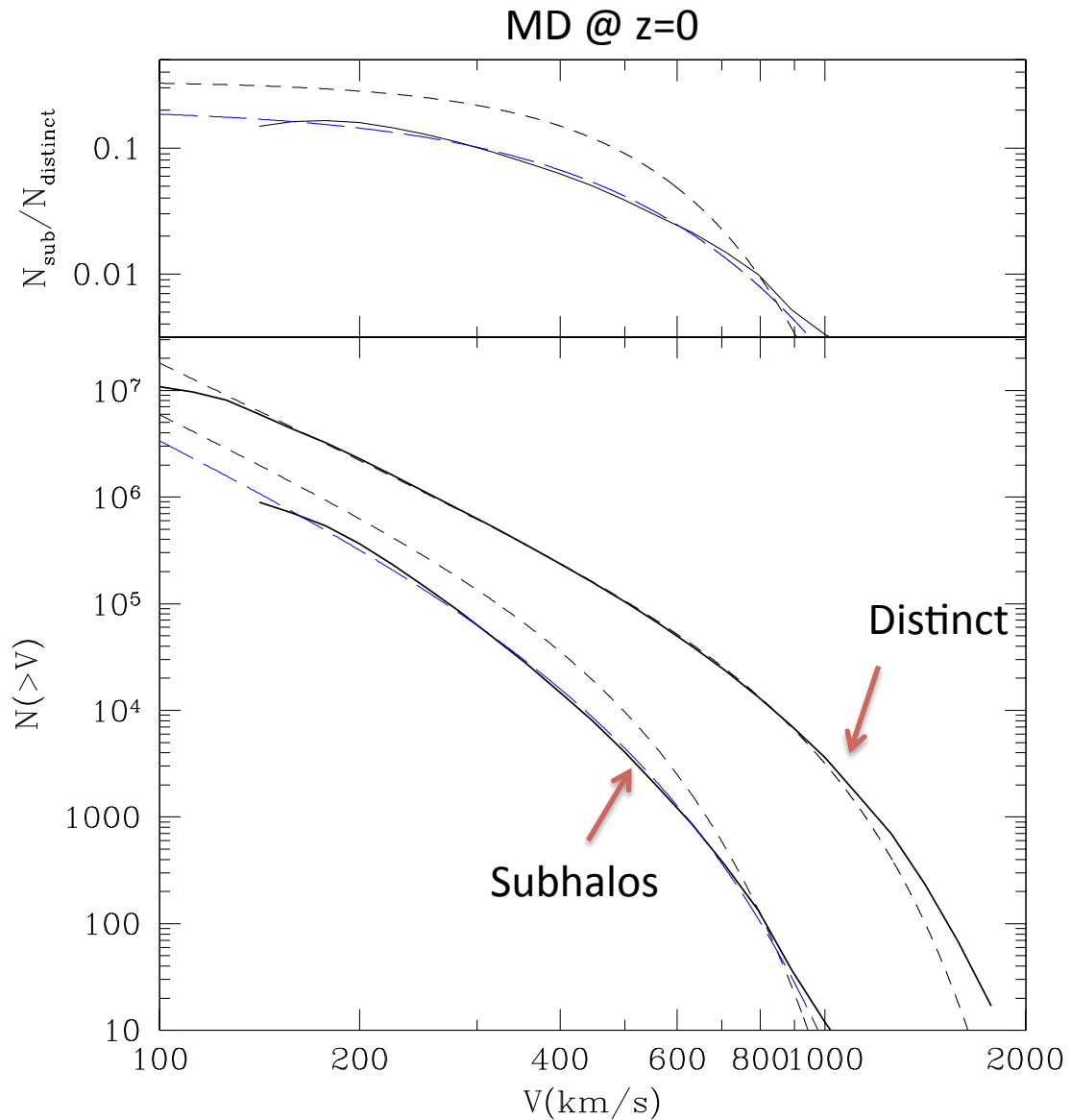
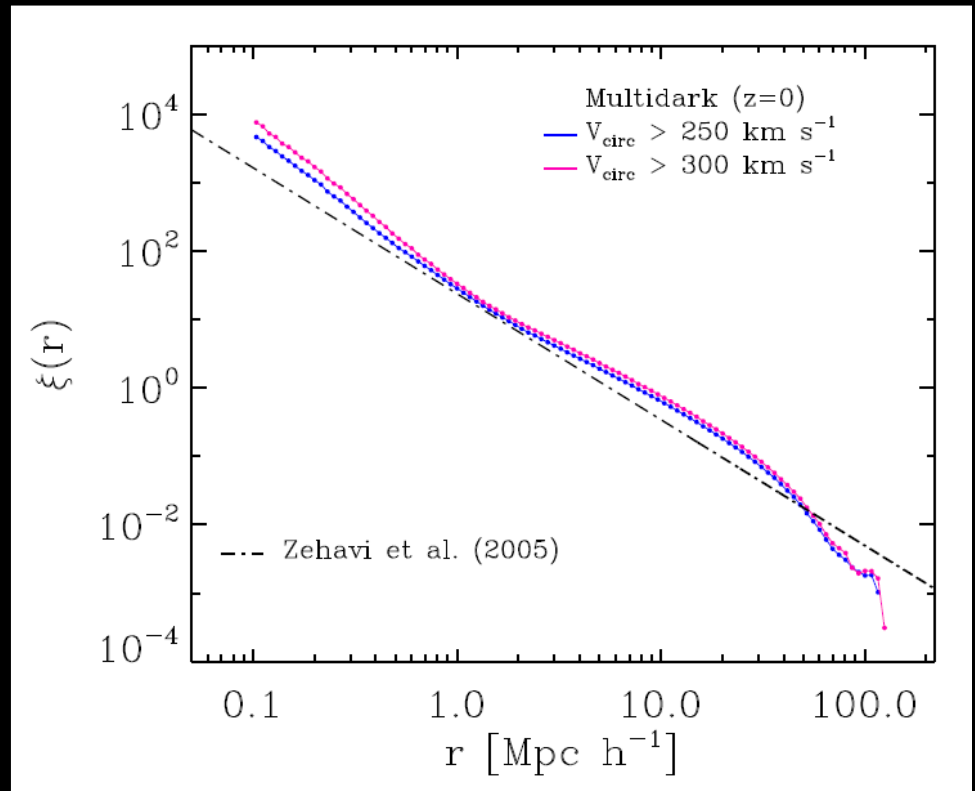# MultiDark real space correlation function at $z = 0$

$r = (x^2+y^2+z^2)^{1/2}$

* 1-halo and 2-halo terms clearly visible

* Simple halo abundance matching technique
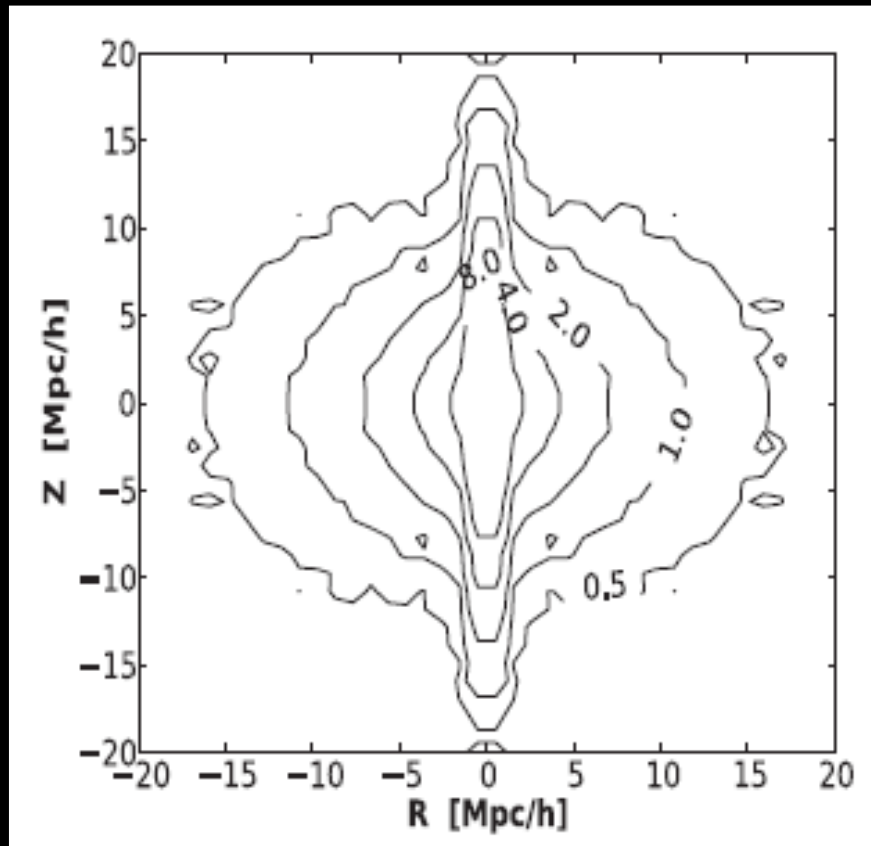 to get the correct number density of objects

$$\overline{n}_g = n_h(>V_{max})$$

* Consistent to clustering measures of the local
  Universe

MultiDark 2D correlation function at z = 0.53

$$\left.\begin{array}{l} \boxed{w} = (x^2 + y^2)^{1/2} \\ \boxed{w} = (z^2)^{1/2} \end{array}\right\} \boxed{w}(\boxed{w}, \boxed{w})$$

BOSS CMASS, White et al. (2011)
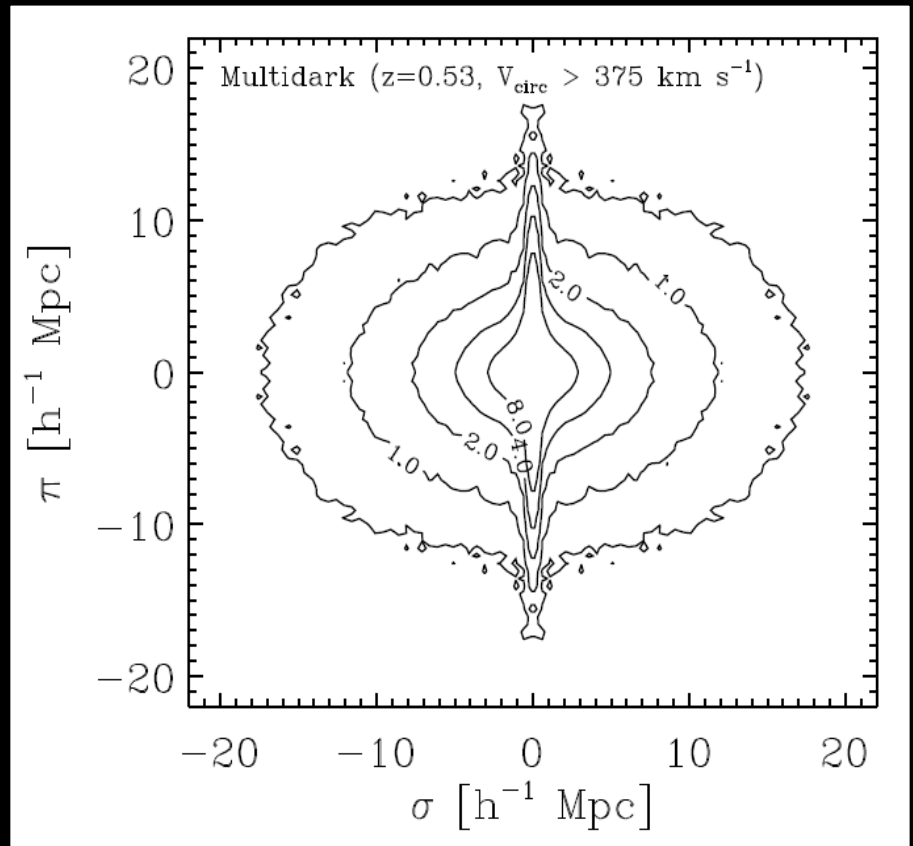
Multidark
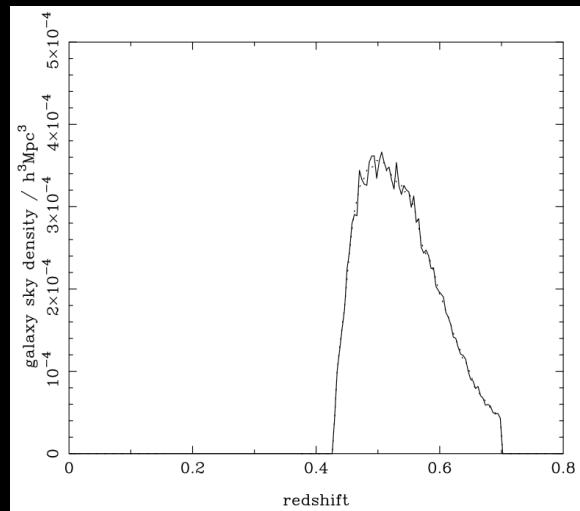

$V_{circ} > 375$ km s^{-1}

$\langle n \rangle \sim 3.4 \times 10^{-4}$ h^{-3} Mpc^3

MultiDark projected correlation function at $z = 0.53$ compared with most recent BOSS estimation from A. Sánchez for CMASS sample

* BOSS estimation of the projected CF
  for $0.4 < z < 0.7$ CMASS sample

* In practice, the 2D CF is
  integrated up to ~100-150 h^{-1} Mpc

$$\Xi(\sigma) = 2 \int_{\pi=0}^{\pi_{max}=\infty} \xi(\sigma, \pi) \, d\pi$$

First results!
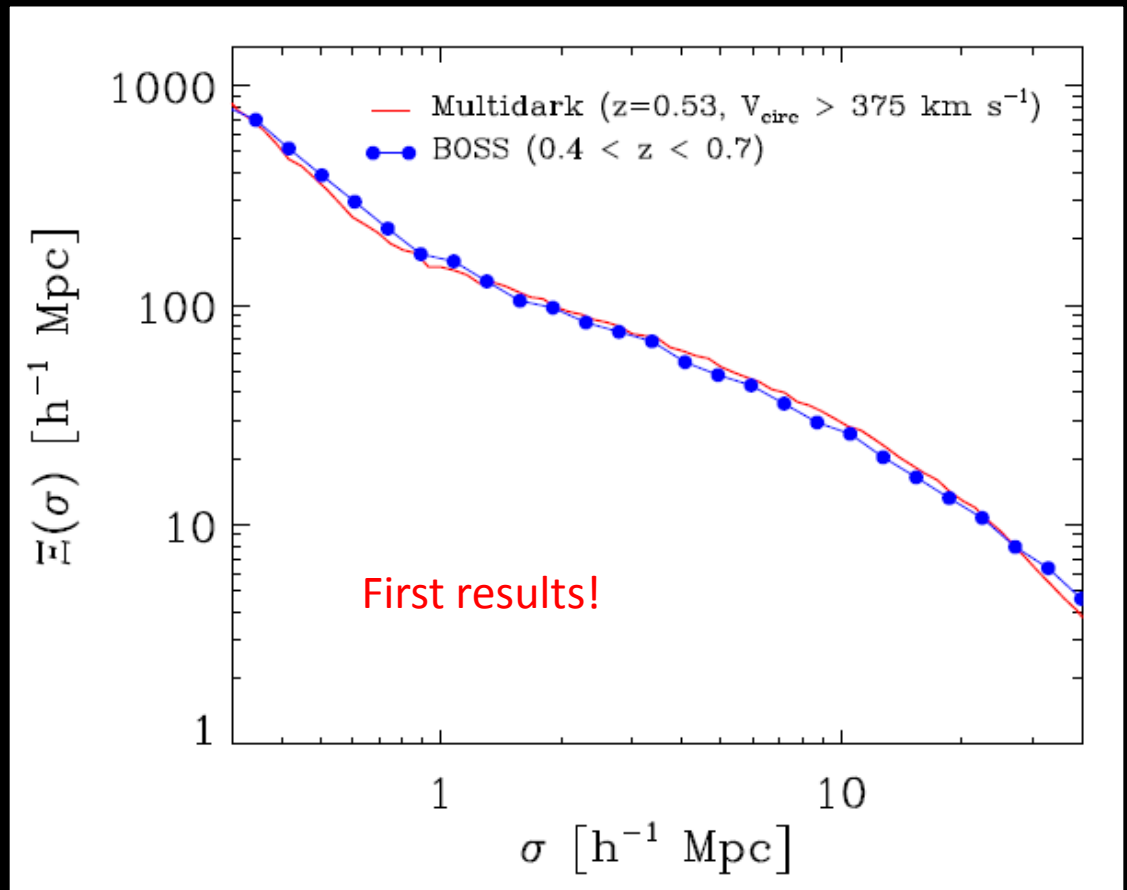
Redshift space correlation function

$$z \quad \Longrightarrow \quad z + v_{pec} * H^{-1}(t)$$

BIAS
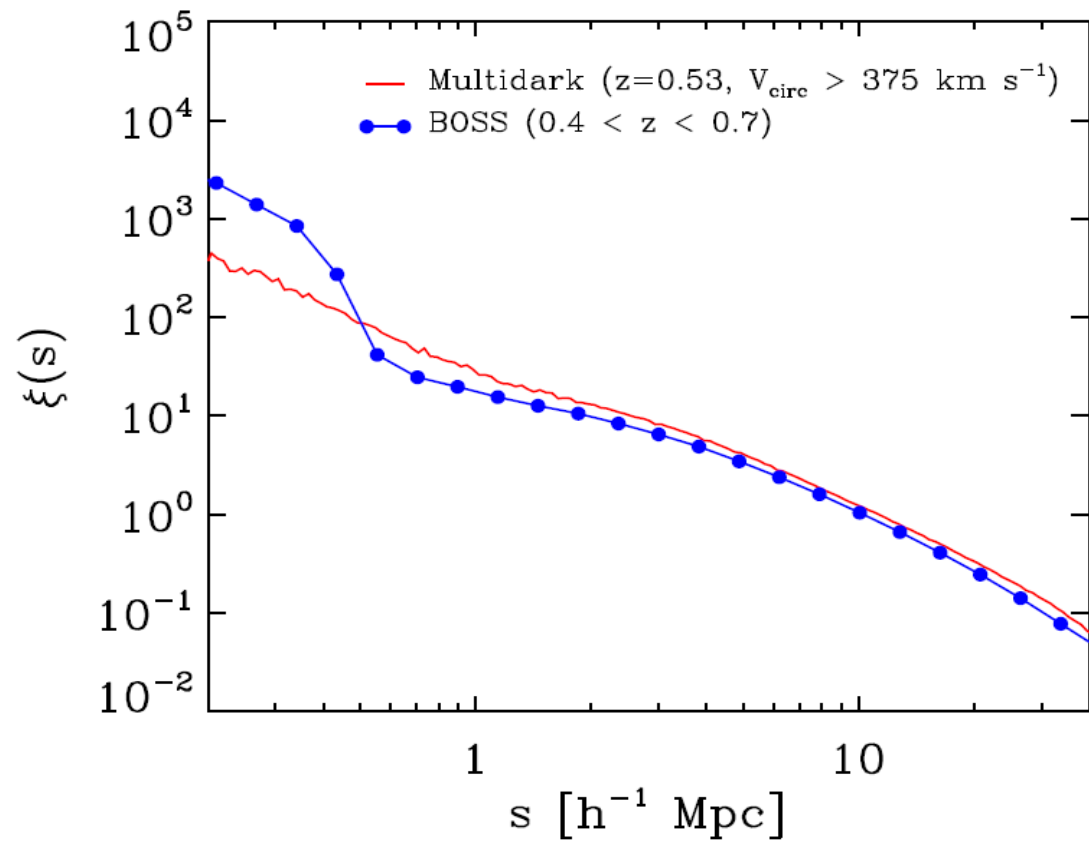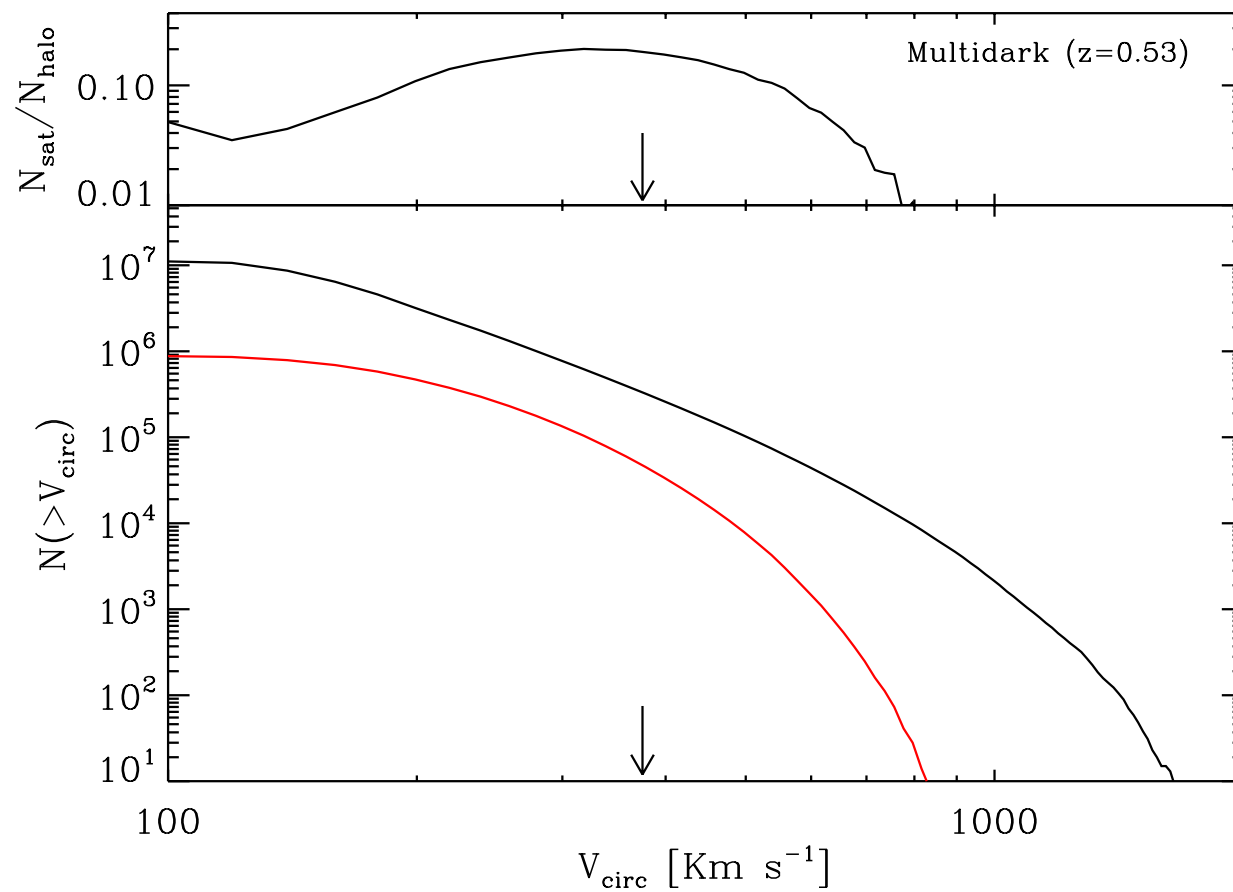
Satellite Fraction

Plans for mock galaxy catalogs & new simualtions

MultiDark Database

- collaboration with Astrophysical Institute Potsdam (AIP), supported by GAVO

- Database for MULTIDARK simulations will include:
  - halo + galaxy catalogues (positions, velocities, properties)
  - kinematic and density profiles
  - snapshots of simulations (particle selection)

- design similar to Millennium Simulation DB

- compliant to international VO (virtual observatory) standards

- Web interface:
  - direct access via SQL queries
  - store results of queries in own database (registered users)
  - history of previous queries
  - on-line documentation

www.multidark.org

MultiDark Database

Home
  Registration
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  Status
  Images & Movies

Query Form

Credits

Documentation

MultiDark
Multimessenger Approach
for Dark Matter Detection

GERMAN ASTROPHYSICAL
GAVO
VIRTUAL OBSERVATORY

AIP

Welcome to the MultiDark Database

*** All data provided here are currently only in a pre-release state and MUST NOT (yet) be used for SCIENTIFIC purposes! ***
The MultiDark database provides results from cosmological simulations performed within the MultiDark project. This database can be queried by entering SQL statements directly into the Query Form. The access to that form and thus access to the public & private databases is password protected - if you haven't done so, please register first.
More information on the simulations, the database, its design and the possibilities to access the data are described in the Documentation, where we also provide a little tutorial on SQL (SQL Step-by-Step) and some Frequently Asked Questions.

Registration
Access to the Query Form is password-protected - if you don't want to register, use the **public user**:
  username: multidark_public
  password: [none]
For gaining full access to all data in the database, registration via the Registration Form, also linked at the Registration page of the Documentation, is required.
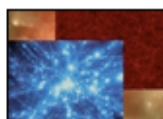
Contact
For any comments, suggestions, help requests, bug reports etc., please don't hesitate to contact us by filling out our Contact Form.
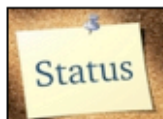
Status
The current status of the database and the web application is reported in the section Status. This is the place to look for any news related to the simulations and the database.

Images & Movies
We have collected some images (and now also the first movies!) related to the MultiDark simulations at Images & Movies. Feel free to use them for talks, posters or just enjoy them!
You have created a nice movie yourself and want to share it with other people? Excellent! Just fill out the Contact Form and send us a short description, where to find the movie/picture, what it shows and which data and code was used to produce it. We will then consider adding it to this web page.

Demo Video
For an easy start we created a little video on YouTube for you which demonstrates the basic usage of the web interface for accessing the MultiDark Database. Have a look at our section Demos&Tutorials or watch it directly on YouTube.

MultiDark Database

MultiDark
Multimessenger Approach
for Dark Matter Detection

GERMAN ASTROPHYSICAL
GAVO
VIRTUAL OBSERVATORY

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AIP
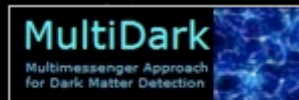
Query the MultiDark Database

Welcome Multi Dark test user!

Admin Pages

*** All data provided here are currently only in a pre-release state and MUST NOT (yet) be used for SCIENTIFIC purposes. ***

Place your SQL statement directly in the text area below and submit your request by pressing one of the 'Query' buttons.
Please note, that there is a timeout and row limit for each query:
Streaming queries: return unlimited number of rows in CSV format and are cancelled after 420 seconds.
Browser queries: return a maximum of 1000 rows in HTML format and are cancelled after 30 seconds.

```
select top 10 * from miniMDR1..FOF where snapnum = 85 order by np desc
```

[Query (stream)] [Query (browser)]   Maximum number of rows to return: [10 ⇅]

[Help]   [Clear Text]

Previous queries

Show all previous queries for current user (max. 1000) with additional information in a new window:
[Advanced query history]

Demo queries

www.multidark.org

MultiDark Database

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Credits

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Thank you!