

# **WP6 of GAESWG: Theoretical Models**

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**Aim: discuss feedback to/from data relevant for the GAESWG; initially acted as a conduit to other SWGs (Cosmological Simulations in particular). Re-activated at the end of 2020 with goal to identify specific needs for pre-launch KPs.**

**Members: communications typically sent to all SWG but feedback requested from all WP coordinators. Broad internal expertise on modeling.**

# Status WP6

## Circa 1 year ago:

- Kick-off telecon in February 2021 with (almost) all WP coordinators, different groups working on development of theoretical models, plus interested people. Goal: identify what needed and what available.
- Plan: the complexity and wide range of requirements are such that it is virtually impossible to find a unique model that is able to provide all of them. Three models identified that could provide most of the required info (MAMBO, GAEA, Magneticum); generate dedicated light-cones plus additional properties for these three.

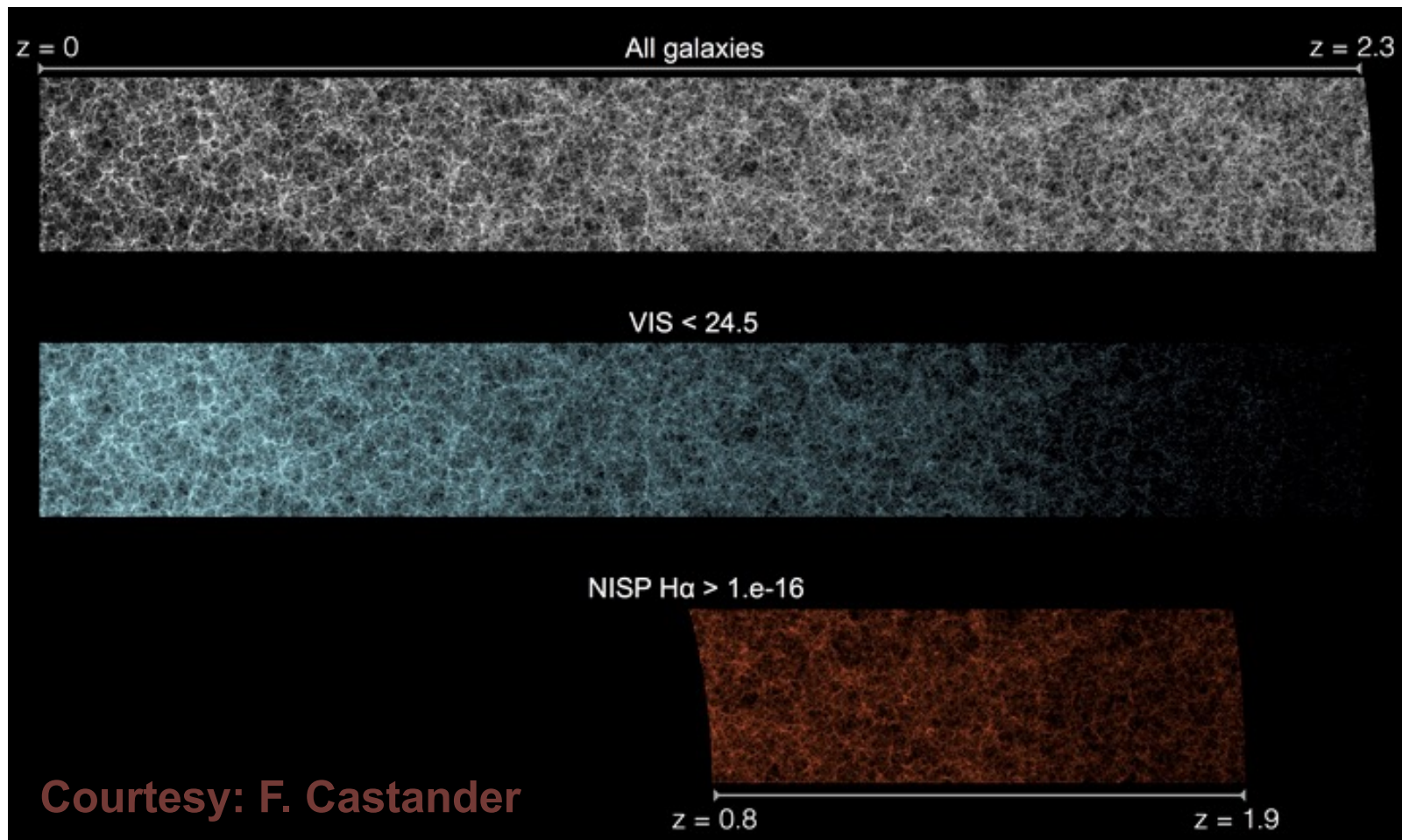
## Current:

- Original goal achieved for 5 independent models based on different techniques. Refinements ongoing; further goals identified.



# Flagship2 mocks

Based on Flagship2 simulation, and on a hybrid HOD and abundance matching approach – mocks are being constructed and validated by a dedicated tiger team. Should be released in two weeks.



Courtesy: F. Castander

# Available theory mocks:

Info about goals, development, details:

[https://euclid.roe.ac.uk/projects/geswg/wiki/Theoretical\\_models](https://euclid.roe.ac.uk/projects/geswg/wiki/Theoretical_models)

- Magneticum Simulation contact person Klaus Dolag (DE).
- Horizon-AGN; contact person Clotilde Laigle (FR)
- BAHAMAS; contact person Amandine Le Brun (FR)
- MAMBO; contact person Micol Bolzonella (IT)
- GAEA; contact person Fabio Fontanot (IT)

Beware:

- not all required information are available for all mocks;
- the resolution is circa adequate for the wide for almost all mocks (not for BAHAMAS), but not for the deep fields;
- produced on best effort basis by several individuals that have invested different degrees of effort.

# Available “Euclid like” info

Many science questions require “realistic” info (e.g. photo-z, emission lines, spectra with realistic noise, mock images, etc).

Tiger team established after dedicated splinter meeting @Euclid2021. Coordinated by O. Cucciati and G. De Lucia (relevant input from M. Bolzonella, M. Talia and others).

All relevant info and outputs can be found here:

<https://euclid.roe.ac.uk/projects/simulation-verification/wiki>

Euclid-like quantities were computed for all mocks available by O. Cucciati and include:

- Perturbed observed mags in relevant bands and errors
- Photometric redshifts (full PDF plus statistics)
- H $\alpha$  fluxes including dust attenuation (+independent for GAEA)

# What is next

Bulk of work completed. Refining/correcting what is available.

One step pending:

- Producing full SEDs from at least a couple of the models available (for MAMBO already available; software ready for GAEA; waiting for a sub-sample selection)

Ongoing/next steps:

- Dedicated mocks that preserve large-scale structure (relevant for environmental analysis and proto-cluster). Activity led by O. Cucciati and based on GAEA+Millennium; projected boxes ready; ongoing discussion about how to include foreground and background contamination. Will be released to the consortium.
- Dedicated mocks for deep fields. Unfeasible for (large) mocks based on hydro-sims. More difficult for different techniques. Activities (not exclusively focused on Euclid) ongoing (P-Millennium, PINOCCHIO)



# Final remarks

- Wide range of scientific goals imply a rich and variegated set of requirements that no available galaxy formation model can meet simultaneously. Intense ongoing activity on KPs new trigger for WP6.
- Goals planned ~1 year ago achieved: mocks + Euclid-like quantities are available and have been distributed to the consortium (beyond original SWGs). Significant effort from many individuals - check wiki page for how/who to include in papers and refs to add.
- Ongoing/next steps:
  - Full SEDs available for sub-sample of galaxies (easy/soon)
  - Mocks that preserve large-scale structure (~1-2 months)
  - Mocks for deep fields (~summer/end of the year)