Expand All | Collapse All

EAS 2022

Welcome & News
About
COVID-19
Organisers
Code of conduct
FAQ
Travel & Covid
Venue
Registration
Abstract Submission
Programme
Interactive Programme
Plenary Talks
Social Events
Public lecture
Fee waivers and/or grants
Accommodation
Child care
Graphics
Sponsorship & Exhibition
Sponsors & Exhibitors
ESO Reflex Helpdesk
Contact

Organiser

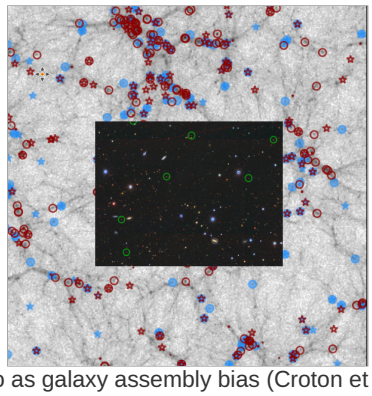
Host

Partner

Symposium S2 **30 June - 1 July 2022**

Galaxies as cosmological tracers

Aims and scope



In the LCDM cosmological model, matter is distributed in space in a non trivial way. This distribution is the result of the evolutionary growth of initial density perturbations, which directly depend on the composition of the Universe. We use galaxies as the visible tracers of the matter distribution at different cosmic times.

A general expectation of structure formation theories is that halo clustering does not depend on any property besides halo mass; nonetheless, cosmological simulations predict that the clustering of haloes depends on multiple halo properties at fixed mass; this effect is known as halo assembly bias (Sheth & Tormen 2004; Gao et al. 2005). In principle, this effect could propagate into galaxy clustering due to the tight connection between galaxies and halos; this effect is commonly referred to as galaxy assembly bias (Croton et al. 2007).

Stage IV cosmological surveys such as 4MOST, DESI and Euclid are starting now or will start in the near future. These surveys will use galaxies to constrain cosmological parameters with an expected exquisite precision. The increasingly high statistical precision of these surveys needs to be matched by more precise predictions of the galaxy-matter connection. The models needed to make such predictions are complex and computationally expensive.

In this session, we aim to gather the latest developments on modelling the galaxy-matter connection and to discuss better strategies to improve the cosmological parameter constrains using 3-D galaxy maps. The main goals of this session are:

i) Understand the galaxies targeted by cosmological surveys as tracers of dark matter haloes.

ii) Explore how the physics of baryons and assembly bias affect the distribution of dark matter and how this should be taken into account within simplified models.

iii) Discuss what the community needs to get better cosmological constrains with the current and future data from galaxy surveys.

Programme

- Halo and galaxy assembly bias
  In this block, we will discuss the origin of halo and galaxy assembly bias, and the latest advances on their modelling.

- Influence of assembly bias on cosmic probes
  The impact of assembly bias on cosmic probes has the potential to lead to systematic biases in cosmological constraints inferred without accounting for this effect. In this session, we explore the latest developments on the modelling of assembly bias on mock galaxy catalogues, the influence of assembly bias on cosmological constraints, and new avenues for extracting this effect from observations.

- Galaxy evolution and the two point correlation function.
  The physics of baryons can affect the measured two point correlation functions at both large (e.g. the baryon acoustic oscillations) and small scales (e.g redshift space distortions).

- Galaxies, alternative statistical probes and beyond LCDM.
  Cosmological constraints from 3-D galaxy maps can come not only from the two point correlation functions, but also from higher-order statistics, forward modelling, marked density field, etc. In this session we will explore the effect (or lack of it) that galaxy physics has on these alternative statistical probes. Here we will also explore modifications of gravity, primordial non-Gaussianities and other cosmologies beyond LCDM in connection to their visible tracers.

- Fast modelling the galaxy-dark matter connection

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Full N-body simulations are costly and we require of larger volumes in order to interpret and properly account for systematic errors in upcoming galaxy surveys.

- Stage IV cosmological surveys: needs and wishes
  We will close this session with a review talk on the past, present and future of galaxy cosmological surveys and a discussion about what is needed to accomplish the accuracy expected from stage IV cosmological surveys and what the community wishes for.

Invited speakers

Review talks by:

- Jiamin Hou (MPI for extraterrestrial Physics, Germany).
- Eva-Maria Mueller (University of Portsmouth, UK)
- Zheng Zheng (University of Utah, USA)

Scientific organisers

- Carlton Baugh (Professor at Durham University, UK).
- Jonás Chaves-Montero (Post-doc at Donostia International Physics Center, Spain), Chair.
- Sergio Contreras (Post-doc at Donostia International Physics Center, Spain), Chair.
- Ginevra Favole (Post-doc at EPFL, Switzerland).
- Jiamin Hou (Post-doc at MPI for extraterrestrial Physics, Germany).
- Violeta Gonzalez-Perez (Fellow at Universidad Autónoma de Madrid, Spain), Chair.
- Hong Guo (Research Associate at Shangai Observatory, China).
- Ian McCarthy (Professor at Liverpool John Moores University, UK).
- Pauline Zarrouk (Researcher at Sorbone Universite, France).
- Idit Zehavi (Professor at Case Western Reserve University, USA).

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