Advanced Cosmology

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https://www.unibo.it/en/teaching/course-unit-catalogue/course-unit/2023/468927

This course is intended to present the current understanding of the main advanced topics in Cosmology. After completing the course, students will acquire a thorough and updated knowledge of **modern cosmological frameworks**, with particular focus on **dark matter** and **dark energy models**, and on all the **main cosmological probes**. Furthermore, they will learn the primary statistical methods of **modern observational Cosmology**.

Readings/Bibliography

- **General Relativity: The Essentials**
  Carlo Rovelli; Cambridge University Press

- **Modern Cosmology** Second Edition
  Scott Dodelson, Fabian Schmidt; Academic Press

- Lecture slides, notes and selected scientific papers

Outline

General Relativity

fields; space and time; curved spaces;

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Numerical tools

C++/Python;

CosmoBolognaLib

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- **The concordance cosmological model**
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- **The inhomogeneous Universe**
  the Boltzmann equation for photons, cold dark matter, baryons and neutrinos; scalar-vector-tensor decomposition; the Einstein equations for scalar perturbations; tensor perturbations

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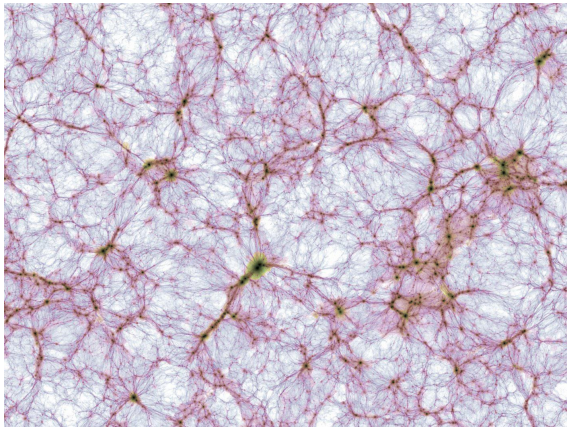
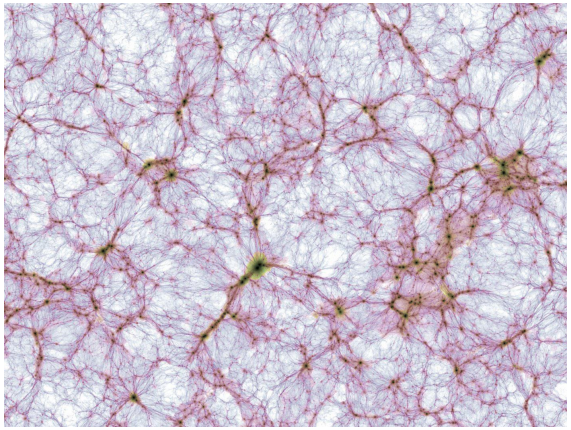
- **Probes of structure: tracers**
  statistics of galaxies, galaxy clusters and cosmic voids; angular and 3D clustering; bias; baryon acoustic oscillations; redshift-space distortions; geometric distortions

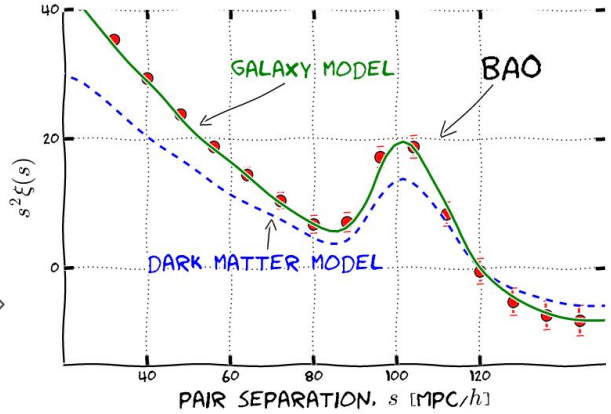
large-scale structures



large-scale structures



cosmological probes



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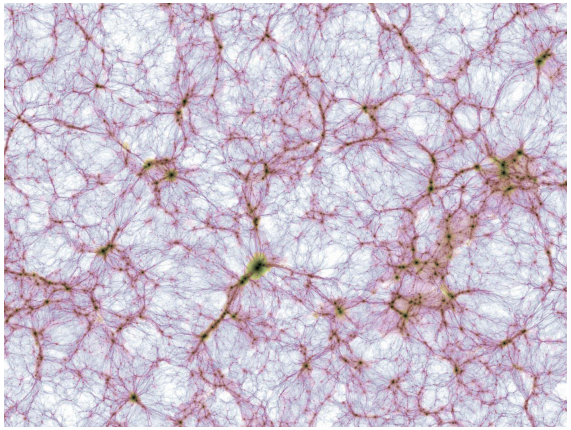

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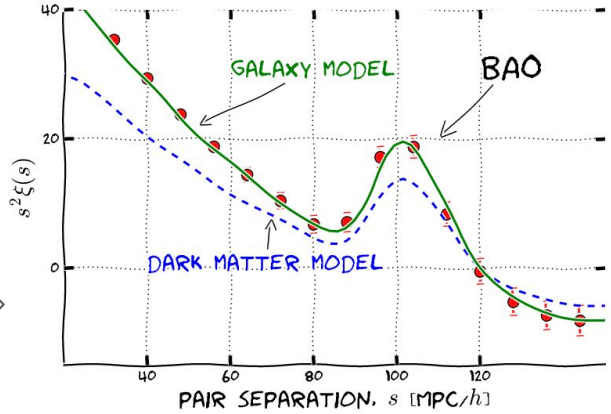
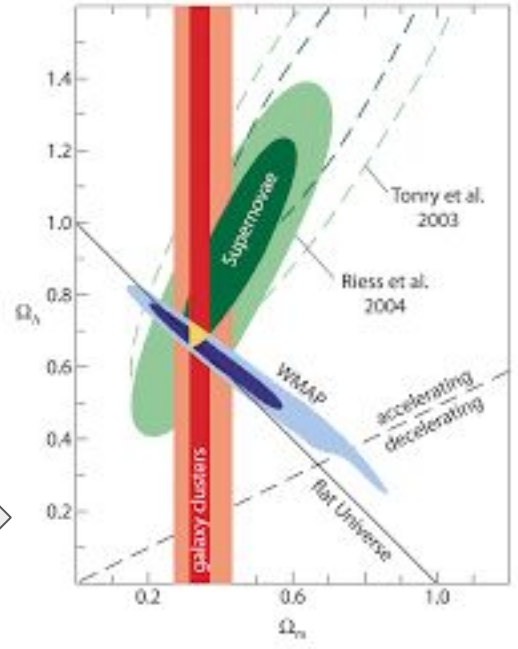


cosmological constraints



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