Welcome !

Organizing Committee
Francis Bernardeau (IAP & IPhT Saclay)
Michele Levi (IAP, ILP, UPMC)
Patrick Valageas (IPhT Saclay)
Ben Wandelt (IAP, ILP, UPMC)

ILP Coordinator
Olivia Leroy

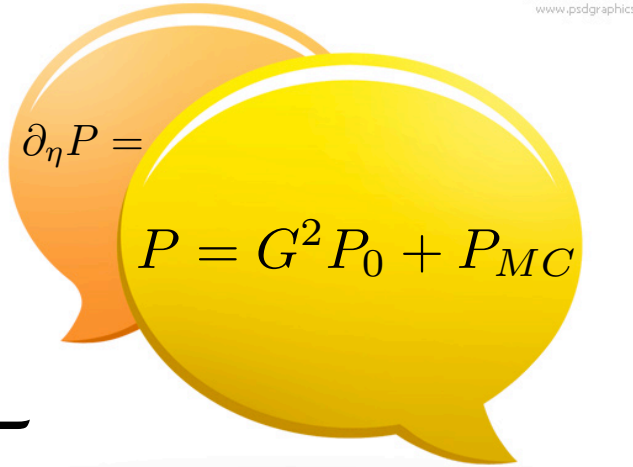
IPhT Saclay Coordinators
Laure Sauboy
Sylvie Zaffanella

The workshop gathers active researchers, who aim to push forward the analytical treatment of the nonlinear large scale structure of the Universe, in view of the ongoing numerical progress, and the timely observational demands.

It will provide an overview of the current main perturbative approaches, and their up to date status, including their advanced applications to study alternative theories of Gravity, massive neutrinos, and non-Gaussianity.

The workshop is designed to be a meeting of diverse researchers, bringing in their various perspectives on the field, yet allowing for large informal interaction, in order to foster a meaningful and fertile exchange of notions for progress in the field.

Institut de Physique Théorique
CEA-Saclay
Gif-sur-Yvette
20-22 September, 2011



PT *chat*

A Workshop on Resummation Methods in Cosmological Perturbation Theory

Convenors:
Francis Bernardeau
Martín Crocce
Román Scoccimarro
Emiliano Sefusatti

Participants:
Stefano Anselmi
Benjamin Audren
Tobias Baldauf
Guillermo Ballesteros
Philippe Brax
Ram Brustein
Vincent Desjacques
Julien Lesgourgues
Sabino Matarrese
Takahiko Matsubara
Takahiro Nishimichi
Massimo Pietroni
Robert Smith
Atsushi Taruya
Patrick Valageas
Nicolas Van de Rijt
Filippo Vernizzi
Zvonomir Vlah

The workshop aims at gathering active researchers in the development of efficient analytical methods for the computation of the statistical properties of the large-scale structure of the Universe. It will provide the opportunity for participants to present and discuss the merit ands scopes of the different Perturbation Theory approaches that have been put forward in recent years.

This meeting is supported by the French
Programme National de Cosmologie et Galaxies

PTChat at Cargèse
April 30 – Mai 3, 2013

Francis Bernardeau
Institut de Physique Théorique de Saclay
91191 Gif-sur-Yvette
Francis.bernardeau@cea.fr
Tel 0169088116

PT *chat at Cargèse*

$\partial_\eta P =$

$P(k) = [\Gamma^{(1)}(k)]^2 P_0(k) + ...$

Second Workshop on Resummation Methods in cosmological Perturbation Theory

With the advent of a new generation of wide field cosmological surveys aiming at characterizing the mass and energy content of the universe, it becomes important to develop tools for predicting and computing cosmic field statistical properties, such as cosmic density spectra or bispectra beyond the linear regime. To achieve such an objective, besides N-body simulations, one can rely on Perturbation Theory techniques that allow to approach such quantities in a controlled way. Furthermore those methods could in principle be exploited for a variety of cosmological models that include non-standard effects such as massive neutrinos or modified gravity models.
In this context, this workshop aims at gathering active researchers in the development of efficient analytical methods for the computation of the statistical properties of the large-scale structure of the Universe. It will provide the opportunity for participants to present and discuss the merits and scopes of the different Perturbation Theory approaches that have been put forward in recent years.

Main topics will include

- hardcore methods of perturbation theory
- application to redshift-space distortions
- biasing mechanisms and properties of halos
- construction of modified gravity & dark energy models
- impact of massive neutrinos on the development of large-scale structure
- computations of covariances

Program

The scientific program will gradually be established, based on the proposals of accepted contributions

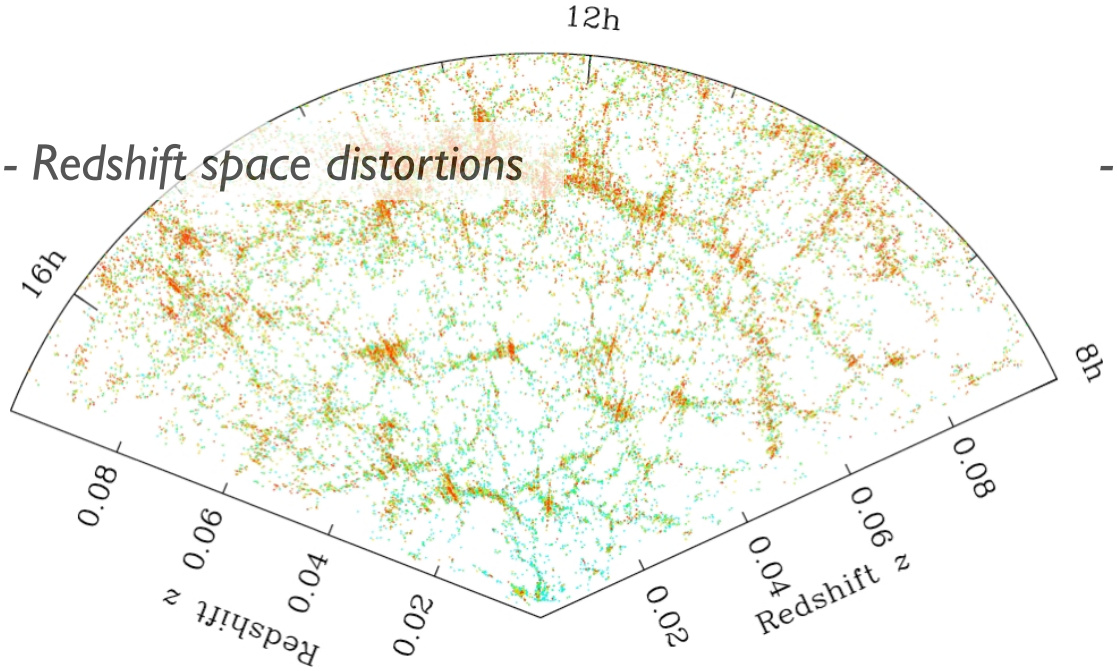
Organization Committee

Francis Bernardeau (IPhT Saclay FR), Takahiro Nishimichi (IPMU & IAP, Tokyo JP et Paris FR), Patrick Valegeas (IphT Saclay FR)

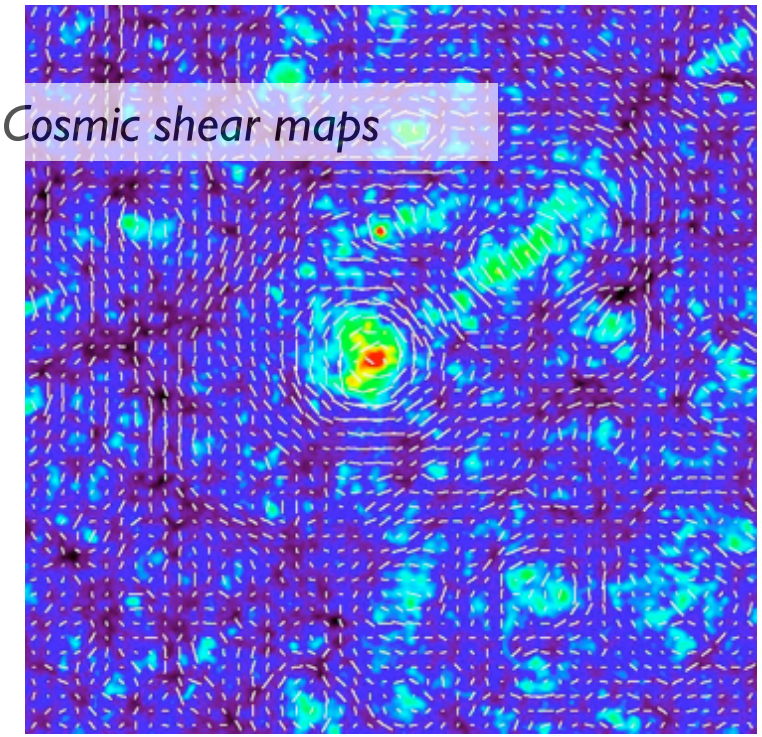
Application and registration

http://www.iesc.univ-corse.fr/index.php?id=81&L=0&tx_iescielecoles_pi4[idecole]=804

No Registration fees
Deadline for applications to April 7th, 2013



- Redshift space distortions



- Cosmic shear maps

What is at stake?

- using LSS data to constrain models

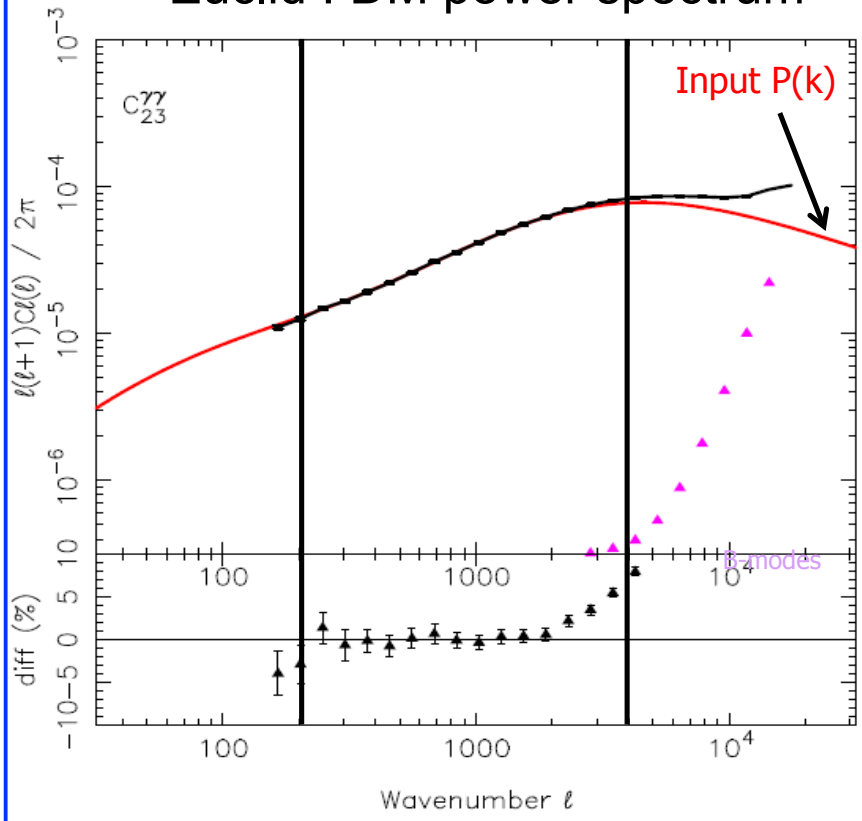
What do we want to learn?

- Initial metric perturbations, spectra, primordial non-Gaussianities
- constraints on the dark matter particles - mass of the neutrinos
- dark energy/modification of the gravity in the expansion/growth of structure

Nonlinear effects are ubiquitous!

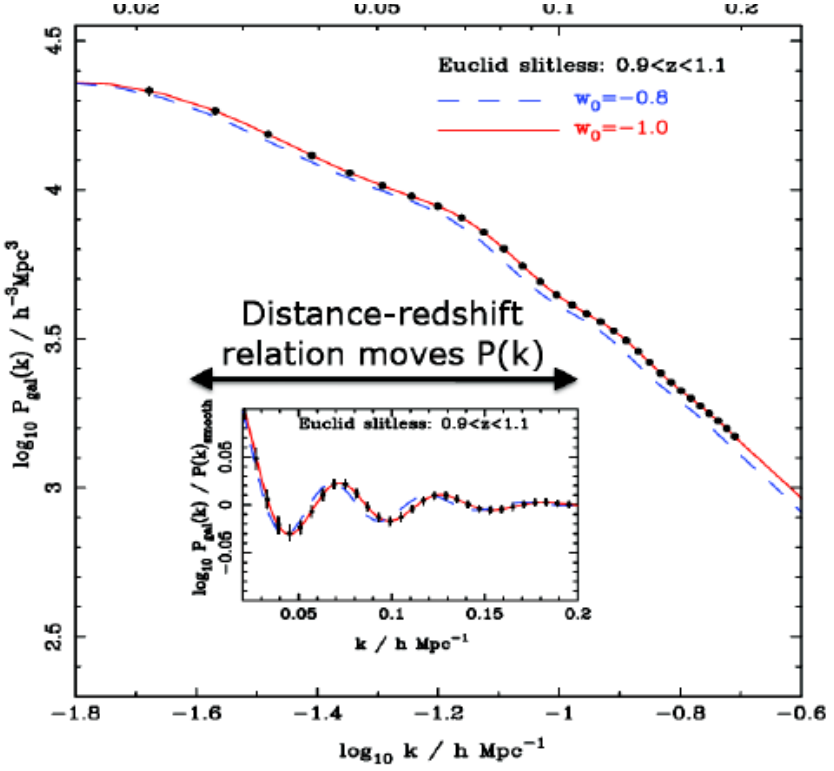
Data in next generation surveys will be of fantastic precision !

Euclid : DM power spectrum



- **Tomographic WL shear cross-power spectrum for 0.5 < z < 1.0 and 1.0 < z < 1.5 bins.**
- **Percentage difference [*expected* – *measured*] power spectrum: recovered to 1% .**

Euclid: Galaxy power spectrum



- **V_{eff} ≈ 19 h^{-3} Gpc^3 ≈ 75x larger than SDSS**
- **Redshifts 0.7<*z*<1.85**
- **Percentage difference [*expected* – *measured*] power spectrum: recovered to 1% .**

Standard observables : power spectra

- Power spectra are identified as the primary mean for constraining cosmological parameters
  - which statistical errors ?
  - which systematic uncertainties (instrumental, astrophysical) ?
  - which theoretical uncertainties ?

- Theoretical predictions: for what? How accurate are they?
  - Linear / direct PT (parameter free) predictions
  - EFT approaches for which regimes? How are the EFT parameters identified and determined (marginalized over ? from simulations?)
  - How to take into account extensions from the standard ingredients (modified gravity models, massive neutrinos)?
  - How to quantify the accuracy of the predictions?

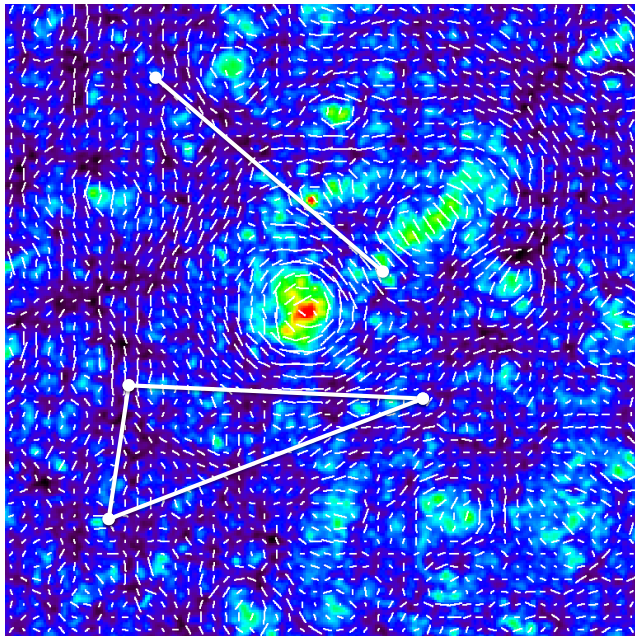
- **Euclid Wide:**
  - 15000 deg^2 outside the galactic and ecliptic planes
  - 12 billion sources (3-σ)
  - 1.5 billion galaxies with
    - Very accurate morphometric information (WL)
    - Visible photometry: (u), g, r, i, z , (R +I+Z) AB=24.5, 10.0 σ +
    - NIR photometry : Y, J, H AB = 24.0, 5.0σ
    - Photometric redshifts with 0.05(1+z) accuracy
  - 35 million spectroscopic redshifts of emission line galaxies with
    - 0.001 accuracy
    - Halpha galaxies within 0.7 < z < 1.85
    - Flux line: 2 . 10^{-16} erg.cm^{-2}.s^{-1} ; 3.5σ

- **Euclid Deep:**
  - 1x10 deg^2 at North Ecliptic pole + 1x20 deg^2 at South Ecliptic pole

    + 1x10 deg^2 South Equatorial field
  - 10 million sources (3-σ)
  - 1.5 million galaxies with
    - Very accurate morphometric information (WL)
    - Visible photometry: (u), g, r, i, z , (R +I+Z) AB=26.5, 10.0 σ +
    - NIR photometry : Y, J, H AB = 26.0, 5.0σ
    - Photometric redshifts with 0.05(1+z) accuracy
  - 150 000 spectroscopic redshifts of emission line galaxies with
    - 0.001 accuracy
    - Halpha galaxies within 0.7 < z < 1.85
    - Flux line: 5 . 10^{-17} erg.cm^{-2}.s^{-1} ; 3.5σ

Quasi-non-standard observables

- Higher order correlation functions
  - expected to be large
  - expected to carry significant amount of information



Non-standard observables

For a non-Gaussian fields, what are the best statistical tools ?

- More robust observables or best fitted for specific physical probes?
  - Minkowski functionals?
  - density PDFs ?
  - …

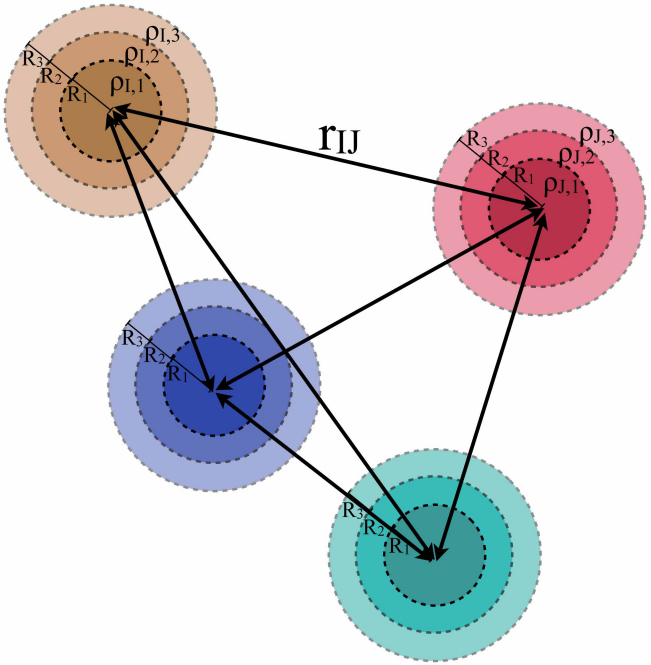


Figure 1. The configuration of spherical cells considered in this

Workshop Program

Nonlinear Large Scale Structure: Theory Meets Expectations

Tuesday, May 24th 2016 ***Reality Check***	
09:00	Registration
09:10	**Francis Bernardeau** (IAP & IPhT Saclay, France) *Introduction to nonlinear large scale structure*
09:30	**Yannick Mellier** (IAP & SAp CEA, France) *Exploring large scale structures with Euclid*
10:30	Coffee
11:00	**Florian Beutler** (U. of Portsmouth, UK) *Recent large scale structure measurements*
12:00	Discussion **Francis Bernardeau**
12:30	Lunch break
14:00	**Uros Seljak** (UC Berkeley, US) *LSS: Data, simulations, theory*
15:00	Coffee
15:30	**Stephane Colombi** (IAP, France) *High precision simulations for high precision Cosmology*
16:30	Coffee
17:00	**Pier-Stefano Corasaniti** (Observatoire de Paris, France) *N-body power spectrum & covariance benchmarks for future galaxy survey data analyses*
18:00	Discussion **Francis Bernardeau**

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Knowing the data
measurements, precision and systematics

Confronting our understanding of the physical processes with simulations

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Confronting our understanding of the physical processes with simulations

Wednesday, May 25th 2016 *Perturbative Theory Methods*	
09:30	**Roman Scoccimarro** (NYU, US) *Standard & renormalized perturbation theories and beyond*
10:30	Coffee
11:00	**Takahiko Matsubara** (Nagoya U., Japan) *The Lagrangian and the integrated perturbation theories*
12:00	Discussion **Uros Seljak**
12:30	Lunch break
14:00	**Massimo Pietroni** (INFN Padova, Italy) *The time renormalization group and coarse-grained perturbation theories*
15:00	Coffee
15:30	**Leonardo Senatore** (Stanford U. & SLAC, US) *Aspects of the effective field theory of large scale structures*
16:30	Coffee
17:00	**Matias Zaldarriaga** (IAS, US) *Effective field theory of large scale structure in Lagrangian space*
18:00	Discussion **Uros Seljak**
20:45	Dinner cruise on the Seine

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The methods.
How good? How far? Do they meet the requirements ?

Thursday, May 26th 2016 ***Beyond Standard Models***	
09:20	Workshop photo
09:30	**Enrico Pajer** (Utrecht U., Netherlands) *Primordial non-Gaussianity in large scale structures*
10:00	**Drian van der Woude/Yvette Welling** (Utrecht U./Leiden U., Netherlands) *Effective theory of large scale structure with primordial non-Gaussianity*
10:30	Coffee
11:00	**Patrick Valageas** (IPhT Saclay, France) *Large scale structure in some modified Gravity scenarios*
11:30	**Atsushi Taruya** (U. of Kyoto, Japan) *Redshift space distortions as a probe of modified Gravity*
12:00	Discussion **Matias Zaldarriaga**
12:30	Lunch break
14:00	**Helene Dupuy** (U. of Geneva, Switzerland) *Including massive neutrinos in standard perturbation theory*
14:30	**Diego Blas** (CERN, Switzerland) *Massive neutrinos and LSS beyond the linear regime via the time RG approach*
15:00	Coffee
15:30	**Carmelita Carbone** (INAF Merate, Italy) *Clustering, lensing and ISW-RS from very large simulations with massive neutrinos*
16:00	**Michele Levi** (IAP & ILP, France) *Massive neutrinos in nonlinear LSS: A consistent perturbation theory approach*
16:30	Coffee
17:00	**Daniele Bertolini** (UC Berkeley, US) *The EFT of LSS at NNLO: Trispectrum and covariance of the power spectrum*
17:30	**Katelin Schutz** (UC Berkeley, US) *N-point functions in the EFT of LSS: practical challenges and future prospects*
18:00	Discussion **Matias Zaldarriaga**

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Exploring physics with LSS probes

Workshop organization:

We have privileged long presentations that should favor open interactions during the presentations.

Discussion sessions are key moments during the workshop.

Feel free to bring materials (slides) for the discussion sessions

Francis Bernardeau (IAP & IPhT Saclay)
Michele Levi (IAP, ILP, UPMC)
Patrick Valageas (IPhT Saclay)