IAP: visions for the Lagrange Institute

1st ILP day 13 March 2014

A short presentation of IAP and its scientific activities

IAP celebrated its 75th anniversary in 2013

Theoretical and observational cosmology

Inflationary physics ;
CMB physics with Planck and after Planck ;
The Large-scale structure of the universe: observation, characterization, statistical properties;
Dark energy

Fundamental physics and gravitation

The universe as a physical object
Nature of inflation ;
Dark matter, dark energy and gravitational waves

High energy astrophysics

The origin and physics of Gamma-ray bursts
Black hole physics and co-evolution of galaxies and black holes
Line of sight absorbing lines

Intergalactic medium and galaxy evolution

Evolution and dynamics of the Galaxy and the local group with GAIA
Galaxy physics and synthetic spectra

Extrasolar planets

physics of discs;
exo-atmospheres:
detection of exasolar planets with micro-lensing and radial velocity measurements ;

world class projects

Planck DPC

IAP hosts one of the key center where Planck results were analyzed. Planck data are by far the richest window we have on the physics of the early universe.

Euclid

The next big project. It aims at mapping the large-scale mass and galaxy distributions through weak-lensing measurements and the construction of spectroscopic galaxy catalogues.

SVOM

A satellite to address the physics detect gamma-ray bursts and study their afterglow.

Numerical simulations

A trans-disciplinary expertise

...

Topics covered by the The Institut Lagrange de Paris

An interdisciplinary enterprise

- Connecting string theory to new observational and experimental constraints,
- *Using cosmic microwave background and large-scale structure observations to get insight into inflation and the underlying theoretical framework of the cosmic beginning,*
- Jointly analyzing cosmological observations and particle physics data to home in on nature of dark matter,
- *Searching for signatures of physics beyond the standard models of particle physics and cosmology,*
- Exploiting new mathematical approaches and numerical techniques to advance our understanding of the gravitational evolution of cosmic structures,
- *Creating innovative approaches to large-scale numerical simulation, analysis of large databases and statistical analysis relevant to the science themes of the ILP.*

Interdisciplinary developments should not be taken for granted. They have to be carefully nurtured.

ILP is a perfect place for that !

More to be done on Interdisciplinary cross-breedings

ILP *focus* days with short presentations

1st ILP Day | March 13, 2014 | "Salle Panoramique" UPMC

Topical lecture series by senior fellows and visitors

"Cosmological Inflation after Planck", lecture series at LPTHE by S. Renaux-Petel, April 2013

"Massive gravity" lecture series at IHP by Shinji MUKOHYAMA, spring 2015

Some of these crossings are to be found at IAP

The CMB sky

- *Window to the physics of the early universe*
- *Physics of recombination beyond linear order, from GR to galaxies*
- *Applied mathematical tools for component separation*

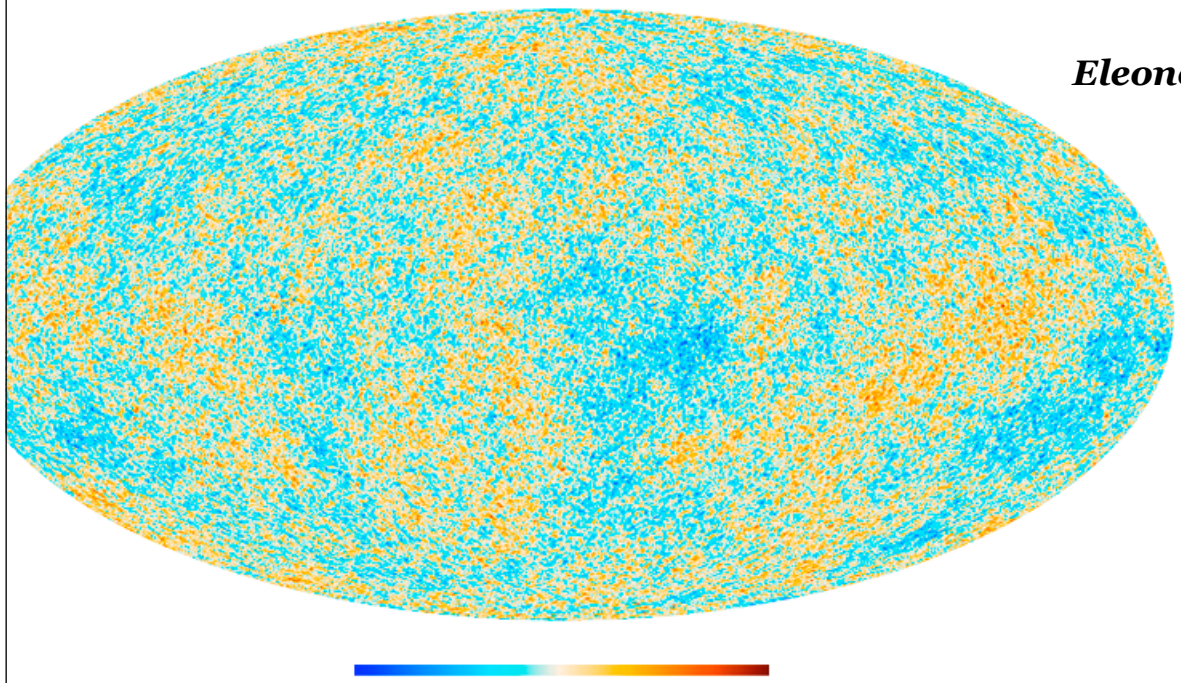
The non-linear universe

- *the Vlasov-Poisson system and theoretical Perturbation Theories*
- *numerical simulations and modeling*

The high energy universe

- *the production of gravitational waves*
- *the production and interpretation of the Gamma-ray bursts.*

The CMB sky after Planck



Signatures of early universe physics or non trivial content of the universe

Eleonora Di VALENTINO 01/11/14 au 31/10/16

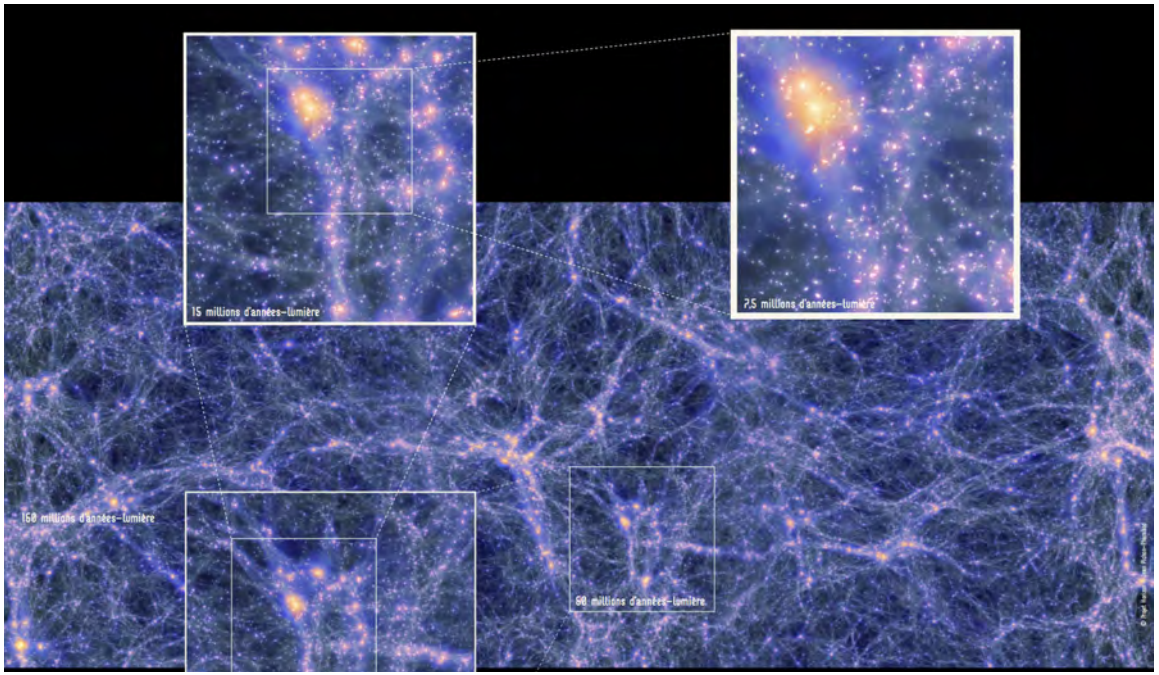
applied math for optimal component separations

Caterina UMILTA 01/10/14 au 30/09/17

Detailed recombination physics (2nd order Boltzmann)

***Moritz MUNCHMEYER* 01/03/13 au 31/01/14**

Impact of the low-z astrophysics on the properties of such a map



A Vlasov-Poisson system entering the nonlinear regime

Tom ABEL, 6 month visit as a Chair Lagrange

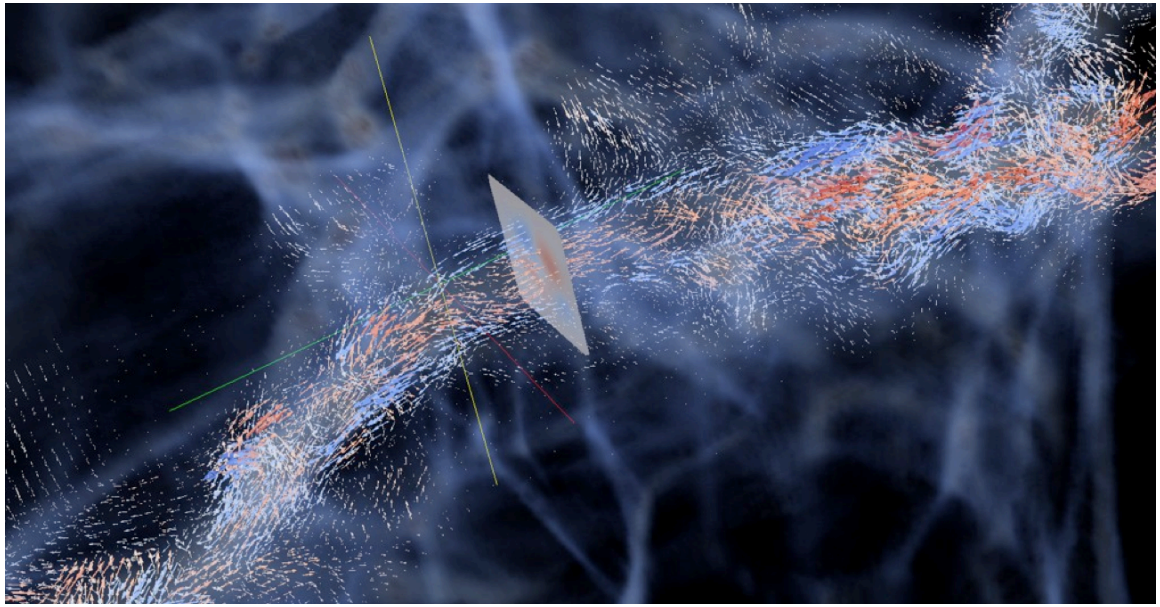
How to unveil dark -energy properties?

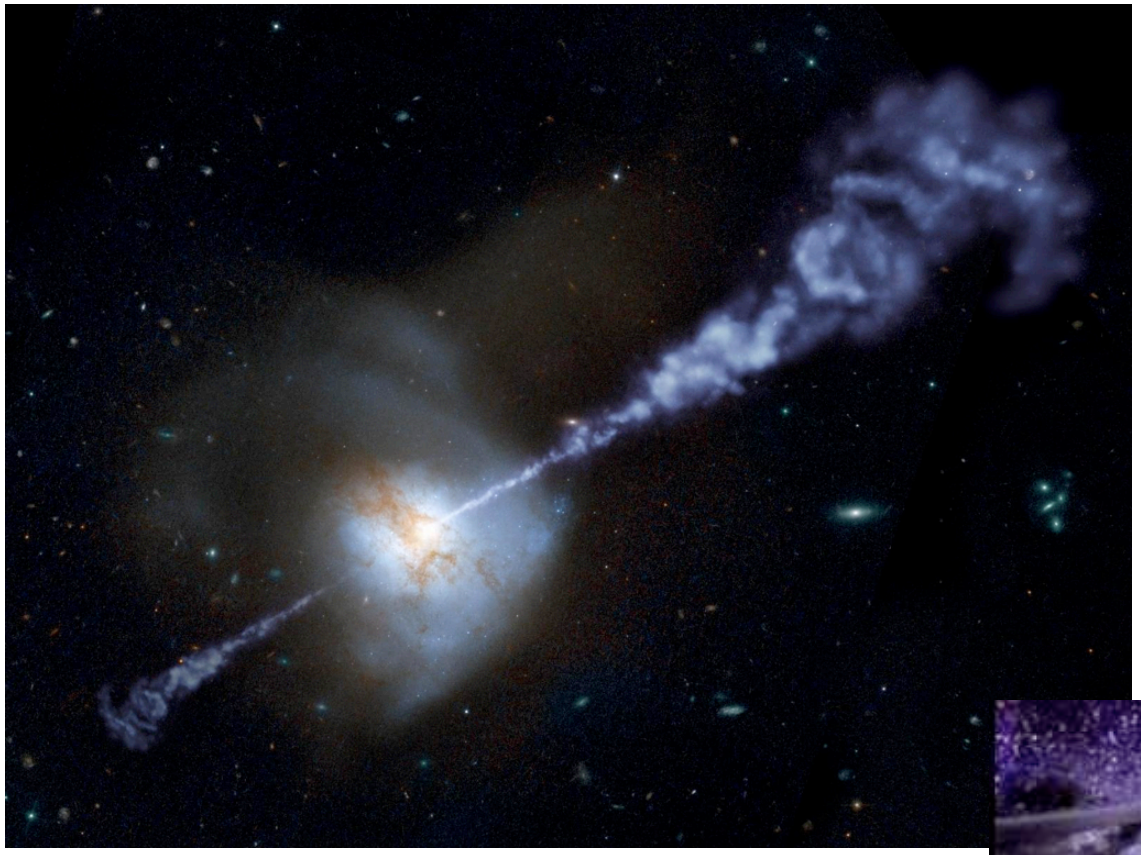
sub grid physics : the effects of BH physics and backreaction

Yi MAO 14/08/2012 au 13/08/2015

The evolution of galaxies and its connexion with the cosmic web

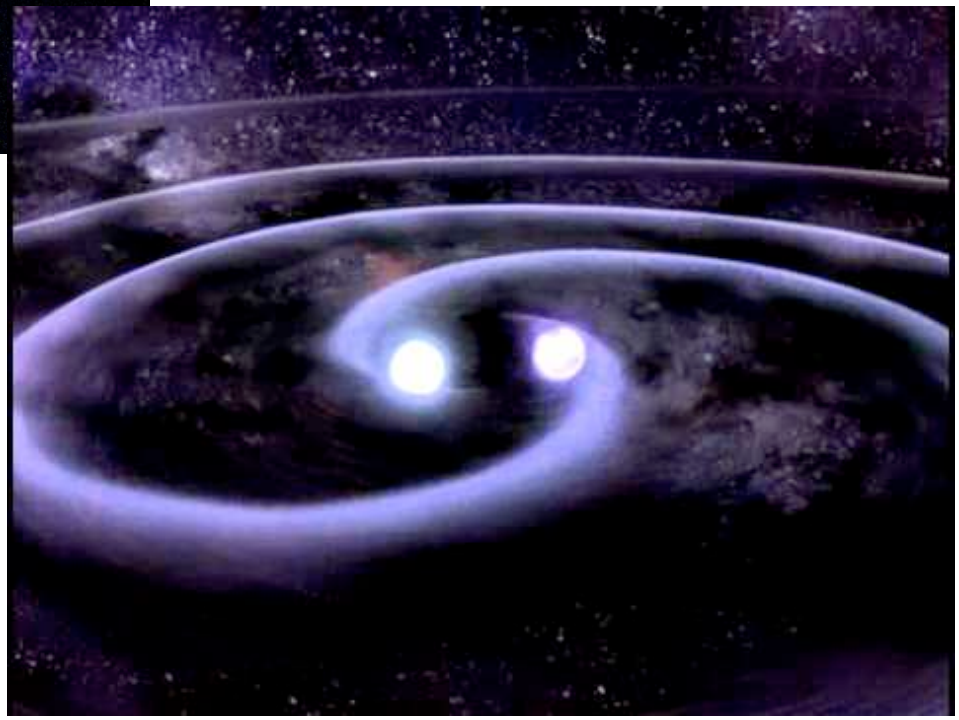
Clotilde LAIGLE ***Rebekka BIERI***





relativistic plasma physics and shocks

feedback effects between small and large scale physics



modified gravity models : from black holes to the whole universe

Michele LEVI 01/10/13 au 30/09/15

The production of gravitational waves

Thank you !