



# Inhomogeneous Cosmology and the Dark Universe

Université

de Strasbourg

October 10 - 11 - 12, 2017

**WHAT ?** A series of lectures on Inhomogeneous Cosmology as an alternative to standard cosmological models, and on the implications on the “Dark Energy problem”.

**WHERE ?** Strasbourg Astronomical Observatory,  
Université de Strasbourg

**WHO ?** The invited lecturer is **Professor Thomas BUCHERT** (CRAL, Université Lyon 1), pioneer of the study of the impact of inhomogeneities on the average properties of the universe we observe.

**AUDIENCE ?** The lectures target PhD students, as well as masters’ students in physics or related fields. Researchers and advanced amateur physicists or astronomers are also welcome.

(for details, read on)

# Inhomogeneous Cosmology and the Dark Universe



The standard cosmological model is a successful fitting model to observational data. It leaves, however, in suspense an explanation of the physical origin of Dark Energy and Dark Matter. The contribution of the former converges to about 68% and that for the latter to about 27% of the sources of the standard cosmological equations, up to a few percent that have to be attributed to known sources such as baryonic matter, radiation and neutrinos.

There exist a large number of international projects that deal with the Dark Energy problem of standard cosmology. Most of the efforts focus on (i) alternative theories of gravitation, or (ii) the study of phenomenological models for postulated new fundamental fields. Large experiments are conducted worldwide to search for Dark Matter.

This course is based on a third, more recent, research direction, co-pioneered by the lecturer, that aims at understanding the dark sources on the basis of a more realistic description of the Universe, i.e. it remains within General Relativity, and it does not postulate new sources in the energy-momentum tensor. It challenges the priors of the standard model, for example the conjecture that the average properties of the Universe are well-described by a homogeneous solution (the standard model). The impact of inhomogeneities on average properties of the Universe is called “cosmological backreaction”.

The course will present in an elementary way the relevant notions in both Newtonian gravity and General Relativity. We shall need only a few aspects of these theories to derive cosmological models. We then look at average properties like the average expansion of the Universe and show that, without any restricting assumptions, we arrive at more general cosmological models. These models contain additional terms that can act as Dark Energy on large scales, but also as Dark Matter on smaller scales, thus unifying physically the “dark sector”. We shall study these additional “backreaction terms” and discuss important related questions.

Since a couple of years this research direction enjoys a strongly growing popularity. It has been the subject of special issues of leading journals in the field, and is regularly the object of conferences and workshops. Popularity is not only met at the level of the professionals but also in the broad audience.

**Lecture times :** 10-12am & 2-4p on Oct. 10, 11, 12

Lecture notes will be distributed.

**Address :** Observatoire astronomique de Strasbourg, 11 rue de l'Université, 67000 Strasbourg

**Registration :** registration is free but compulsory (max 28 participants). Please send a request by email to both the following:

Mrs. Leyla Ermis (registration desk): [leyla.ermis@unistra.fr](mailto:leyla.ermis@unistra.fr)

Pr. Ariane Lançon (Observatory): [ariane.lancon@astro.unistra.fr](mailto:ariane.lancon@astro.unistra.fr)

**More information :**

[http://www.galpac.net/members/buchert\\_en.html](http://www.galpac.net/members/buchert_en.html)

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