

**Master and PhD course:**

Theory of cosmological perturbations with applications to inflation and the late-time universe

**Programme:**

**L:** Lectures ; **Tut:** Tutorial

- Basics of Cosmology ( L1: 2h)
  - GR and the cosmological principle.
  - The homogeneous universe.
  - Inflation.

Tut. 1: Introduction to xAct.

- General theory of cosmological perturbations (L2: 2h)
  - Decomposition theorem.
  - Gauge transformations. Gauge-invariant variables.
  - Adiabatic perturbations. Weinberg theorem.

Tut.2: Computation of perturbations.

- Cosmological perturbations during inflation (L3: 3h)
  - Perturbations in single field inflation models.
  - The effective field theory of inflation. Non-linearly realised symmetries.
  - Inflationary models with alternative symmetry breaking patterns. Validity of Weinberg's theorem.

Tut. 3 & 4: Computation of the quadratic action for scalar perturbations in single field inflationary models.

- Cosmological perturbations in the late-time universe (L4: 3h)
  - Evolution of density perturbations.
  - The transfer function.
  - CMB power spectrum
  - Matter power spectrum
  - Dark energy perturbations.

Tut. 5: Computation of the density contrast evolution equation.