

Ecole doctorale Astronomie & Astrophysique d'Ile-de-France (ED127)

OBSERVATOIRE DE PARIS (SIEGE DE L'ECOLE DOCTORALE)
UNIVERSITES PIERRE-ET-MARIE-CURIE (PARIS VI),
DENIS-DIDEROT (PARIS VII), PARIS SUD XI (ORSAY),
VERSAILLES-ST QUENTIN

&

PARTENARIATS: ECOLE NORMALE SUPÉRIEURE (ULM)
ECOLE NATIONALE DES SCIENCES GÉOGRAPHIQUES
DIRECTION DES SCIENCES DE LA MATIERE (CEA)

Doctoral lectures- Cours Doctoral- 2021 *for PhD students, post-docs, and all interested*

Registration required to << ed127.formations@ias.u-psud.fr >>

Distant Galaxies : Observations and models from $z>3$ up to dark ages

Les Galaxies Lointaines : Observations et Modèles de $z>3$ aux âges sombres

Site : Institut d'Astrophysique de Paris (IAP)

Dates: May 31-June 4, 2021

(virtual by Zoom, address to be confirmed)

Coordinated by *Observations : Dr François Hammer (Obs.Paris) francois.hammer@obspm.fr

***Modèles : Pr Brigitte Rocca-Volmerange (IAP,Paris) brigitte.rocca@iap.fr**

Abstract :

Distant Galaxies at $z>3$ will be keys to discover the galaxy formation physics, redshifts of formation in relation with cosmology, the reionization of the universe and the environment (DM haloes, clusters,..) to primeval fluctuations, but also clarifying their links with AGN and quasars or starbursts. Already discovered up to $z>7$, individual as deep large galaxy surveys will reveal their formation with the perspectives of future telescopes on the far-UV to farIR/submm domains, extended to X-gamma rays as the synchrotron emission. Presently models are limited at $z=6$ by spectroscopic measurements requiring predictions for $z>7$. Numerical simulations, requiring a specific expertise, will be shortly compared to models .

The present lectures propose clarifying talks, exercises and discussions to help PhD students, postdocs or young researchers for their orientations as to complete their general galaxy and cosmology backgrounds.

1. General principles on star formation, mass growth, evolution of stars, metals and dust, distance effects with basic kinematics.
2. Future observations of surveys with the perspectives of JWST, Euclid and e-ELT (sensitivity, spectral and angular resolutions).
3. Models of spectro-photometrical chemical evolutions (SED, magnitudes, colors, masses, distance, redshifts, environments).

*) "*Studying Distant Galaxies: Methods and Analyses*" Hammer et al., <https://arxiv.org/abs/1701.03794> ou <http://www.worldscientific.com/worldscibooks/10.1142/q0016>

***) *Code Pégase.3 (Fioc & Rocca-Volmerange 2019, A&A.)* <http://www2.iap.fr/users/fioc/Pegase/Pegase.3/>

Monday, May 31, 2021

9h30-10h45 Morphological classification and spatially resolved kinematics for galaxies:

11h-12h30 The case of distant galaxies: mergers versus rotating disks & Tully-Fisher relation

Francois Hammer, Observatoire de Paris

Lunch

15h00-16h00 Spectro-chemical evolution of galaxies with the code PEGASE.3 (versions Python and Fortran95): From UV to far-IR with metal, grain and dust effects on stellar continua, nebular lines.

Michel Fioc, IAP and Sorbonne U.

16h15 -17h30 Exercises 1: Initiation to the code Pégase.3.0.1: synthetic SEDs

Tuesday, June 1, 2021

9h30-10h30: Galaxy evolution and star formation: distant effects

10h45-11h45: The case of primeval galaxies

Brigitte Rocca-Volmerange, IAP and Paris-Saclay U.

12h00 -12h30: First comments on Exercises 1 (graphics)

Lunch

14h-17h30 Exercises 2 : SED parameters (Star Formation, metals, dust,..) and colors.

Wednesday, June 2, 2021

9h30-10h45 Properties and evolution of grains in the Universe

Frédéric Galliano, CEA

Break

11h-12h Polarized dust foregrounds from Planck2018

Karim Benabed, IAP

12h-13h Optically invisible galaxies in the early universe,

David Elbaz, CEA

free afternoon, après-midi libre

Thursday, June 3, 2021

9h30-11h00 Large surveys (CANDELS, VUDS, 3D-HST) and luminosity/mass functions

François Hammer, Observatoire de Paris

11h15-12h30 Extremely deep multi-wavelength imaging surveys

Pascal Oesch, U. de Genève

Lunch

14h00-15h15 Performances of MUSE and the future blueMUSE on high-z galaxies,

Johan Richard, CRAL, Obs. Lyon

15h15-16h30 Galaxies in absorption at high-z

Pasquier Noterdaeme, IAP

Break

16h45-17h45 Molecules and Dust in high-redshift Galaxies

P. Cox, IAP

Friday, June 4, 2021

9h30 -10h45: H2 and ALMA over the UHDF

R. Decarli, INAF, Bologna

11h00-12h30 Exercises 3 : Finalization and summary

lunch

14h00-15h00 Star formation and turbulence,

Pierre Guillard, IAP and Sorbonne Université

15h15 -16h15 Gamma-Ray-Bursts (GRB) at high-z,

Frédéric Daigne IAP and Sorbonne Université and Robert Mochkovitch, IAP

16h15-17h00 **Discussion and conclusion**