Modeling the panchromatic emission of galaxies to understand their evolution

Hubble / Optical | Hubble & Webb | Webb / Infrared

SUMMARY.

With galaxies of all sizes, shapes, colors, and luminosities, the local universe is fabulously rich and incredibly diverse. How then did the precursors of the current galaxies, small blobs that we can barely distinguish in the farthest reaches of the universe, morphed into those rich and radically different objects that populate the Hubble tuning fork in the local universe? To answer this question, measuring the physical properties of galaxies is key. In this METEOR, we will learn how to build advanced spectro-photometric models of galaxies including stars, gas, active nuclei, and dust and use them to measure their physical properties using Bayesian statistics.

OBJECTIVES

The students will learn how to build physically-motivated panchromatic models of galaxies, understanding the importance and respective effects of the different baryonic components on the electromagnetic emission of galaxies and determine critically the strengths and weaknesses of their models. Ultimately, combining public observations with panchromatic models with Bayesian techniques, they will measure physical properties and compare these results with those of recent publications, assessing the impact from the assumptions in their model.

PREREQUISITES

It is mandatory to have followed General Astrophysics course. A good working knowledge of Python is needed.

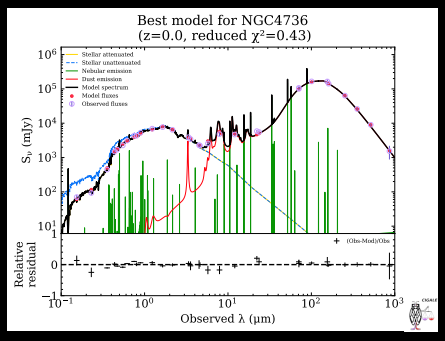
THEORY

by Médéric Boquien

This METEOR will cover the following topics: complex stellar populations, ionized gas, dust absorption, dust emission, active galactic nuclei, intergalactic medium absorption, photometry, synthetic catalogs, and Bayesian statistics.

APPLICATIONS

by Médéric Boquien



The students will create panchromatic models and fit them to state-of-the-art panchromatic observations of galaxies with HST and JWST (and more!) published in the literature to measure their physical properties using Bayesian statistics. Then, they will compare the results with the published study, carry out a critical analysis, and infer what they tell us about the evolution of galaxies.

MAIN PROGRESSION STEPS

The first week will be dedicated to an overview of the panchromatic modeling of galaxies and an introduction to the project topics, which will be selected by the end of the second week. Theoretical courses will follow and the project will be carried out in parallel until the last week, which will focus on the preparation of the oral presentations.

EVALUATION

Five oral presentations on the main physical and components of galaxies and Bayesian techniques (30%). Written report on the project with an important emphasis of the critical analysis of the results and their importance on our understanding of galaxy evolution (30%). Final oral presentation (40%).

BIBLIOGRAPHY & RESSOURCES

Boquien et al. (2019)
Pacifici et al. (2023)

CONTACT

☎ +56 9 5135 7642
✉ mederic.boquien@uantof.cl