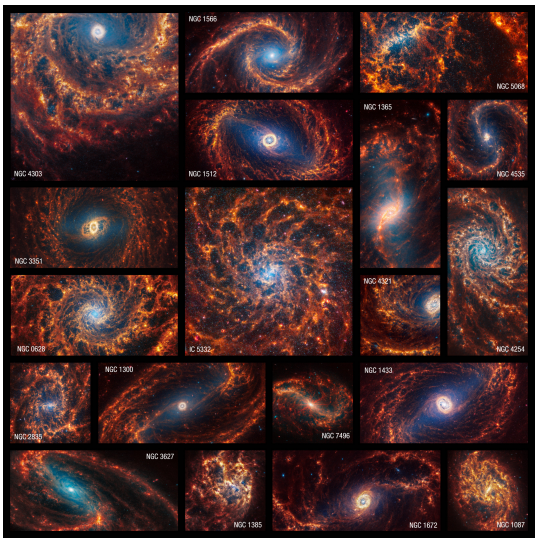
Diving into galaxies: a modern panchromatic view of celestial giants



SUMMARY.
Prepare to unlock the secrets of the universe! In this exciting METEOR, we will embark on a thrilling path that will lead us across the universe from the young and fiery galaxies that we can barely discern just a few hundreds million years after the Big Bang all the way to these beautiful galaxies that populate the otherwise tranquil neighborhood of the Milky Way. Along this journey we will delve deep into the heart of galaxies. From stars to gas, from active nuclei to dust, we will peel back the layers of galaxies as they form and evolve throughout the universe's history. But we will not stop there! Armed with some of the most advanced spectro-photometric models and harnessing the exquisite power of Bayesian statistics, we will explore these celestial giants and move closer to understanding the formidable forces that shape the life and death of galaxies across cosmic times.

— OBJECTIVES

Over this METEOR, our grand objective will be to learn how to **craft physically-grounded models of the emission of galaxies across a broad swath electromagnetic spectrum**. From the blazing cores of active galactic nuclei to the majestic dust clouds, we will **explore and understand the physical processes that govern the formation and the evolution galaxies across cosmic times**. Armed with cutting-edge Bayesian techniques, comparing observations with our models, we will **measure some of the most fundamental properties of galaxies**, allowing us to delve into galaxies. Ultimately, we will **compare our findings to the latest research**, challenging assumptions and pushing the boundaries, one model at a time.

— PREREQUISITES

None, come as you are!

— THEORY

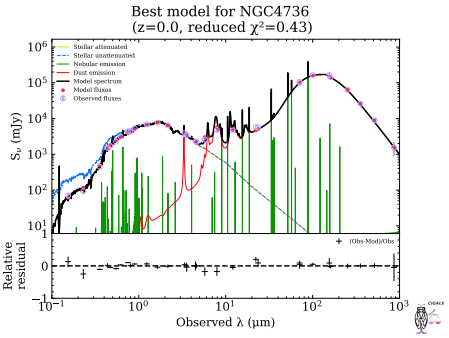
by Médéric Boquien

This METEOR will delve into a broad array of captivating topics, including complex stellar populations, ionized gas, dust absorption and emission phenomena, growth of supermassive black holes at the center of galaxies, absorption in the intergalactic medium, photometry and spectroscopy, the generation and utilization of synthetic catalogs, all ingredients assembled together by a robust framework of Bayesian statistics.

— APPLICATIONS

by Médéric Boquien

During this course, we will construct comprehensive panchromatic models and apply them to cutting-edge observations of galaxies obtained from instruments like the Hubble Space Telescope (HST) and the James Webb Space Telescope (JWST), among others, as documented in current literature. Through the lens of Bayesian statistics, they will quantify the galaxies' physical properties. Subsequently, we will rigorously compare our findings with those of published studies, conducting a meticulous analysis to discern insights into the evolutionary trajectory of galaxies.



Here we see a panchromatic model in action. It includes stars, ionized gas, and dust and is fitted to the multi-wavelength emission of the nearby galaxy, NGC 4736. Such models that we will build over the course of this METEOR will allow us to measure some of the fundamental physical properties of galaxies, such as their stellar mass, which are essential for constraining galaxy evolution models.

— MAIN PROGRESSION STEPS

The first two weeks of the course will be dedicated to providing a comprehensive theoretical overview of panchromatic galaxy modeling, coupled with an introduction to the range of projects available, which will be selected by the end of the second week. The following weeks will be focused on the project implementation and presentations of complementary topics around galaxy modeling. The course will culminate on the preparation of the oral presentations during the final week.

— EVALUATION

The first component of the evaluation will comprise five short oral presentations that will complement theoretical lectures, revolving around the main physical components of galaxies and Bayesian techniques (30%). The second part of the evaluation will be based on the written document that will dig into one of the topics seen during the class (30%). Final oral presentation (40%).

— BIBLIOGRAPHY & RESOURCES

- Boquien et al. (2019)
- Pacifici et al. (2023)
- Beautiful panchromatic survey of nearby galaxies

— CONTACT

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