ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

DIPARTIMENTO DI FISICA E ASTRONOMIA
Department of Physics and Astronomy - DIFA

PhD project in ASTROPHYSICS

Title of the Project: Characterizing High-Redshift Quiescent Galaxies with the James Webb Space Telescope

Supervisor : Sirio Belli

Scientific Case:
In the first year of scientific observations, the James Webb Space Telescope (JWST) has already revolutionized our understanding of the Universe, and particularly of high-redshift galaxies, for which near-infrared observations are crucially needed. One of the most important open questions in this field is the formation and evolution of massive quiescent galaxies. These systems are the first to experience "quenching", a poorly understood process that is responsible for shutting down star formation and turning galaxies into passive, gas-poor systems. To identify the physical mechanisms involved we need to study the properties of galaxies close to the epoch of quenching, which for massive galaxies is at $z>2$. These are difficult observations because high-redshift quiescent galaxies are faint and lack strong emission lines. Luckily, the unprecedented sensitivity and wavelength coverage offered by JWST make it possible to study the physical properties of this key population.

Outline of the Project:
The goal of the project is to measure the physical properties of quiescent galaxies at $1 < z < 5$. The analysis will be based on data from the *Blue Jay* survey (a JWST medium-size program that is obtaining deep spectra of galaxies at $z\sim2$), and also from large JWST surveys such as PRIMER and COSMOS-Web. We will combine the near-infrared photometry from JWST/NIRCam, the mid-infrared photometry from JWST/MIRI, and the spectroscopy from JWST/NIRSpec to obtain a detailed, multi-wavelength view of these systems that has never been accessible before. The student will fit templates to the observed photometry and spectroscopy using advanced statistical methods to characterize fundamental aspects of quiescent galaxies such as their star formation rate, stellar ages, chemical abundances, dust absorption and emission, and AGN activity. Depending on the availability of new data, the project may also include complementary types of analysis, such as a study of the morphology, resolved stellar populations, or cold gas.

The student will work in close collaboration with the *Blue Jay* team, which includes 17 researchers in the US, Australia, UK, and Germany; and will also be part of the Bologna-based, ERC-funded *Red Cardinal* project, starting in 2023.

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