

COURSE: SCIENTIFIC DATA HANDLING AND IMAGE PROCESSING

Lecturer : Prof. Pasquale Mazzotta

Lab Assistants: Dr. Dario Del Moro and Dr. Giancarlo de Gasperis

CONTACTS: Mazzotta@roma2.infn.it; delmoro@roma2.infn.it;
degasperis@roma2.infn.it

COURSE DESCRIPTION

The course provides an introduction to the common techniques used in science to extract relevant information from large astrophysical data sets. The course will deal with digital processing of signals, focusing on image processing, transformation, and object classification.

The course offers an overview of the main mathematical and statistical methodologies for signal extraction and visualisation of scientific data, providing the appropriate skills to retrieve the most useful information hidden in the large datasets.

In the labs, these methodologies, will be applied to a number of scientific data set acquired at the most advanced astrophysical facilities available, giving the opportunity to familiarize with modern software tools of scientific data manipulation and visualization.

CONTENTS

- 1) Introduction to science data acquisition and storage
- 2) Signal and Noise in scientific data
- 3) Fundamentals of Digital Image Processing
- 4) Fourier transform and frequency-domain filtering
- 5) Image transformation and denoising
- 6) Wavelets
- 7) Image restoration and enhancement
- 8) Pattern Classification Methods
- 9) Virtual observatories

Lab

- 1) 1D signal analysis
- 2) 2D signal analysis
- 3) Wavelet analysis