

Thesis Proposal for the Master's Degree in Physics

Gruppo "Superfici e Energia"
Ref. Prof. Raffaele G. Agostino

The Surface and Energy research group at the University of Calabria, led by Raffaele G. Agostino, focuses on studying materials with innovative chemical-physical properties for both fundamental and applied purposes, such as energy and electronics. The team, consisting of researchers and collaborators, utilizes **advanced spectroscopic and microscopic techniques** (HREELS, XPS, UPS, SEM, etc.) to characterize surfaces and interfaces. Currently, they are involved in building the **STAR X-ray source** for advanced microtomography and spectroscopy studies. Their main research areas include gas adsorption in nanostructured materials, the characterization of self-assembled molecular layers, the analysis of two-dimensional systems like graphene, and the development of advanced tomographic imaging techniques. Additionally, the group contributes to the **DeltaH laboratory** for hydrogen storage solutions and conducts pioneering research in **virtual histology** using **artificial intelligence** techniques for tissue analysis.

Title:

High-Resolution 3D Imaging of Soft Biological Tissues Using Micro-Computed Tomography

Abstract:

This thesis investigates the application of (phase-contrast) micro-computed tomography for high-resolution imaging of soft biological tissues. By leveraging polychromatic X-rays, we achieved detailed 3D reconstructions through numerical algorithms (GPU-accelerated filtered back-projection) and advanced image processing techniques. This study explores the optimization of parameters such as pixel size, field-of-view, and propagation distances to enhance the signal-to-noise ratio and minimize beam hardening. The effectiveness of different algorithms in visualizing soft-tissue structures is evaluated, providing insights into micro-CT's potential for applications in biological and medical imaging.

Supervisor(s):

Vincenzo Formoso, Sandro Donato, Alberto Bravin

E-mail(s):

vincenzo.formoso@unical.it

sandro.donato@unical.it

alberto.bravin@unimib.it

Laboratory where the thesis is carried out:

μ Tomo/SoftX-STAR in collaboration with Elettra Synchrotron Trieste and Università Milano Bicocca

Type of thesis:

Experimental and data analysis