

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:

Proximity effects investigation at the topological insulator surface/superconducting metallic film interface

Abstract:

Over recent decades, the study of structural and electronic phenomena at the interfaces between two contacting materials unveiled intriguing results in both physics and nanotechnology. By carefully combining two materials, it is possible to either induce novel electronic properties at the interface, or extend the exotic behavior of one material to the other via proximity effects. A particular focus today is on topo-

logical superconductors, where a superconductor is brought into contact with a topological insulator. By detailed angle-resolved photoemission spectroscopy, X-ray photoemission and scanning tunneling microscopy measurements we aim to investigate proximity effects arising at the interface between topological insulators and metallic films

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Laboratory where the thesis is carried out:

LSAM-STAR

Type of thesis:

Experimental and data analysis