PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH UNIVERSITY OF YAHIA FARES OF MÉDÉA PhD PROGRAM OFFER FOR THE ACADEMIC YEAR 2025/2026

Specialization: Materials Physics

1. Global Objective of the Doctoral Project

This doctoral project aims to investigate the structural, mechanical, electronic, and magnetic properties of advanced materials with potential applications in renewable energy, superconductivity, energy storage, and smart sensing technologies.

Focus will be placed on studying:

- Topological materials
- Nanostructured and hybrid materials
- Zintl phases, perovskites, and chalcogenide compounds

Theoretical approaches will be based on *ab initio* methods such as Density Functional Theory (DFT), DFT+U, and Molecular Dynamics (MD), complemented by experimental data when available.

The main goals are to train doctoral candidates who can:

- Master modern tools for modeling and quantum-level calculations of materials;
- Establish strong correlations between microscopic structure and physical properties;
- Design and predict new functional materials for targeted technological applications.

2. Curriculum Highlights

- Advanced solid-state physics
- Statistical mechanics and quantum effects
- Materials modeling and simulation
- Advanced numerical techniques (DFT, DFT+U, MD)
- Applications in renewable energy, superconductors, and sensors

3. Advanced Doctoral Training

The program includes rigorous academic and methodological training, hands-on involvement in research projects, participation in scientific workshops, and guidance for publication in peer-reviewed journals.

4. Core Courses

- Solid State Physics II
- Crystal Lattice Dynamics
- Collective Excitations in Condensed Matter
- Introduction to Quantum Modeling of Materials (DFT)
- Magnetic and Electronic Properties of Solids

5. Advanced Topics

- Topological Phases of Matter
- Nanomaterials and Nanostructures
- Superconductivity and Phase Transitions
- Electron–Phonon Interactions
- High-Pressure Physics of Materials

6. Complementary Training

Scientific English:

- Technical writing and scientific reports
- Oral presentations and communication
- Scientific vocabulary in materials physics

Research Methodology:

- Thesis preparation techniques
- Scientific publishing and referencing tools
- Research ethics and academic integrity

7. Knowledge Enhancement Training Program

Domain	Year 1	Year 2	Year 3
Scientific English	Basic communication	Technical writing &	Publishing & interviews prep
	skills	presentations	
Research Methodology	Introduction to	Scientific writing	Ethics & thesis defense prep
	research methods	techniques	
Applied Computing	Simulation tools	Programming (Python,	Computational workflow
		Bash)	automation