



جامعة عبد المالك السعدي  
جامعة عبد المالك السعدي  
Université Abdelmalek Essaadi

Pole for Doctoral Studies  
Center for Doctoral Studies  
Sciences and Technology and Medical Sciences

## ANNOUNCEMENT OF DOCTORAL THESIS DEFENSE

**Ms Jihad BEN YAMOUN**

**Will present his research work with the aim of earning a  
Doctorate**

**Doctoral program: Mathematical and Physical Sciences and New  
Technologies**

**Discipline: Physics**

**Specialty: Electronics and Telecommunications**

**On 23/12/2025 at 10H00 at the Defense room of the Faculty of  
Sciences of Tetouan**



**Under the theme**

**Study and design of new antennas for mobile and wireless  
communications**

**Front of the jury composed of:**

First Name & Last Name	Establishment	Designation
Pr. Mohamed ESSAAIDI	ENSIAS Rabat, Mohamed V University	President
Pr. Saida AHYOUN	FS Tetouan, Abdelmalek Essaadi University	Reviewer
Pr. Naima AMAR TOUHAMI	FS Tetouan, Abdelmalek Essaadi University	Reviewer
Pr. Tomader MEZRI	ENSA Kenitra, Ibn Tofail University	Reviewer
Pr. Fernandez OSCAR FERNANDEZ	ETS, University of Cantabria	Examiner
Pr. Larbi SETTI	FP Larache, Abdelmalek Essaadi University	Examiner
Pr. Noura AKNIN	FS Tetouan, Abdelmalek Essaadi University	Supervisor

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Sciences, Tetouan*

# Abstract



This thesis explores into the role of metamaterials applied to antenna design, exploring a range of innovative projects. Hybrid materials, such as polylactic acid (PLA) and alumina, are incorporated where 3D printing becomes an essential fabrication tool, and the exploration of chirality and switchable metamaterials opens new avenue. The first work innovates by integrating a stacked rectangular DRA with hybrid dielectric materials, presenting dual resonance frequencies, high gain, and an ultra-wideband characteristic. The second technique revolutionizes design by manufacturing a 3D-printed Ring Dielectric Resonator Antenna (DRA) using acrylonitrile butadiene styrene (ABS) filament, achieving an ultra-wide bandwidth and high gain. The third project introduces innovative 3D chiral metamaterials with enhanced circular dichroism and a broad response bandwidth. The fourth method introduces a tunable extrinsic chiral metamaterial in a sawtooth form, demonstrating efficient polarization conversion and a desirable bandwidth. Finally, a proposed chiral metamaterial with extrinsic chirality effectively acts as a polarization converter for a ring-shaped DRA. This comprehensive research significantly contributes to the advancement of dielectric resonator antennas, offering diverse approaches to improve gain, bandwidth, and miniaturization. These advancements open new perspectives for the future of antenna technology.

The proposed antenna designs and chiral metamaterial-based structures are well suited for modern mobile and wireless communication systems, where wide bandwidth, compactness, and polarization control are key performance requirements.

**Keywords:** Metamaterials, Antenna Design, Hybrid Materials, 3D Printing, Chirality, Tunable Metamaterials, Circular Dichroism, Wideband, Resonator Dielectric Antennas, PLA, Alumina, ABS Filament.