

CURRICULUM VITAE

Wassila EL KANAWATI

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PhD in Nuclear and Subatomic Physics from Grenoble University - France

1. EDUCATION

2008-2011 : **Ph.D. degree** from Joseph Fourier University - Grenoble, specialist Subatomic Physique and Astroparticles, mention: Very Honorable with congratulations of the examiners.

PhD thesis entitled "Elemental characterization of materials by neutron interrogation with the Associated Particle Technique (APT)", prepared in the Nuclear Measurement Laboratory at CEA centre of Cadarache and at the Physics Doctoral School of Grenoble, under the direction of Mr. Johann COLLOT, Professor at UJF Grenoble, Mr. J.C. ANGELIQUE, Professor at ENSICEAN, et Mr. Bertrand PEROT, Research scientist engineer at CEA Cadarache, and defended July 13, 2011.

June 2008 : **Master's degree** from Joseph Fourier University, Grenoble, France, option Subatomic Physics and Astroparticles.

Master Project Title : Production of ultra-cold neutrons in superfluid helium at ILL, Grenoble

2004-2007 : **Bachelor's degree** from Lebanese University, Beirut, Lebanon, Honorable, Option General Physics, Very Honorable.

June 2003 : Baccalaureate scientific, General Science – Lebanon, Very Honorable.

2. PROFESSIONAL ACTIVITIES

From Sep 2022: Full time Assistant Professor in Physics at Beirut Arab University – Faculty of Science.

Oct' 2011-June2023 : Non-permanent Associate Professor in Physics at Lebanese University - Faculty of Science.

Jan'2014-Aug'2016 : **Post-doctoral position** at LAPP (Particle Physics Laboratory at Annecy-Le-Vieux) on the European project STEREO for sterile neutrinos detection.

Oct'2011-Sep'2013 : **Post-doctoral position** at INSA of Lyon, in Creatis Laboratory, in the frame of Prouesse project (ANR) & the European project ENVISION on proton-therapy.

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Oct'2008-Sep'2011 : **PhD fellowship** from CEA (Commissariat à l'Énergie Atomique et aux énergies alternatives) for the preparation of PhD thesis in the Nuclear Measurement Laboratory at CEA centre of Cadarache in order to obtain the diploma of Doctor at Grenoble University.

March – June 2008 : **Training as part of an internship** of my Master in the "NPP" Group at the Institute Laue Langevin (ILL), Grenoble, under the direction of Mr. O. Zimmer.

March – June 2007 : **Training as part of an internship** of my Physics Bachelor in the Nuclear Physics at the Lebanese University.

3. ACADEMIC EXPERIENCE FROM OCTOBER 2011

- **BAU – Faculty of Science:**

A- Teaching responsibilities :

- **Responsible of the Medical Physics Master Program.**
- **Under-graduated courses:** « General Physics », « Materials Properties and Heat », « Accelerators » « Classical mechanics » and « Biophysics ».
- **Graduated course for Master and PhD students:** « Introduction to radiation physics », « Physics of Radiotherapy », « Physics of Radionuclides », « Nuclear and Radiation Therapy », « Medical radiation Physics », « Nuclear Medicine Physics », and « Advanced Classical Mechanics ».

B- Responsibilities in Research for Master Students Thesis:

- May 2024 : **Director of Master Research Thesis**, of Mr Asaad Khreis, " Comparison of CT Images for the Diagnosis of Brain Abdomen and Pelvis in Different Slices Involving Study of Radiation Protection ".
- March 2024 : **Director of Master Research Thesis**, of Mr Rayan Bou Chakra, " Heart Dose Measurements taking into account the Respiratory Motion During Left Breast Irradiation in Free Breathing Mode ".
- March 2024 : **Director of Master Research Thesis**, of Mrs Rawan Issa, " Survey measurement to set diagnostic reference levels for bone and lung cancer in nuclear medicine in PET/CT imaging in Lebanon ".
- March 2024 : **Director of Master Research Thesis**, of Mrs Maguy Sekaan, " Comparison between CT and MRI for the diagnosis of the metastasis due to Brain cancer ".
- March 2024 : **Director of Master Research Thesis**, of Mr Hadi Allam, " Evaluating MRI And CT Techniques For Early Detection Of Neurological Disorders ".
- June 2023 : **Director of Master Research Thesis**, of Mrs Aya Abou Arabi, " Assessment of the radiotherapy treatment in North Bekaa over one decade ".
- June 2023 : **Director of Master Research Thesis**, of Mrs Rana Dib, " The Importance of SUV of Image Fusion (PET-CT) in the Delineation of the Target Volume in Radiotherapy ".
- June 2023 : **Director of Master Research Thesis**, of Mrs Lama Yassine, " Comparison between PET-CT and Gamma Camera for the Diagnosis of the Metastasis Due to Breast Cancer ".

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C- Responsibilities in Research for PhD:

- February 2025 : **Director of PhD Thesis**, of Mrs Sara Abi Neaj, " Electron FLASH Radiotherapy to Reduce Late Effects for Children with Medulloblastoma in Low, Middle and High Income Countries ".
- September 2023 : **Director of PhD Thesis**, of Mr Khodor Rizk, " Laser in ophthalmic: Simulation, Numerical Calculation and Validation ".
- September 2023 : **Director of PhD Thesis**, of Mrs Nagham Shokor, " Reducing Gadolinium Dose and Enhancing Brain MRI Images Clarity Using Machine Learning Techniques".
- June 2023 : **Director of PhD Thesis**, of Mrs Dana Bou Daher, "Synthesis, Characterization and Physical Properties of Nano Composites ".
- June 2023 : **Director of PhD Thesis**, of Mrs Zainab Mazeh, " Optimization of Quality Parameters in Volumetric Modulated Arc Radiation Therapy ".
- May 2023 : **Director of PhD Thesis**, of Mrs Zainab Sahrour, " Artificial Intelligence neural networks for quality assurance of image registration CT/MRI for brain and Head Cancer ".
- March 2023 : **Director of PhD Thesis**, of Mrs Nourhane Moussawi, " Plan quality metrics for assessing the effectiveness 3DCRT and VMAT treatment strategies for left sided breast cancer patients ".
- March 2023 : **Director of PhD Thesis**, of Mrs Sara Haidar, " Tractography Applied to Nerves with 3T: Optimization of Acquisition Parameters and Measurement of Diffusion parameters ".

• Lebanese University – Faculty of sciences 1:

A- Teaching responsibilities :

- **Under-graduated course** for 1st year students: « **waves and optics** »
- **Under-graduated course** for 1st year students: « **Thermodynamics** »
- **Under-graduated course** for 2nd year students: «**Math for physicists** »
- **Graduated course** for M1 students « **Neutron physics and Reactors** »
- **Graduated course** for M2R students « **Nuclear Models** »

B- Responsibilities in Research Internship:

- March-July 2016 : **Director of Master 2 Research internship**, of Mrs Arwa EL HAJJ, "Characterization gamma & neutron background using MCNP for STEREO detector".
- March-July 2017 : **Director of Master 2 Research internship**, of Mrs Hawraa KHALIFE, "Elemental characterization of radioactive wastes by neutron interrogation ".
- March-July 2018 : **Director of Master 2 Research internship**, of Mrs Rola Monzer, "Simulation of gamma rays spectra induced by 14 MeV neutrons".
- March-July 2019 : **Director of Master 2 Research internship**, of Nourhane Kassem, "Elemental characterization of radioactive wastes by neutron interrogation ".
- March-July 2020 : **Director of Master 2 Research internship**, of Mrs Fatima Assaf Radioactive Waste Characterization with 14 MeV Neutrons Interaction".

• Al Maaref University (From 2017-2020):

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- **Responsible of course, and exercises in Thermodynamics Physics** for undergraduate students, at MU – Faculty of Engineering.
 - **Responsible of course, and exercises in Waves and Vibrations** for undergraduate students, at MU – Faculty of Engineering.
 - **Responsible of course, and exercises in Waves and Vibrations** for undergraduate students, at MU – Faculty of Engineering.
 - **Responsible of course, and exercises in Remedial physics** for undergraduate students, at MU – Faculty of Engineering and Faculty of Sciences.
- INSA – Lyon : FRANCE (2011-2013)
 - **Responsible of lab works, and exercises in Mechanical Physics** for undergraduate students, at INSA - Lyon 1st cycle.
 - **Responsible of course, exercises and lab works and in Waves and Optical Physics** for undergraduate students, at INSA - Lyon 1st cycle.
 - **Responsible of practical experiments (TP) "Non Destructives Controls", Option "Ionizing Radiations"** in the department of Science and Materials (SGM) at INSA - Lyon.

4. RESEARCH ACTIVITIES

4.1. Initial Research Activities

My research activity began with my M2R internship at the ILL (Institut Laue Langevin) Grenoble – France, on the study of the production of ultra-cold neutrons (0-260 neV) by phonon excitation in superfluid helium. During this brief but fruitful experience at the ILL, I acquired a first working knowledge on experimental data analysis and monitoring. In only 4 months, I had an overview of the most important research topic related to low-energy neutron physics, namely the experimental proof of neutron energy quantification. Thanks to this first experience I decided to continue with the research but preferring a new topic, in order to extend my knowledge on different fields. I had a scholarship from CEA (*Commissariat de l’Energie Atomique*) that allowed me to do my PhD in nuclear physics, at the Nuclear Measurement Laboratory (LMN) – CEA Cadarache, on the elemental characterization of matter by neutron interrogation based on the associated particle technique (APT). In this thesis I worked on two key research topics for our laboratory: the first one relating to the detection of illegal objects (explosives, illicit drugs ...) in transport containers in the framework of the European project EURITRACK which allowed to acquire solid skills in data commissioning and analysis and the validation of measurements by MCNP simulation, and the second topic concern the elemental characterization of long-lived and medium activity (LL-MA) radioactive waste packages in view to their geological storage (GIGEO project in France) by neutron interrogation taking into account matrix effects (attenuation of radiation in the dense materials of these waste packages).

Nuclear physics continue to be my main interest as post-doctoral researcher at INSA and UBCL – Lyon, France. I worked in the framework of European project Preuesse and ENVISION in the field of proton-therapy to develop a fast tools based on Gate/Geant 4 and

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the Track Length Estimator method (TLE) in order to simulate the prompt gamma rays emitted by nuclear fragmentation reactions of protons in human tissues.

Nuclear physics was also the main topic of my research activity at LAPP (*Laboratoire d'Annecy-le-Vieux de Physique des Particules*) but applied to neutrino physics in the framework of STEREO project in order to prove the existence or not of a sterile neutrino. My task consists to study the gamma and neutron background around the STEREO detector placed at 10m from the ILL reactor at Grenoble-France.

4.2. Current Research Activities

A. Radiotherapy and Diagnosis: 3 main subjects are under study:

1. Optimization of Quality Parameters in Volumetric Modulated Arc Radiation Therapy: Volumetric modulated arc radiation therapy is a highly precise technique used in cancer treatment. This therapy yields better outcomes and reduced side effects. However, producing high-quality treatment plans requires the optimization of quality parameters such as dose conformity, homogeneity, and target coverage.
2. Artificial Intelligence neural networks for quality assurance of image registration CT/MRI for brain and Head Cancer: The overall aim of this study is to develop and assess a method for quality assurance (QA) of rigid and deformable image registration of brain and head & neck CT/MR scans using convolutional neural networks. This quantitative procedure will help radiation oncologists and medical physicists by using artificial intelligence to save time and enhance the quality of treatment planning for cancer patients.
3. The study aimed to compare and evaluate plan quality metrics differences between two main methods of radiotherapy: 3D conformal radiation therapy (3D-CRT) and volumetric modulated arc therapy (VMAT) for left-sided breast cancer patients after mastectomy in the radiotherapy department of Ain Wazein Medical Village Hospital (AWMV) using the Monaco treatment planning system. Then the point of research will aim to compare and evaluate if the hypofractionated regimen with free-breathing (FB) offers comparable clinical outcomes and dosimetric benefits to a conventional regimen with DIBH for left breast cancer patients after breast-conserving surgery using the VMAT technique in the radiotherapy department of Ain Wazein Medical Village Hospital (AWMV) using the Monaco treatment planning system.

B. Nano Materials Synthesis and Characterization:

the aim of this research is to synthesize and characterize a composite material consisting of rare-earth doped Bismuth ferrite (BiFeO_3) and Barium hexaferrite ($\text{BaFe}_{12}\text{O}_{19}$). The incorporation of rare earth elements aims to enhance the multifunctional properties of the composite material. This study will focus on investigating the structural, dielectric, and magnetic properties of the composite, utilizing various rare earth doping concentrations. The experimental investigation will be accompanied by a theoretical analysis to provide a comprehensive understanding of the material's behavior.

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4.3. Publications

- 11 journal papers
- 6 international conference papers
- 1 thesis report
- 6 reports (technique notes) during the PhD thesis
- 1 report for Master training.

4.4. Awards

« **Best Presentation Award** » at the conference IYNC (International Youth Nuclear Congress) in Cape (South Africa), July 2010.

5. SKILLS

5.1. Technique

- Gamma spectroscopy, Neutron interaction (elastic and inelastic scattering neutron) Particles detection, Subatomic Physics
- Detection of particles and gamma rays
- Time-Of-Flights measurement of particles by the associated particle technique
- Proton interaction with matter, proton-therapy
- Radiotherapy
- Gamma and neutron background and shielding
- Numerical simulations: Monte-Carlo N-Particle transport MCNP, Geant4 and GATE
- Analysis of experimental and simulated data (ROOT, Origin,...).

5.2. Computing Skills

- Operating systems : Windows, Linux
- Software : MS Office, Winedt, Matlab, Latex, MCNP, X Cygwin...
- Data analysis: Origin, ROOT, Gnuplot,...
- Programming Languages : C, C++, and Visual basic, LabVIEW, ROOT

5.3. Training courses

- Experimental validation and calibration of numerical simulation model
- Transmission electronic microscopy
- Mass spectroscopy
- Using of ROOT and LabVIEW software
- Projects and quality in research context.

5.4. Languages

- English: Business fluent
- French: Business fluent
- Arabic: Mother tongue

6. LIST OF PUBLICATIONS

6.1. Journal Papers

1. Nourhane Moussawi, **Wassila El Kanawati**, Hanna El Balaa, “Plan quality metrics to assess the effectiveness of 3DCRT and VMAT treatment strategies for left- sided breast cancer patients”, *Journal of Health and Technology* 15(9804), March 2025 <https://doi.org/10.1007/s12553-025-00956-w>.
2. Bertrand Pérot, Cédric Carasco, Cyrille Eléon, Sébastien Bernard, Alix Sardet, **Wassila El Kanawati**, et al., “Sea Container Inspection with Tagged Neutrons”, *EPJ : European Physical Journal Nuclear Sciences and Technologies* Volume 7, 2021.
3. N. Allemandou, H. Almazán, P. del Amo Sanchez, L. Bernard, C. Bernard, A. Blanchet, A. Bonhomme, G. Bosson, O. Bourrion, J. Bouvier, C. Buck, V. Caillot, M. Chala, P. Champion, P. Charon, A. Collin, P. Contrepois, G. Coulloux, B. Desbrières, G. Deleglise, **W. El Kanawati**, et al., “The Stereo experiment”, *Journal of Instrumentation*, 13 (2018), 7009-7042.
4. **W. El Kanawati**, et al., “Monte Carlo simulation of prompt gamma-ray emission in proton therapy using a specific track length estimator”, *Physics in Medicine and Biology*, 60 (2015), 8067-8086.
5. **W. El Kanawati**, B. Perot, et C. Carasco, “Monte Carlo simulation of high-level radioactive waste characterization with the associated particle technique”, *Nuclear Instruments and Methods in Physics Research, A (NIM-A)*, Volume 705, **2013**, pp. 61–73.
6. **W. El Kanawati**, B. Perot, et al. “Conversion Factors from Counts to Chemical Ratios for the EURITRACK Tagged Neutron Inspection System”, *Nuclear Instruments and Methods in Physics Research, A (NIM-A)*, Volume 654, Issue 1, **October 2011**, pp. 621-629.
7. B. Perot, **W. El Kanawati**, et al., “Quantitative comparison between experimental and simulated gamma-ray spectra induced by 14 MeV tagged neutrons”, *Applied Radiation and Isotopes (ARI)*, In Press, Available online **18 July 2011**.
8. **W. El Kanawati**, B. Perot, et al., “Acquisition of prompt gamma-ray spectra induced by 14 MeV neutrons and comparison with Monte Carlo simulations”, *Applied Radiation and Isotopes (ARI)*, Volume 69, Issue 5, **May 2011**, Pages 732-743.
9. **W. El Kanawati**, C. Carasco et al., “Gamma-Ray Signatures Improvement of the EURITRACK Tagged Neutron Inspection System Database”, *IEEE TNS (Transaction Nuclear Science)*, **October 2010**.
10. B. Perot, C. Carasco, M. Toure, **W. El Kanawati**, C. Eleon, “Elemental Characterization of LL-MA Radioactive Waste Packages with the Associated Particle Technique”, *IEEE TNS (Transaction Nuclear Science)*, VOL. 59, **August 2012**.

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11. C. Carasco, B. Perot, A. Mariani, **W. El Kanawati**, V. Valkovic, et al., “Material characterization in cemented radioactive waste with the associated particle technique”, Nuclear Instruments and Methods in Physics Research Section A (NIM-A), Volume 619, Issues 1-3, **2010**, pp. 432-435.
12. J. Obhodas, D. Sudac, V. Valkovic, M. Baricevic, A. Franulović, B. Perot, C. Carasco, A. Mariani, A.C. Raoux, **W. El Kanawati**, “Analysis of containerized cargo in the ship container terminal”, Nuclear Instruments and Methods in Physics Research Section A (NIM-A), Volume 619, Issues 1-3, **2010**, pp. 460-466.

6.2. Conference Papers

1. **W. El Kanawati**, B. Perot et al., “Improvement of calibration database of the EURITRACK Tagged neutron inspection system”, International Conference on Advancements in Nuclear Instrumentation, Measurement Methods and their Applications, ANIMMA, June 2009, Marseille, France.
2. B. Perot, C. Carasco, A. Mariani, J.L. Ma, S. Dejoies, **W. El Kanawati**, C. Eleon, “Applications of the Associated Particle Technique”, International Conference on Advancements in Nuclear Instrumentation, Measurement Methods and their Applications, ANIMMA, June 2009, Marseille, France.
3. **W. El Kanawati**, B. Perot, et al., “Numerical Simulation of Realistic Tagged Neutron Inspection Data”, International Youth Nuclear Congress – IYNC, 12-18 July 2010, Cape Town, South Africa.
4. B. Perot, **W. El Kanawati**, et al., “Quantitative comparison between experimental and simulated gamma-ray spectra induced by 14 MeV tagged neutrons”, International Conference on Industrial Radiation and Radioisotope Measurement Applications, IRRMA-8, 26 June – 1 July 2011, Kansas City, Missouri, USA.
5. B. Perot, C. Carasco, M. Toure, **W. El Kanawati**, C. Eleon, “Elemental Characterization of LL-MA Radioactive Waste Packages with the Associated Particle Technique”, International Conference on Advancements in Nuclear Instrumentation, Measurement Methods and their Applications, ANIMMA, 6-9 June 2011, Ghent, Belgium.
6. **W. El Kanawati**, et al., “Development of a fast simulator for ion-range monitoring in proton therapy using GATE: distribution of prompt-gamma emitters using the track length estimator method”, International Conference uniting physics, biology and medicine for better healthcare, ICTR-PHE, 6-9 February 2014, CERN, Suisse.