WALID IDRISSI IBNSALIH

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I was born in Fano (I) on 22 April 1993.

After the scientific diploma (in 2012) at the Liceo Scientifico G. Torelli in Fano, I enrolled in the three-year course in physics at the University of Bologna. I continued my studies in Bologna until my Master's degree in Physics: the curriculum "Nuclear and Subnuclear Physics".

I did my master's thesis within the ANTARES Collaboration. This allowed me to join the "Istituto Nazionale di Fisica Nucleare" (INFN), Bologna section. ANTARES is a neutrino telescope, installed at a depth of 2475 meters in Mediterranean Sea. The main goal of the experiment is the search for high-energy neutrinos coming from astrophysical sources. The detection of neutrinos is accomplished through the observation of Cherenkov light produced by ultra-relativistic particles crossing the detector.

During my thesis work I became familiar with the ANTARES software tools: in particular I learned the algorithms used to reconstruct track and shower events and the functioning of event simulations in ANTARES, so as to contribute to the simulation of atmospheric muon events. I performed an analysis to reject atmospheric muon events, which represent an important background for the neutrino detector, and to select the neutrino events through the new Monte Carlo version of ANTARES. The main purpose of my thesis is the comparison of the efficiency in rejecting muon events between two different version Monte Carlo simulations (new and old).

During my studies I also learned to program with the C++ language and the MATLAB software. I improved my programming skills with my thesis work: in particular I acquired good knowledges of the ROOT framework and its TMVA package, useful for multivariate analysis and machine learning.

After I obtained my Master degree, I won a scholarship announced by the Physics Department of Bologna. The work that I am doing involves an analysis of bottom pressure variations in the Mediterranean Sea with the data collected by ANTARES. In particular the main purpose of the analysis is to identify low frequencies variability, as the "Chandler oscillation". In this period I am acquiring notions of geophysics and fluid dynamics, moreover I acquired further knowledge regarding the MATLAB software.

In November 2019, I started in the University of Caserta my PhD course. My activities were principal dedicated for the Cubic Kilometre Neutrino Telescope (**KM3NeT**) collaboration, a under construction Cherenkov detector located in the bottom of the Mediterranean Sea. The KM3NeT telescope consists in two differents sites: the ORCA (**Oscillation Research Cosmics in the Abyss**) detector, optimized for the low energy neutrinos (1-100 GeV) and projected to be installed in the bottom sea (depth about 2500 m) near Toloun (FR), and ARCA (**Astroparticle Research with Cosmics in the Abyss**) telescope, instead is building principal for the astrophysical high energy (10 TeV - 10 PeV),and will be installed at a depth of 3500 meters close to the Sicilian coast, in Italy.

During this period, I worked within the **CAPACITY** (Campania AstroPArtiCle InfrastrucTure facilitY) laboratory, projected with the collaboration between the INFN and "Physics and Mathematics" department of the Caserta University. The principal PhD project consisted to calculate the probability for KM3NeT/ARCA detector to observe high-energy neutrinos coming from the resevoir galaxies, in particular the Starburst and Starforming galaxies (SBGs and SFGs). The SBGs are astrophysical sources with a high star-forming activity and are guaranteed reservoirs of high-energy cosmic rays (CRs). Furthermore, these sources are considered a possible responsible at a part of the IceCube (Cherenkov neutrino detector installed in South Pole) observations. During my analysis I calculated the sensitivities for different point source SBGs that can be interesting for KM3NeT: for example the Small Magellanic Cloud (SMC), Circinus, NGC1068. The most important result obtained with this analysis was to provide differential limits for the KM3NeT detector: this parameter describes the performance to reject background events in different energy range. Moreover, a differential sensitivity was also introduced in the diffuse flux scenario considering different typologies of events (track-like, shower-like and double bang events). During my PhD studies, these results were presented in different conferences (poster and talk) and were updated in various KM3NeT Collaboration meetings.

I acquired knowledge regarding the statistical analysis elements (in particular the frequentist statistic), reconstruction

algorithms, events selection strategies and Monte Carlo simulations. I also improved my skills in programming languages: I obtained very good capacities for python, PyRoot (useful for the Gammapy, Scipy and PyStats package), Roofit and RooStats.

During this period, I gave my contribute in the integration activity of the Detection Unit (DU) at the CAPACITY laboratory for the KM3NeT/ARCA detector. A DU of KM3NeT consists in 18 Digital Optical Module (DOM): pressure resistent glass composed by 31 photomultipliers (PMTs). Using an appropriate dark room, my work consisted in the measurements of the time calibration and perform checks of the DU principal component (optical, acoustic, compass, etc..). Moreover, during my PhD activity I performed the calibration for 8 DUs: 7 of them are currently installed in the bottom sea. The KM3NeT/ARCA telescope is under installation: nowadays consists in 21 Detection Units. These activities allow me to acquire new expertise: for example in data acquisition, detector calibration, data analysis and management hardware components.

I also had the opportunity to teach few lessons (programming and data analysis with ROOT) for a master course in the physics department of the University of Caserta held by the Prof. D. Vivolo.

EDUCATION

Università degli Studi della Campania, Caserta Phd thesis in KM3NeT experiment, Expected title: "Study of Starburst galaxies observability though KM3NeT/ARCA telescope calcuting differential limits and time calibration of detector units" Supervisor: Prof. **P. Migliozzi** and Prof. **A. Marinelli** Date for PhD defense: 20/03/2023.

University of Bologna, Bologna Master's degree in Physics, Nuclear and Subnuclear Physics, Mar. 2019, Final thesis: "Selection of showering events and background suppression in ANTARES: comparison between the effects using two different Monte Carlo version", Supervisor: Prof. **M. Spurio**.

Final grade: 110/110.

University of Bologna, Bologna Bachelor's degree in Physics, Mar. 2016, Final thesis: "Il getto relativistico nella galassia Virgo-A (M87)", Supervisor: Prof. **G. Giovannini**.

Final grade: 100/110.

Liceo Scientifico G.Torelli, Fano High-School Diploma, Scientific specialisation.

Final grade: 80/100.

ADDITIONAL SCHOOLS

4th International School on High Energy Physics (ISHEP), Cargese, France
Summer School , iTHEPHY project, 7 – 11 May 2018.

Final grade: 110/110.

CONFERENCE

I presented my work in the following conferences:

- Very Large Volume Neutrino Telescope Workshop (VlVnT) 2021

- International Cosmic Ray Conference (ICRC) 2021

- Neutrino 2022

- Roma International Astroparticle Physics conference (RICAP) 2022

- Cosmic Ray International Seminar (CRIS) 2022

PROGRAMMING SKILLS

- Excellent knowledge of Windows, Unix and MacOSX operating systems.

- Excellent knowledge of Python and PyRoot programming language.

- Excellent knowledge of C++, C and Fortran programming language.

- Excellent knowledge of Bash programming language.

- Excellent knowledge of MATLAB programming language.

- Excellent knowledge of ROOT, Roofit and Roostats framework.

- Excellent knowledge of TMVA package: BDT, Fischer disciminant and RDF algorithm.

- Basic knowledge of VHDL language.

- Good knowledge of GEANT4 simulation software.

- Excellent knowledge of LaTeX.

- Good knowledge of LabView.

- Excellent knowledge of Microsoft Office, OpenOffice and LibreOffice software.

SPOKEN LANGUAGE

- **Mother tongue**: Italian, Arabic

- **Excellent/Good knowledge**: English (B2/C1), Spanish (B1/B2), Portuguese (C1/C2)

- **Other language**: French (A2)

ADDITIONAL INFORMATIONS

- Volunteer with clochard in Bologna (2015-2019)

- Volunteer with a Christian community in Ecuador, Colombia and Costa Rica (2018/2019).

- Worked as a waiter in a restaurant ("Florida", in Fano) from 2009-2015

- Worked as a waiter and kitcken porter in different restaurants and "Burger and Lobster company" during my period in London (March 2016 - November 2016)

Today 10/11/2022
Signature