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Ioannis Nomidis

CURRICULUM VITAE

INFORMAZIONI PERSONALI

COGNOME	NOMIDIS
NOME	IOANNIS
DATA DI NASCITA	29/10/1982

(15 pagine)

Professional Experience

- Post-doctoral Research Associate at CNRS/[LPNHE](#), Paris, France (2018-present)
- Post-doctoral Research Associate at Carleton University, Ottawa, Canada (2014-2018)
- PhD student/Research Associate at Aristotle University, Thessaloniki, Greece (2009-2014)

Research Expertise and Highlights

A short list highlighting research interests and achievements is given below, while a detailed summary is attached at the end of this cv.

Higgs physics

Measurements of the Higgs properties in the channels $H \rightarrow ZZ^* \rightarrow 4\ell$ and $H \rightarrow \gamma\gamma$: mass, cross-section, couplings and EFT interpretation. Expertise in event selection and background estimation. Development of a novel mass fit method used for the Higgs mass determination.

B -physics

PhD thesis on heavy-flavour production at the LHC with the ATLAS detector. Differential cross-section measurements, mass-lifetime measurements. Delivered the observation of the first B mesons produced in ATLAS, one of the first physics results from the LHC.

Lepton performance

ATLAS muon software development: reconstruction, validation, data quality. Performance with data-driven and simulation-based studies. Expert on low-momentum muon performance. Involvement in the implementation of a new clustering algorithm for electrons.

Gaseous detectors

Construction and characterization of small-strip thin-gap chambers (sTGC) for the upgrade of the ATLAS muon spectrometer in 2020. Directly involved in the construction of the prototype chamber that led to the qualification of the Canadian lab as an official production site.

Responsibilities and Leadership

Physics analysis contact ($h \rightarrow \gamma\gamma$: 2019-, $H \rightarrow 4\ell$: 2015-2017)

Coordinated the work of ATLAS analysis groups for $h \rightarrow \gamma\gamma$ resonance searches (more than 20 members) and measurements in the $H \rightarrow ZZ^* \rightarrow 4\ell$ channel (more than 50 members). Responsible for event selection and background estimation, editor of the analysis documentation, conference notes and publications.

Software validation contact and coordinator (HGamSW: 2018-, MuonSW: 2014-2017)

Muon software validation contact, responsible for the validation and performance of the ATLAS muon reconstruction software. Software coordinator for diphoton analyses in ATLAS.

Lab management (2014-2017)

Co-supervised staff of five technicians and two students working in the ATLAS sTGC construction lab at Carleton University. Responsibilities: assembly procedures, quality assessment, implementation and testing of the gas and X-ray system used for detector operation and characterization.

University Education and Academic Training

- 2013: **PhD** in particle physics, Aristotle Univ. of Thessaloniki, title: “[Study of the b-quark properties with the first ATLAS data](#)”, Grade: “Excellent”. Committee: Ch. Petridou (AUTH, advisor), S. Palestini (CERN), R. Nikolaidou (CEA-IRFU), Th. Alexopoulos (NTU Athens), M. Dris (NTU Athens), D. Sampsonidis (AUTH), K. Kordas (AUTH)
- 2009: **MSc** in Computational Physics, AUTH, Grade: 9.75 / 10 (“Excellent”), thesis: “Muon Data Quality Assessment in ATLAS”.
- 2006: **Ptychion** (four-year degree) in Physics, AUTH, Grade: 7.6 / 10 (“Very Good”).
- CERN-Fermilab Summer School **HCP 2013**, CERN, Geneva, Switzerland
- International School of Trigger and Data Acquisition **ISOTDAQ 2013**, Thessaloniki, Greece
- International School of Theory and Analysis in Particle Physics **ISTAPP 2011**, Istanbul, Turkey
- 65th Scottish Universities Summer School on Physics **SUSSP 2009: “LHC Physics”**, St. Andrews, UK

Selected Talks

- “Measurement of cross sections in Higgs boson decays to two photons with the ATLAS detector”, EPS-HEP, Ghent, Belgium, 10-17 Jul 2019
- “Higgs measurements in the di-boson final state”, Rencontres de Moriond-EW, La Thuile, Italy, 10-17 Mar 2018
- “Requirements, improvements, challenges in Higgs physics at HL-LHC”, Rencontres du Vietnam – Precision Theory, Quy Nhon, Vietnam, 25 Sep-2 Oct 2016
- “sTGC Project Readiness Review: Canadian sTGC Module-0 results”, ATLAS Muon Week, CERN, Switzerland, 7 June 2016
- “Heavy flavour production in ATLAS: Onia and open flavour hadrons”, 15th International Conference on *B*-Physics at Frontier Machines–Beauty 2014, Edinburgh, 14-18 Jul 2014

Talks in ATLAS workshops and Seminars

- “ e/γ performance in Higgs physics analyses”, ATLAS e/gamma Workshop, Sheffield, 2019
- “ $H \rightarrow 4\ell$ background estimations overview”, ATLAS HZZ Workshop, University of Oxford, UK, 10-13 Apr 2018
- “Higgs measurements in $H \rightarrow ZZ^* \rightarrow 4\ell$ in Run 2”, ATLAS-Canada, Ottawa, 2-3 May 2016
- “Background estimation for $H \rightarrow 4\ell$ ”, ATLAS HZZ Workshop, Max-Planck Institute for Physics, Munich, Germany, 26-29 Apr 2016
- “VBF $H \rightarrow 4\ell$ studies”, ATLAS HZZ Workshop, CERN, Switzerland, 28 Apr 2015
- “Physics Monitoring with Z and J/ψ events”, Artemis RTN annual meeting, Pisa, Italy, 18-19 Jul 2009

- “Higgs mass measurement with ATLAS data from Run-2 of the LHC”, Aristotle University of Thessaloniki, Greece, 7 Nov 2018
- “Measurements of the Higgs properties”, Carleton University, Ottawa, 11 May 2018
- “A new measurement of the Higgs mass with the ATLAS data from Run-2 of the LHC”, University of Athens, Greece, 16 Jan 2018
- “Studies of SM processes and elucidation of the spontaneous symmetry breaking mechanism with the first LHC data”, Ottawa-Carleton Institute for Physics, Ottawa, 9 Dec 2014

Publications

I am co-signing more than 800 peer-reviewed publications of the ATLAS collaboration and have contributed in several public notes reviewed by the ATLAS collaboration and presented in international conferences; a list of papers and notes in which I had direct contributions follows.

Peer-reviewed journals:

- “Measurement of the four-lepton invariant mass spectrum in 13 TeV proton-proton collisions with the ATLAS detector”, JHEP 04 (2019) 048
- “Constraints on off-shell Higgs boson production and the Higgs boson total width in $ZZ \rightarrow 4\ell$ and $ZZ \rightarrow 2\ell 2\nu$ final states with the ATLAS detector”, Phys. Lett. B786 (2018) 223
- “Measurement of the Higgs boson mass in the $H \rightarrow ZZ^* \rightarrow 4\ell$ and $H \rightarrow \gamma\gamma$ channels with $\sqrt{s} = 13$ TeV pp collisions using the ATLAS detector”, Phys. Lett. B784 (2018) 345
- “Measurement of the Higgs boson coupling properties in the $H \rightarrow ZZ^* \rightarrow 4\ell$ decay channel at $\sqrt{s} = 13$ TeV with the ATLAS detector”, JHEP 03 (2018) 095
- “Measurement of inclusive and differential cross sections in the $H \rightarrow ZZ^* \rightarrow 4\ell$ decay channel in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector”, JHEP 10 (2017) 132
- “Muon reconstruction performance of the ATLAS detector in proton-proton collision data at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C (2016) 76:292
- “Measurement of the differential cross-section of $B^\pm$ meson production in pp collisions at $\sqrt{s} = 7$ TeV at ATLAS”, JHEP 10 (2013) 042
- “Measurement of ZZ production in pp collisions at $\sqrt{s} = 7$ TeV and limits on anomalous ZZZ and $ZZ\gamma$ couplings with the ATLAS detector”, JHEP 03 (2013) 128
- “Search for the decay $B_s^0 \rightarrow \mu^+\mu^-$ with the ATLAS detector”, Phys. Lett. B713 (2012) 387
- “Studies of the performance of the ATLAS detector using cosmic-ray muons”, Eur. Phys. J. C71 (2011) 1593

ATLAS-reviewed notes:

- “Electron and photon performance measurements with the ATLAS detector using the 2015-2017 LHC proton-proton collision data”, arXiv:1908.00005 [hep-ex] (submitted to JINST)

- “Measurements and interpretations of Higgs-boson fiducial cross sections in the diphoton decay channel using 139 fb^{-1} of pp collision data at $\sqrt{s} = 13 \text{ TeV}$ with the ATLAS detector”, ATLAS-CONF-2019-029
- “Measurements of Higgs boson properties in the diphoton decay channel using 80 fb^{-1} of pp collision data at $\sqrt{s} = 13 \text{ TeV}$ with the ATLAS detector”, ATLAS-CONF-2018-028
- “Search for resonances in the 65 to 110 GeV diphoton invariant mass range using 80 fb^{-1} of pp collisions collected at $\sqrt{s} = 13 \text{ TeV}$ with the ATLAS detector”, ATLAS-CONF-2018-025
- “Measurement of the Higgs boson mass in the $H \rightarrow ZZ^* \rightarrow 4\ell$ and $H \rightarrow \gamma\gamma$ channels with $\sqrt{s} = 13 \text{ TeV}$ pp collisions with the ATLAS detector”, ATLAS-CONF-2017-046
- “Electron and photon reconstruction and performance in ATLAS using a dynamical, topological cell clustering-based approach”, ATL-PHYS-PUB-2017-022
- “Study of the Higgs boson properties and search for high-mass scalar resonances in the $H \rightarrow ZZ^* \rightarrow 4\ell$ decay channel at $\sqrt{s} = 13 \text{ TeV}$ with the ATLAS detector”, ATLAS-CONF-2016-079
- “Measurement of the fiducial cross sections of the Higgs boson and search for new physics in the $ZZ^* \rightarrow 4\ell$ final state with ATLAS using 2015 LHC pp collisions”, ATLAS-CONF-2015-059
- “ATLAS Phase-II Upgrade Scoping Document”, contribution to physics prospects for VBF $H \rightarrow ZZ^*$, [CERN-LHCC-2015-020](#)
- “Prospective results for vector-boson fusion-mediated Higgs-boson searches in the four lepton final state at the High Luminosity Large Hadron Collider”, ATL-PHYS-PUB-2016-008
- “Measurement of the total ZZ production cross section in the four-lepton channel with 4.7 fb^{-1} of ATLAS data”, ATLAS-CONF-2012-026
- “Observation of the $B^\pm$ meson in the decay $B^\pm \rightarrow J/\psi(\mu^+\mu^-)K^\pm$ ”, ATLAS-CONF-2010-098

Proceedings and articles:

- “ATLAS pins down the Higgs boson properties with the full Run-2 data”, ATLAS coll. (co-editor), CERN Courier (*to be published*)
- “Higgs measurements in the diboson final state”, I. Nomidis, Moriond-EW 2018 Proceedings
- “Heavy flavour production in ATLAS: Onia and open flavour hadrons”, I. Nomidis, PoS(Beauty2014)015
- “ B -physics studies with the ATLAS detector”, I. Nomidis, PoS(IHEP-LHC-2011)016

Teaching and Supervising Experience

I have supervised a notable number of undergraduate research theses on topics that I proposed and have co-supervised PhD students on subjects closely related to my area of expertise. A comprehensive list follows, together with a list of university courses for which I have provided teaching assistance. A detailed statement on my teaching philosophy is attached at the end of this cv.

Co-supervision of PhD students

- 2018–: Ahmed Tarek ([LPNHE](#)), Higgs differential cross-sections and EFT interpretations
- 2018–: Yufeng Wang ([LPNHE-USTC](#)), diphoton resonance searches
- 2014–2017: Graham Cree ([Carleton U](#)), muon reconstruction / Higgs mass measurement
- 2014–2017: David di Valentino ([Carleton U](#)), electron reconstruction / Higgs couplings

Supervision of undergraduate students

- 2019: “Study of the Higgs mass in the diphoton final state”, Alexis Maloizel, L3 internship, [École Normal Supérieur Paris-Saclay](#)
- 2015: “Background study for the $H \rightarrow ZZ^* \rightarrow 4\ell$ channel”, Nuiok Dicaire, [CERN](#) summer student
- 2015: “Setup and calibration of an x - y stepper motor for X-ray scanning of sTGC”, Stephen Lee, honours project, [Carleton U](#)
- 2014: “Development and testing of an n-C₅H₁₂/CO₂ mixing gas system for sTGC”, Robert Hunter, honours project, [Carleton U](#)
- 2013: “Estimation of the Higgs-boson mass reconstructed in the four-lepton channel with ATLAS 2012 data”, Stelios Balomenakis, undergraduate thesis, [AUTH](#)
- 2013: “Extraction of exclusion limits on anomalous Trilinear Gauge Couplings with ATLAS 2012 data”, Marievi Tsopoulou, undergraduate thesis, [AUTH](#)
- 2012: “Estimation of $Z+J/\psi$ production from multiple parton interactions”, Christos Roskas, undergraduate thesis, [AUTH](#)
- 2012: “Background measurement in $pp \rightarrow ZZ \rightarrow 4\ell$ using same-signed leptons with ATLAS 2012 data”, Nefeli Santorinaiou, undergraduate thesis, [AUTH](#)
- 2011: “Background measurement for $ZZ \rightarrow 4\ell$ using a fake-factor method with ATLAS 2011 data”, Dimitris Kyriazopoulos, undergraduate thesis, [AUTH](#)
- 2011: “Study of final-state radiation in Z decays using trilepton final states with ATLAS 2011 data”, Eve Emmanouilidou, undergraduate thesis, [AUTH](#)

Teaching lectures and assistance

- 2016: “Modern Physics 2” (undergraduate courses, [Carleton U](#)).
- 2010–2012: “Atomic and Molecular Physics Laboratory”, “Nuclear Physics Laboratory”, “Advanced Subjects on Elementary Particles” (undergraduate courses, [AUTH](#)).
- 2010–2012: “Introductory course to Linux, programming with C/C++ and data analysis with ROOT” (hands-on tutorial for physics students, [AUTH](#)).

Outreach activities

<u>Guide:</u>	University open days - research lab tours, 2016-2017 Carleton U ; “Sundays in AUTh” - lab experiments, June-July 2012 AUTh
<u>Public talk:</u>	“The contribution of A.U.Th. in the Experiment of the Century”, 19/1/2013, Noesis - Science Centre and Technology Museum, Greece
<u>High school lectures:</u>	3 rd & 4 th Physics Summer School for high-school students, 2013 & 2014, Giannitsa, Greece; Model Experimental High-School of the University of Thessaloniki, 2013 Thessaloniki, Greece
<u>Tutor:</u>	EPPOG Masterclasses (European Particle Physics Outreach Group), 2009-2012, AUTh
<u>Event organizer:</u>	“All about...CERN”, 9/5/2009, AUTh

Contacts

References regarding past research work may be requested from the following individuals:

- Dr. Giovanni Marchiori, LPNHE-Paris ($H \rightarrow \gamma\gamma$)
Giovanni.Marchiori@lpnhe.in2p3.fr
- Dr. RD Schaffer, LAL-Orsay ($H \rightarrow ZZ$)
R.D.Schaffer@cern.ch
- Dr. Lydia Roos, CNRS/IN2P3 ($\gamma\gamma$ searches)
Lydia.Roos@cnrs.fr
- Prof. Thomas Koffas, Carleton U. ($H \rightarrow ZZ$, e/μ reconstruction, detector construction)
Thomas.Koffas@cern.ch
- Prof. Gabriella Sciolla, Brandeis U. (μ performance)
Gabriella.Sciolla@cern.ch
- Prof. Chara Petridou, Aristotle U. of Thessaloniki (μ performance, ZZ , B -physics)
Chariclia.Petridou@cern.ch
- Associate Prof. Kostas Kordas, Aristotle U. of Thessaloniki (ZZ)
Kostas.Kordas@cern.ch
- Dr. Sandro Palestini, CERN (B -physics)
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RESEARCH STATEMENT OF DR. IOANNIS NOMIDIS

July 2019

Research summary

My research interests focus on measurements that test the validity of the Standard Model (SM) of particle physics in areas where deviations from the expectations can reveal new physics. Although the SM has been very successful in describing a wide range of experiments, we know it is incomplete as it fails to explain dark matter and dark energy, neutrino masses and matter-antimatter asymmetry, it is inconsistent with gravity and has flaws in its construction that imply lack of knowledge (hierarchy problem, strong CP problem). The Large Hadron Collider (LHC) provides the opportunity not only for direct searches for new phenomena but also for unprecedented precision tests of the SM. Precision measurements in particular have added value in the search for new physics as they can be translated to exclusion limits on new theories or extensions of the SM. Conducting research as a member of the ATLAS experiment, I have undertaken several projects in B -physics, diboson electroweak and Higgs physics and also technical aspects of the experiment in order to maximize its discovery potential.

Engaging in studies towards a PhD, I joined ATLAS during preparations for first data-taking from the LHC. As the first ATLAS data from the LHC arrived in 2010, I got deeply involved in B -physics studies to work with signals that could be observed with datasets of a few nb^{-1} with the aim of assessing the detector performance and pursue interesting physics measurements. I studied the $J/\psi \rightarrow \mu^+\mu^-$ and $B^\pm \rightarrow J/\psi K^\pm$ signals, using them as ‘standard candles’ in the at-the-time unexplored environment of LHC proton-proton collisions. The measurements of the mass and lifetime of these signals were an important assessment of the performance of the track and vertex reconstruction algorithms and the first B -physics results of the ATLAS experiment for the observation of beauty events [1]. This was also the first important test of the fit technique which paved the way for interesting measurements in ATLAS as that of the CP-violating weak phase in the $B_s^0 \rightarrow J/\psi \phi$ decay [2] and the mass and lifetime of the Λ_b^0 baryon [3]. Capitalizing on this work, I measured doubly-differential fiducial cross-sections for $B^\pm$ meson production [4], serving as a test of perturbative QCD calculations for $b\bar{b}$ production. Moreover, the measurement of the $B^\pm$ production in the specific decay channel was an important milestone in the search for rare, loop-induced, leptonic B -decays, the production of which is measured relative to this cross-section to allow the cancellation of common systematic uncertainties (i.e. luminosity). In particular, the search for the $B_s \rightarrow \mu^+\mu^-$ decay [5] was one of the first sensitive tests of the SM to be performed with Run-1 data, as any measured enhancement of the branching ratio compared to the SM prediction would be a clear indication of the existence of new undetected particles in the loop of this process.

Following my studies in B -physics, I took a completely different direction in order to exploit the wealth of the LHC data. ZZ production in its fully leptonic final state is a very clean channel for searches and stringent tests of the electroweak sector of the SM. The non-resonant ZZ production is interesting to measure in order to test the higher-order QCD calculations and ensure good understanding for what is an irreducible background to $H \rightarrow ZZ$ and other searches. I contributed to the measurements of its cross-section and set limits to new physics in the context of anomalous trilinear gauge couplings, using Run-1 data [6][7]. These measurements were an important milestone towards the discovery of the Higgs boson in Run-1.

During my first post-doctoral appointment at Carleton University, I joined the Higgs analysis group and contributed to precision measurements of its properties using the $H \rightarrow ZZ \rightarrow 4\ell$ decay with the first Run-2 data [8, 9, 10]. In the analysis of this multi-lepton final state, I made substantial contributions and carry expertise in the optimization of the event selection, the background suppression and its estimation, the cross-section and couplings measurement and in the measurement of the Higgs mass. From the beginning of my commitment to the analysis group, I engaged in projects that would allow me to bring improvements in the $H \rightarrow 4\ell$ analysis in Run-2. Regarding the event selection in $H \rightarrow 4\ell$, I proposed and implemented improvements based on my expertise in low-momentum muons and vertexing techniques from B -physics, that led to a 6% increase in signal acceptance and 30% rejection of background. I also explored the background estimation methods; I proposed changes to established methods and implemented new ones, ensuring robustness of the estimates for this channel. Simultaneously, I explored new methods in $H \rightarrow 4\ell$ for the measurement of the couplings and mass of the Higgs particle by co-supervising two PhD students working on these subjects (David di Valentino, Graham Cree). The work on the couplings involved a straight-forward alternative to the current method and also a means to combine measurements from different channels. The work on the mass measurement provided a novel method that outperformed the one used in Run-1 and will become extremely relevant in the future when the statistical precision will improve and the systematics will need to be well under control. My contributions to the $H \rightarrow 4\ell$ group were quickly acknowledged as I have been assigned various responsibilities as one of the analysis coordinators, editor of the documentation of the analysis and also of the publication for the mass measurement.

During my second post-doctoral appointment at LPNHE, I went outside my comfort zone and embarked on Higgs studies in the diphoton final state. Carrying significant experience in physics analysis and Higgs physics, I had no problem to familiarize fast with the new environment of the diphoton final state. I have been guiding two PhD students working on cross-section measurements of the Higgs boson and interpretations in the context of an Effective Field Theory, EFT, (Ahmed Tarek) and on new resonance searches (Yufeng Wang). Within a few months I already had substantial contributions to the measurements and searches and have provided results with 80–139 fb⁻¹ [11][12][13]. My work covered a wide range of items including critical ones such as the background modelling and spurious signal estimation. I have been serving as analysis coordinator for the diphoton resonance searches and carried out important responsibilities as editing the note for the cross-section measurement with the full Run-2 data and presented the results in a high-profile conference. In recognition of the quality of my work, commitment and leadership skills, I have been offered the position of the HGam group convener in order to guide the effort of a group of more than 80 physicists towards publishing results of more than seven analyses.

Regarding the outcome of the Higgs measurements in $H \rightarrow 4\ell$, $H \rightarrow \gamma\gamma$ [14], the data seem to be well in agreement with the SM predictions; no statistically significant deviations have been observed. Still, most measurements come with sizeable statistical uncertainties and there is theoretical motivation to measure the Higgs-boson couplings with uncertainties at the few-percent level in order to reveal or constrain new physics. Regarding searches for new resonances, no excess is seen above expected backgrounds in analyses performed with 36 and 80 fb⁻¹ covering the high (>200 GeV) and low mass (65–110 GeV) range, respectively. Therefore, given the absence of indisputable hints of new phenomena beyond the SM predictions, the end of Run-2 marks the beginning of a new era where the Higgs measurements become part of the precision physics program of the LHC.

In parallel with physics analysis, I have also been involved in technical aspects of the ATLAS experiment with long-term commitments to muon reconstruction. During preparations for the first ATLAS collision data from the LHC, I contributed to the development of the data quality monitoring framework for the reconstruction of muons and dimuon resonances [15] which was used during the commissioning of the muon system with cosmic-ray muons [16] and is still used to monitor and assess the quality of data from proton and heavy-ion collisions. During Run-2, I got more deeply involved in the development of muon reconstruction software and had a central role in the validation of the reconstruction. I delivered many performance studies with simulated and real collision data to ensure that high-quality objects are provided for use in physics analyses [17]. Regarding electron reconstruction, I had a crucial contribution in the development of a new technique for ATLAS that replaced the established approach of fixed-size clustering of calorimeter cells with a dynamic, variable-size clustering method for the measurement of the energy depositions of electrons and photons, bringing remarkable improvement in electron energy resolution [18]. With dedicated software tools that I developed, I studied at truth level the shower deposit in the calorimeter and the ability of each clustering algorithm and configuration to capture its true energy. These studies were essential in order to demonstrate the improvement of the new clustering algorithm and also to fine-tune it for electrons and photons.

Lastly, as a post-doc researcher at Carleton University I enriched my scientific profile with hardware-related work in an upgrade project of the ATLAS experiment. I worked on the construction of the small-strip Thin-Gap Chambers for the muon system upgrade in 2020, a crucial improvement that will allow ATLAS to record interesting events based on muon signatures at high rates without compromising the physics potential. I took multiple responsibilities in the construction lab in Canada and co-supervised staff of five technicians and two students (Robert Hunter, Steven Lee). I was responsible for the design, implementation and testing of the $n\text{-C}_5\text{H}_{12}/\text{CO}_2$ gas system used for detector operation during the Quality Assessment of the assembled chambers. I was also responsible for establishing the assembly procedures, proposing solutions to occurring problems, and the Quality Assessment of the assembled chambers. Therefore I was directly involved in the construction of the prototype chamber that led to the qualification of the Canadian lab as an official production site.

Future directions

After the discovery of the Higgs boson, the priority is to measure its properties and couplings with high precision in order to identify the true nature of the electroweak symmetry breaking. In the absence of a clear signal of physics beyond the Standard Model (SM), the only guaranteed legacy of the forthcoming LHC program is to constrain new physics, in which precise measurements of the Higgs properties will play a significant role. Analyses of the diboson final states, such as $H \rightarrow \gamma\gamma$ and $H \rightarrow ZZ^* \rightarrow 4\ell$, have been driving the overall sensitivity of the Higgs measurements at the LHC. Therefore, for the analysis of the LHC Run-2 and Run-3 datasets, the interest of the scientific community is concentrated primarily on the performance of these channels. My goal is to work on projects closely related to my expertise that will allow me to deliver new, high-precision measurements of high scientific impact.

In the immediate future, my goal is to contribute to measurements of Higgs properties (i.e. cross-sections, couplings, mass) and combine the measurements from different channels to improve the statistical precision, using the already delivered dataset of about 139 fb^{-1} from Run-2. As an

HGam group convener, I will directly guide the efforts in the diphoton channel and will also contribute to the searches for resonances with photons in the final state (i.e. $Z\gamma$, $\gamma\gamma$ +missing energy). It is worth noting that Higgs measurements should not be seen as stand-alone tests. They can be combined with precision measurements in the electroweak and top sector to perform global fits to check the overall consistency of the SM and can also be interpreted in the context of EFT in order to set limits on the strength of potential new interactions. As the LHC community will have to wait quite a few years before a new larger dataset is delivered, I aspire to make the most of the available data by improving on previous measurements, proposing and delivering complementary measurements, and eventually interpreting the measurements in a global EFT framework.

Looking further into the future of particle physics and how I see myself contributing to it, it lies in the full exploitation of the potential of the LHC with its upgrade to the High-Luminosity LHC (HL-LHC). Regarding the physics goal, at the HL-LHC we will be able to measure Higgs couplings with an ultimate precision of a few percent and eventually observe ultra-rare processes as that of di-Higgs production.

Regarding the HL-LHC and my potential involvement in its upgrade program, I have a clear preference for participating to a project that will allow me to continue making substantial contributions to the technical aspects of the ATLAS experiment simultaneously with physics analysis. I would join the ongoing efforts for the inner tracker upgrade (ITk) which I consider as the most crucial item in the ATLAS upgrade program for the HL-LHC. As a former member of the Carleton group and current member of the LPNHE group, both already engaged in ITk-related activities, I have been following closely details on module testing and characterization during the group meetings. I am looking forward to the challenge of working in the lab for ITk module assembly, exploiting my previous valuable lab experience from assembling sTGCs in Canada. I aspire to dedicate a significant fraction of my time and take up new responsibilities that will allow me to contribute effectively to the project until its successful completion.

Throughout my career I have exhibited commitment to all aspects of experimental particle physics, from detector construction to performance studies and physics analysis and eventually to the publication of physics results. In this statement I have presented my achievements together with a plan on how to extend these commitments in a meaningful way that will both satisfy my scientific curiosity and allow me to push the limits of physics knowledge. Well-aware that this is a team effort, I would contribute positively with my passion for physics and eagerness to engage young physicists in this quest for knowledge and progress.

References

- [1] Observation of the $B^\pm \rightarrow J/\psi(\mu^+\mu^-)K^\pm$ resonance in ATLAS, ATLAS-CONF-2010-098, <https://cds.cern.ch/record/1307530>
- [2] Time-dependent angular analysis of the decay $B_s^0 \rightarrow J/\psi \phi$ and extraction of $\Delta\Gamma_s$ and the CP-violating weak phase ϕ_s by ATLAS, JHEP 1212 (2012) 072
- [3] Measurement of the Λ_b^0 lifetime and mass in the ATLAS experiment, Phys. Rev. D 87, 032002 (2013)

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- [4] Measurement of the differential cross-section of $B^\pm$ meson production in pp collisions at $\sqrt{s} = 7$ TeV at ATLAS, JHEP 10 (2013) 042
 - [5] Search for the decay $B_s^0 \rightarrow \mu^+ \mu^-$ with the ATLAS detector, Phys. Lett. B713 (2012) 387
 - [6] Measurement of ZZ production in pp collisions at $\sqrt{s} = 7$ TeV and limits on anomalous ZZZ and $ZZ\gamma$ couplings with the ATLAS detector, JHEP 03 (2013) 128
 - [7] Measurement of the ZZ production cross section in proton-proton collisions at $\sqrt{s} = 8$ TeV using the $ZZ \rightarrow \ell^- \ell^+ \ell'^- \ell'^+$ and $ZZ \rightarrow \ell^- \ell^+ \nu \bar{\nu}$ decay channels with the ATLAS detector, JHEP 01 (2017) 99
 - [8] Measurement of inclusive and differential cross sections in the $H \rightarrow ZZ^* \rightarrow 4\ell$ decay channel in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector, JHEP 10 (2017) 132
 - [9] Measurement of the Higgs boson coupling properties in the $H \rightarrow ZZ^* \rightarrow 4\ell$ decay channel at $\sqrt{s} = 13$ TeV with the ATLAS detector, JHEP 03 (2018) 095
 - [10] Measurement of the Higgs boson mass in the $H \rightarrow ZZ^* \rightarrow 4\ell$ and $H \rightarrow \gamma\gamma$ channels with $\sqrt{s} = 13$ TeV pp collisions using the ATLAS detector, Phys. Lett. B784(2018) 345
 - [11] Measurements of Higgs boson properties in the diphoton decay channel using 80 fb $^{-1}$ of pp collision data at $\sqrt{s} = 13$ TeV with the ATLAS detector, ATLAS-CONF-2018-028, <http://cds.cern.ch/record/2628771>
 - [12] Search for resonances in the 65 to 110 GeV diphoton invariant mass range using 80 fb $^{-1}$ of pp collisions collected at $\sqrt{s} = 13$ TeV with the ATLAS detector, ATLAS-CONF-2018-025, <https://cds.cern.ch/record/2628760>
 - [13] Measurements and interpretations of Higgs-boson fiducial cross sections in the diphoton decay channel using 139 fb $^{-1}$ of pp collision data at $\sqrt{s} = 13$ TeV with the ATLAS detector, ATLAS-CONF-2019-029, <http://cdsweb.cern.ch/record/2682800>
 - [14] Combined measurement of the total and differential cross sections in the $H \rightarrow \gamma\gamma$ and the $H \rightarrow ZZ^* \rightarrow 4\ell$ decay channels at $\sqrt{s} = 13$ TeV with the ATLAS detector, ATLAS-CONF-2019-032, <http://cdsweb.cern.ch/record/2682844>
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 - [16] Studies of the performance of the ATLAS detector using cosmic-ray muons, Eur. Phys. J. C71 (2011) 1593
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STATEMENT OF TEACHING PHILOSOPHY

Dr. Ioannis Nomidis, July 2019

When I entered the university to study physics, I was fulfilling my dream. But there, I realized something unexpected, that most of my fellow students ended up in physics because they failed to enter the medical or law school. I found that only 1% of students had a true desire to study physics and pursue the life of a scientist. Even after graduating, few were convinced of the importance of their studies. My teaching philosophy has been affected by these facts. My aim is to ensure that each student appreciates the purpose of studying science and acquiring knowledge. At the same time, I would identify individuals who have a natural inclination for science and equip them properly in order to follow a career path.

I realized that I have a talent for teaching as early as I joined the university. While studying in groups, I would often take a leading role in passing on my understanding of the subject to all members of the group that were lagging in grasping what was fresh knowledge to all of us. This procedure was beneficial not only to my fellows, but to me as well. I felt that this is how I conquer knowledge. Only if I convince others with my explanations I can claim that I have a deep understanding of a subject. With this mentality, I practiced as a young tutor in many different occasions. As a part-time job, I provided preparatory courses on physics and mathematics to high-school students and also worked for a software company as a physicist in developing educational multimedia software. I was a tutor outside physics as well. As a member of the university's photography club, I introduced newcomers to the art and craft of photography. I gave lectures, demonstrated dark room techniques and engaged students in street-photography excursions. One student of mine took one step further and changed career; after completing his engineering studies, he took an MA (Master of Arts) in Photography and acknowledged that my inspirational lectures played a role in this.

As a PhD candidate, I engaged fast in teaching assistance. I was enthusiastic in taking over responsibilities in the atomic/molecular and nuclear physics labs and also in classes on elementary-particle physics. I often managed to attract students to take a thesis in the subject of experimental particle physics, although there were many other options in a large physics department practicing research in astronomy, astrophysics, mechanics, solid state physics, electronics and computers and environmental physics. Many of them I would later co-supervise on subjects that I proposed and depart from my expertise in the analysis of multi-lepton final states with data from the ATLAS experiment. As a young mentor, I would guide the students through all stages of a physics analysis, discussing the underlying theory, introducing experimental concepts, challenging them with tasks to improve their technical competencies, and advising them on the interpretation and presentation of the results. Moreover, for the better preparation of students that would take up a research thesis, I proposed and organized introductory courses and hands-on tutorials regarding the computing environment and tools that are widely used by the particle physics community (Linux/C++/ROOT/RooFit). Therefore, carrying out my teaching assistance duties to large audiences and several individuals at the undergraduate level in the greek university has been an invaluable experience. What has been particularly rewarding was to see all of the students I worked with continuing their studies in particle physics towards MSc and PhD.

As a Research Associate at Carleton University, I was able to do something new, that is to co-supervise PhD candidates working in more advanced and innovative projects with longer

timescales. There, I guided two PhD students to the successful completion of their projects that were closely related to my expertise; Graham Cree, in particular, was awarded with a University Medal for his outstanding work. I also supervised two Carleton undergraduate students working on honors projects and a summer student from University of Ottawa working with the Carleton ATLAS group on an NSERC scholarship. Currently in LPNHE, I continue to co-supervise students, having two PhD students and a summer student under my responsibility. Therefore, I have demonstrated the capacity to be a mentor also within a foreign academic and educational environment.

As a university professor, I will have the opportunity to realize my full potential as a mentor and teacher. I foresee teaching elementary and modern physics at the introductory or general level at the early stages of my career. Subsequently, I will seek to teach more advanced courses at post-graduate level that would be closer to my research, such as elementary particle physics, experimental techniques, but also subjects relevant to my MSc studies, thus computational physics.

The experience I have in preparing and delivering well-organized and clear presentations is directly applicable to the classroom. The educational methodology that I will follow distinguishes *what* is meant to be passed on as knowledge and *how* it can be better disseminated. Regarding *what* is meant to be taught, the traditional approach is to allow the student to experience the known, conceptualize new terms, analyze problems functionally and learn how to apply a freshly-taught method appropriately. Regarding the *how* aspect, my approach revolves around creating interest and maintaining motivation to follow a course. It is always a good strategy to begin each lecture with a clear outline of its objectives and physical problems it aims to address. I would introduce a physics problem through experience of not only the known, but also of what would be radically new phenomena for the students in order to challenge their empirical grasp of nature. I would not only introduce them to new terminology, but also link it with theoretical knowledge and empirical evidence, so that the new terms can be conceptualized at a deeper level. I would not only teach new methods and their appropriate application, but also cultivate independent thinking by critical review of the methods and search for creative applications. I will encourage students to find alternative approaches to reach a conclusion and come up with thought experiments or real-life experiments to challenge their understanding of a subject.

Maintaining rigor in the classroom is also important and I aim to achieve this by highlighting the importance of taking courses at this level and in a class. It should not be another attempt to accumulate knowledge but instead an interactive procedure through which they can improve their intellect. In the same spirit, I will incorporate modern elements in the lectures (audio/video/keynote presentations) in proper combination with a blackboard lecture. I will attempt new ways to assess and extend the intermediate learning outcomes, such as hackathon-style assignments that could inspire creative problem-solving.

As a closing remark, I should point out that as a professor of physics, I aspire to achieve more than simply a transfer of knowledge. In my teaching philosophy I see a way of contributing to society by infusing ethos and quality. I see the potential of creating future collaborators, better workers and fellow citizens fully equipped to build and live in a more advanced and aware society.

Ioannis Nomidis

CURRICULUM VITAE

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31/07/2019

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Parigi, Francia