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## Research Interest

### *Nuclear and Particle Physics:*

- ◆ Dynamics of strongly interacting particles, hadrons, and their elementary constituents, quarks and gluons, via the study of the hadronization and fragmentation processes that probe the dynamics of quark propagation and hadron formation in cold nuclear matter, and the color transparency phenomenon; that is, the formation and evolution of small size configurations to regular hadrons.
- ◆ Nucleon structure via the study of the anti-quark asymmetry and some medium stimulated effects such as the quark energy loss and the “EMC” effect using the unpolarized Drell-Yan (DY) process as well as the study of the sea-quark Sivers functions, the poorly known gluon/Twist-3 transverse momentum distributions via the  $J/\Psi$  production, and the transverse polarization, or transversity, distribution on the polarized DY production.

## Employment History

- ◆ May 2019 - Present                      Assistant Professor, Department of Physics and Astronomy, Mississippi State University.
- ◆ August 2014 – May 2019              Assistant Professor Bridge Position, Mississippi State University Department of Physics and Astronomy and Jefferson Lab.
- ◆ Dec. 2013 – August 2014              Postdoctoral Associate, Experimental Nuclear Physics Group, Department of Physics, Old Dominion Univ. jointly with Jefferson Lab.  
**Advisor:** Prof. Larry B. Weinstein
- ◆ May 2009 – May 2013                  Postdoctoral Associate, Experimental Nuclear Physics Group, Department of Physics & Astronomy, Rutgers, The State of New Jersey University.  
**Advisor:** Prof. Ronald Gilman
- ◆ July 2008 – January 2009              Visiting Research Scholar, Experimental Nuclear Physics Group, Department of Physics and Astronomy, Rutgers, The State of New Jersey University.  
**Advisor:** Prof. Ronald Gilman
- ◆ Sept. 2003 – Dec. 2007                  Research Assistant, Medium Energy Physics Group, Physics Division, Argonne National Laboratory.  
**Ph.D Advisor:** Dr. Kawtar Hafidi

## Education

- ◆ June 2008 Ph.D. in Experimental Physics, Mohammed V University, Rabat, Morocco.
- ◆ June 2003 Master in High Energy Physics, Mohammed V University, Rabat, Morocco.
- ◆ June 1999 Bachelor in Nuclear Physics, Abdelmalek Essaadi University, Tetouan, Morocco.

## Teaching Experience:

- ◆ Teaching Calculus-based Physics course, Physics III; PH-2233, in Fall 2019.
- ◆ Taught Intermediate Mechanics II; PH-4223/6223, in Spring 2019.
- ◆ Taught Graduate Nuclear Physics; PH-8613, in Fall 2018.
- ◆ Taught Intermediate Mechanics II; PH-4223/6223, in Spring 2018.
- ◆ Taught Intermediate Mechanics I; PH-4213/6213, in Fall 2017.
- ◆ Taught Calculus-based Physics course, Physics III; PH-2233, in Fall 2016.
- ◆ Taught Intermediate Mechanics II; PH-4223/6223, in Spring 2016.
- ◆ Taught Intermediate Mechanics I; PH-4213/6213, in Fall 2015.
- ◆ Taught Nuclear Physics; PH-8613, in Fall 2014.

## Experimental Affiliations and Contributions:

- ◆ CLAS Collaboration, Hall-B at Jefferson Lab, 2005 - present:
  - ✓ Leading the hadronization analysis of the  $\Lambda^0$  hyperon in the current and spectator fragmentation regions in addition to the fracture functions using data-sets of the E02-110 & E02-104 electro-production experiments (EG2 run-group).
  - ✓ Participating in the commissioning and calibration of the new 12 GeV CLAS (CLAS12) spectrometer. The primary contribution includes developing, optimizing and maintaining the calibration and monitoring suites for the drift chambers (DC), debugging the tracking and reconstruction algorithms, training users, and coordinating the DC calibration.
  - ✓ Developed the data explorer suite to check and monitor the operation and the quality of data recorded on various CLAS12 sub-detectors.
  - ✓ Participated in the development of a multi-threaded C++/ROOT-based analysis framework for the newly accumulated CLAS12 data-sets.
  - ✓ Supervised the development of a JAVA-based tool for quality control of DC calibration.
  - ✓ Leading the preparation of my two CLAS12 experiments, color transparency (CT) and color propagation (hadronization/fragmentation study), that passed the experimental readiness review in March 2019. These nuclear targets experiments are “tentatively” scheduled to partially run in spring of 2021.
  - ✓ Participated in the analyses of coherent and incoherent deeply virtual Compton scattering off  $^4\text{He}$  using data-sets of the E07-009 & E08-024 electro-production experiments (EG6 run-group). Primary contribution includes calibration of the time-of-

light (TOF) and radio frequency (RF) systems, reconstruction of the full data-sets, monitoring of data-quality, and maintaining the run-group software and databases.

- ✓ Assisted ODU graduate student in the electromagnetic calorimeter (EC) time-calibration and energy correction development for his EG6 analysis.
  - ✓ Participated in the sanity-check and debugging of the nuclear data-mining software that was developed with JAVA+PYTHON (JYTHON) to integrate the formerly processed and reviewed 6 GeV nuclear targets data in a common and user friendly analysis framework.
  - ✓ Assisted in setting up the simulation chain for the proton analysis of the E03-006 electro-production experiment (EG4 run-group).
  - ✓ Fine-tuned the deuteron analysis of the EG4 run-group experiment. Primary contribution includes debugging and fixing bugs in the run-group's reconstruction software, reconstruction of the full data-sets, simulation for different systematic studies, and mentoring my postdoc Dr. Krishna Adhikari to finalize his thesis analysis that aimed to study the helicity-dependent inclusive cross section differences for deuteron at low momentum transfer, using longitudinally polarized electron beams and targets.
  - ✓ Completed the development and improvement of the track fitter and Kalman fitter for the upcoming BoNuS12 ("Barely off-shell Nucleon Structure") experiment.
  - ✓ EG2 run-group main analyzer. Primary contribution includes monitoring of data-taking, calibration of TOF, RF and EC timing, reconstruction of the full data-sets, extraction of the 5 GeV CT results, and assisting new group members especially (un)graduate students to become familiar with the run-group software and analysis tools.
- ◆ Hall-A Collaboration, Jefferson Lab, 2008 - present:
    - ✓ Participated in the commissioning and shielding of the Bigbite Gas Cherenkov photo-multipliers.
    - ✓ Supervised one Rutgers graduate student in one thesis project related to the calibration of  $^3\text{He}$  polarized target's cells to determine their wall thickness and target density using a low intensity laser beam.
  - ◆ SeaQuest/E906 Collaboration, Fermi National Lab (Fermilab), 2009 – present:
    - ✓ Assisted in data-taking and analysis of the unpolarized Drell-Yan (DY) experiment that aims to study the sea anti-quark asymmetry,  $\bar{d}/\bar{u}$ , and some medium stimulated effects such as the quark energy loss in cold nuclear matter.
    - ✓ Co-led the effort of building a new drift chamber for the second run period. Primary contribution includes manually stretching and measuring the tension of all wire's type, formation of the gas seal windows, mentoring graduate and undergraduate students who participated in this process, and coordinating the work among the collaboration and Fermilab technicians.
    - ✓ Led the refurbishment of the inherited set of drift chambers from the predecessor DY experiments, 9 out of 14 tracking chambers used in the E906 spectrometer. This contribution includes commissioning and maintaining the performance of DC, assisting their calibration, and maintaining their high voltage system and electronics readouts.
    - ✓ Supervised one Rutgers graduate student in his summer project and thesis analysis

related to the DC repair, calibration, and tracking efficiency studies.

- ◆ SpinQuest/E1039 Collaboration, Fermilab, 2015 – present:
  - ✓ Developing a graphical processing unit (GPU) multi-threaded framework for online reconstruction to identify and debug any ongoing issues with data-taking in real time.
  - ✓ Assisting the maintenance and upcoming commissioning of the inherited E906/SeaQuest drift chambers in the spectrometer.
  - ✓ Preparing for the day-one analysis that aims to study the poorly known gluon/Twist-3 transverse momentum distributions using the  $J/\psi$  events produced in the collision of an unpolarized 120 GeV proton beam and transversely polarized cryogenic,  $\text{NH}_3$  and  $\text{ND}_3$ , targets.

### **Professional Organizations and Activities**

- ◆ Chair, Nominating committee for the CLAS Collaboration Nuclear Physics Working Group (NPWG) chair election, Summer 2019 and 2016.
- ◆ Member-at-Large, Southeastern Section of American Physical Society (SESAPS), 2019 – 2022.
- ◆ Reviewer, German Research Foundation Grant Proposals, 2019 – Present.
- ◆ Reviewer, National Science Foundation Grant Proposals, 2018 – Present.
- ◆ Member, Women Club at Mississippi State University, 2018 – Present.
- ◆ Outreach Director, Jefferson Lab User Organization (JLUO) Board of Directors, 2017 – 2019.
- ◆ Member, Ad-hoc Review Committee of CLAS Collaboration Nature paper, 2017.
- ◆ Chair, Review Committee of two CLAS Collaboration proposals to the Jefferson Lab Program Advisory Committee (PAC), PAC 44/45, 2016/2017.
- ◆ Representative, Institutional Board of the Electron-Ion Collider (EIC) Users Group, 2016 – Present.
- ◆ Member, Electron-Ion Collider Users Group, 2016 – Present.
- ◆ Secretary, CLAS Speakers Committee (CSC), 2015 – Present.
- ◆ Chair, Colloquium Committee of Miss. State U. Physics and Astronomy Department, 2015 – Present.
- ◆ Member, Colloquium Committee of Miss. State U. Physics and Astronomy Department, 2014 – Present.
- ◆ Representative of NPWG in CSC, 2014 – Present.
- ◆ Member, International Women’s Leadership Association (IWLA), 2015 – Present.
- ◆ Member, CLAS Collaboration Analysis Review Committees, 2011 – 2018.
- ◆ Member, Association of Women in Science (AWIS), 2010 – Present.
- ◆ Member, SESAPS, Division of Nuclear Physics (DNP), Topical Group on Hadronic Physics (GHP), and Division of Particles & Fields (PDF), - Present.
- ◆ Member, American Physical Society, 2004 – Present.
- ◆ Member, JLUO, 2003 – Present.

### **Honors and Awards**

- ◆ Hall-B/Jefferson Lab, “Memorandum Of Understanding for Full Membership of Miss. State U. on the CLAS Collaboration”, 2014 – 2020.

- ◆ Jefferson Lab/Miss. State U., “Assistant Professor Bridge Appointment”, 2014 - 2019.
- ◆ CLAS Collaboration, Hall-B/Jefferson Lab, “Full Membership”, December 2016.
- ◆ International Women’s Leadership Association (IWLA), [Top Female Professional](#) , as a recognition of excellence in physics research and education, December 2015.
- ◆ Argonne National Lab, “Graduate Fellowship”, 2003 – 2008.

### Research Grants and Travel Awards

- ◆ **U.S. Department of Energy**, “Precision Measurements at Medium Energy”, DE-FG02-07ER41528, **Co-P.I.**, 09/2019 – 08/2022, **\$1,787,000**, in which **P.I.** of **\$714,800**.
- ◆ **Hall-B of Jefferson Lab**, “1/2 Postdoctoral Research Associate Position for Dr. Taya Chetry”, **P.I.**, 02/2019 - 08/2019, **\$17,092**.
- ◆ **U.S. Department of Energy**, “Study of Gluon Transverse Momentum Distributions with J/Y Production in the E1039 Polarized Drell-Yan Experiment”, DE-FG02-07ER41528, **P.I.**, 09/2018 – 08/2019, **\$125,000**.
- ◆ **Hall-B of Jefferson Lab**, “1/2 Postdoctoral Research Associate Position for Dr. Krishna Adhikari”, **P.I.**, 01/2017- 05/2017, **\$13,119**.
- ◆ **U.S. Department of Energy**, “Nuclear Dependence of Delta and Lambda Production”, DE-FG02-07ER41528, **P.I.**, 09/2016 – 08/2019, **\$317,000**.
- ◆ **ODU Data-mining Research Fund**, travel award for my postdoc Dr. Krishna Adhikari to attend a workshop in July 2015, **\$1000**.
- ◆ **ODU Data-mining Research Fund**, travel award to support my extended Jefferson Lab visit in Spring 2015, **\$2000**.
- ◆ **ODU Data-mining Research Fund**, travel award for my postdoc Dr. Krishna Adhikari to attend a workshop in August 2014, **\$1100**.
- ◆ **Jefferson Science Associates/Jefferson Lab**, G00000799, “Bridged-appointment Faculty Position”, **Co-P.I.**, 08/2014 – 05/2019, **\$535,433**.

### Advisory Experience

#### ◆ Postdoctoral Associates:

- \* Dr. Taya Chetry, 2019 – Present.
- \* Dr. Hao Jiang, 2018 – 2019.
- \* Dr. Md Latiful Kabir, 2017 – 2019.
- \* Dr. Krishna Adhikari, 2014 – 2017.

#### ◆ Graduate Students (GS):

- \* Hamza El Rhrissi (Ph.D 2024).
- \* Nada Nouhi (Ph.D 2024).
- \* Shirsendu Nanda (M.S. 2019).
- \* Pubuduni Ekanayaka Mudiyansele Egeda Walawwe (M.S. 2018).

### Presentations (<sup>P</sup>Invited Talks)

#### ◆ Conference/Workshop Presentations

- ✓ APS/DNP Annual Meeting 2018, Waikoloa, Hawaii, Oct 25<sup>th</sup>, 2018: “Highlights of Fragmentation Studies in CLAS”.

- ✓ <sup>¶</sup>EIC Users Group Meeting, Washington, D.C., July 31<sup>st</sup>, 2018: “QCD Signature in Nuclei: Hadronization and Color Transparency Studies in CLAS-6/12”.
- ✓ <sup>¶</sup>Next Generation Nuclear Physics with JLab12 and EIC Workshop, February 12<sup>th</sup>, 2016: “Hadronization with JLab 6/12 GeV”.
- ✓ <sup>¶</sup>Fall APS/DNP Meeting, Oct 28<sup>th</sup>, 2015: “The Emergence of Hadrons from QCD Color”.
- ✓ <sup>¶</sup>International Workshop on Experimental and Theoretical Topics in CLAS Data Mining, July 27<sup>th</sup>, 2015: “Data Conversion Progress”.
- ✓ <sup>¶</sup>11<sup>th</sup> Conference on the Intersections of Particle and Nuclear Physics (CIPANP 2012), St. Petersburg, Florida, June 2012: “Overview of color transparency measurements”.
- ✓ <sup>¶</sup>Nuclear Chromo-Dynamic Studies with a Future Electron Ion Collider Workshop, Argonne National Laboratory, Apr 2010: “CT in Rho production”.
- ✓ Gordon Conference on Photonuclear Reactions, Aug. 2012: “Highlights of the E906/SeaQuest Experiment at Fermilab” (Poster).
- ✓ Gordon Conference on Photonuclear Reactions, Aug. 2012: “Search for the onset of color transparency in  $\rho^0$  electroproduction off nuclei”,
- ✓ APS April Meeting, Apr. 2011: “Hadronization dynamics of  $\Lambda^0$  baryon”.
- ✓ APS Meeting, Feb. 2010: “Measurement of the anti-quark distributions on Drell-Yan process”.
- ✓ Hampton University Graduate School contributed talk, June 2005: “Search for the Onset of Color Transparency @ CLAS: JLab E02-110 Experiment”.

### By Research Group:

- ✓ APS/GHP 2019 Workshop, Denver, Colorado, April 10 - 12, 2019: “Study of  $\Lambda$  Hyperon Fragmentation in Current and Target Regions using CLAS” (*by my current postdoc Dr. Taya Chetry*).
- ✓ APS/GHP 2019 Workshop, Denver, Colorado, April 10 - 12, 2019: “Fracture Functions from  $\Lambda^0$  Leptoproduction for Target Remnant Description” (*by a former ANL postdoc and collaborator Dr. Sereres Johnston*).
- ✓ APS/DNP Annual Meeting 2018, Waikoloa, Hawaii, Oct 25<sup>th</sup>, 2018: “Study of Forward and Backward Fragmentation Processes in  $\Lambda^0$  Leptoproduction” (*by a former ANL postdoc and collaborator Dr. Sereres Johnston*).
- ✓ APS April Meeting, Columbus, Ohio, Apr. 16<sup>th</sup>, 2018: “CLAS12 Drift Chambers Tracking and Calibration” (*Poster by my former postdoc Dr. Md Latiful Kabir*).
- ✓ Jefferson Lab CLAS12 First Experiment Workshop, Newport News, Mar. 6<sup>th</sup>, 2018: “DC Calibration - status and plans” (*by my former postdoc Dr. Latiful Kabir*).
- ✓ Jefferson Lab CLAS12 First Experiment Workshop, Newport News, March 28<sup>th</sup>, 2017: “Drift Chambers Calibration” (*by my former postdoc Dr. Krishna Adhikari*).
- ✓ APS April Meeting, Washington, DC, January 28<sup>th</sup> - 31<sup>st</sup>, 2017: “New results on spin structure functions at very low momentum transfers from Hall B in Jefferson Lab” (*by my former postdoc Dr. Krishna Adhikari*).

- ✓ <sup>¶</sup>Baryons 2016, Tallahassee, FL, May 16<sup>th</sup> - 20<sup>th</sup>, 2016: “New results on spin structure functions at very low momentum transfers from Jefferson Lab” (*by my former postdoc Dr. Krishna Adhikari*).
- ✓ International Workshop on Experimental and Theoretical Topics in CLAS Data Mining, July 27<sup>th</sup>, 2015: “Hadronization of  $\Lambda^0$  channel: analysis progress”, (*by my postdoc Dr. Krishna Adhikari*).

#### ◆ Colloquium/Seminar/Other Presentations

- ✓ <sup>¶</sup>Jefferson Lab CLAS Collaboration Meeting, Newport News, June 19<sup>th</sup>, 2019: “RG-D readiness status”.
- ✓ <sup>¶</sup>Jefferson Lab CLAS Collaboration Meeting, Newport News, Nov. 14<sup>th</sup>, 2018: “RG-D and RG-E readiness and plans”.
- ✓ <sup>¶</sup>Jefferson Lab CLAS Collaboration Meeting, Newport News, Mar. 9<sup>th</sup>, 2018: “Study of Color Transparency in Exclusive Vector Meson Electroproduction off Nuclei”.
- ✓ <sup>¶</sup>Mississippi State University, Experimental Nuclear Physics Colloquium, May 5<sup>th</sup>, 2014: “Measuring Antiquarks in the Proton”.
- ✓ <sup>¶</sup>Old Dominion University, Experimental Nuclear Physics Seminar, Jun 26<sup>th</sup>, 2013: “Recent Progress of the E-906/SeaQuest Drell-Yan Experiment at Fermilab”.
- ✓ <sup>¶</sup>Jefferson Lab Hall-A, Experimental Physics Seminar, Jun 6<sup>th</sup>, 2013: “Drell-Yan measurements with the E906/SeaQuest Experiment at Fermilab”.
- ✓ <sup>¶</sup>Rutgers University, Experimental Nuclear Physics Seminar, Oct 2008: “Search for the Onset of Color Transparency in Rho Electroproduction”.
- ✓ <sup>¶</sup>Old Dominion University, Experimental Nuclear Physics Seminar, Nov. 2007: “Search for the Onset of Color Transparency @ CLAS Detector”.
- ✓ <sup>¶</sup>Brookhaven National Laboratory, RHIC Spin Physics Seminar, Nov. 2007: “Search of Color Transparency using CLAS Detector”.
- ✓ <sup>¶</sup>Ohio University, Medium Energy Physics Group Seminar, Nov. 2007: “Search for the Onset of Color Transparency @ CLAS Detector”.
- ✓ <sup>¶</sup>Argonne National Laboratory, Medium Energy Physics Seminar, Dec. 2007: “Search for Color Transparency in  $\rho^0$  Electroproduction”.
- ✓ <sup>¶</sup>Argonne National Laboratory, Student Lunch Seminar, Jan. 2017: “Chasing Color Transparency with Exclusive Vector Meson Electroproduction”.
- ✓ <sup>¶</sup>Argonne National Laboratory, Medium Energy Physics Seminar, Feb. 2007: “Search for Color Transparency using CLAS Detector”.

#### By Research Group:

- ✓ 4th UM-MSU Joint Physics Research Symposium, Mississippi State, March 23<sup>rd</sup>, 2019: “Color Transparency Study in Vector Meson Electroproduction with CLAS12 at Jefferson Lab” (*by my former M.S. GS S. Nanda*),
- ✓ E1039/SpinQuest Fall Collaboration Meeting, November 9<sup>th</sup>, 2018: “Plans for the E1039 Online Data Reconstruction with GPUs” (*by my former postdoc Dr. Hao Jiang*).

- ✓ Jefferson Lab CLAS Collaboration Meeting, Newport News, July. 12<sup>th</sup>, 2018: “Studies of Hadronization from CLAS6 and Readiness for CLAS12” (*by my former postdoc Dr. Latiful Kabir*).
- ✓ Jefferson Lab CLAS Collaboration Meeting, Newport News, July. 11<sup>th</sup>, 2018: “DC calibration and performances” (*by my former postdoc Dr. Latiful Kabir*).
- ✓ UM–MSU 2018 Joint Physics Research Symposium, Oxford, Apr. 8<sup>th</sup>, 2018: “Color Transparency Experiment: Motivation and Setup” (*poster by my former MS GS Pubuduni*),
- ✓ 16<sup>th</sup> Annual Graduate Student Research Symposium, Mississippi State, Feb. 17<sup>th</sup>, 2018: “Color Transparency Experiment: Motivation and Setup” (*poster by my former M.S. GS Pubuduni Ekanayaka*).
- ✓ Physics Graduate Student Journal Club Colloquium, Mississippi State, Nov. 17<sup>th</sup>, 2017: “Color Transparency Experiment: Motivation and Setup” (*by my former M.S. GS Pubuduni Ekanayaka*).
- ✓ Jefferson Lab CLAS Collaboration Meeting, Newport News, Oct. 5<sup>th</sup>, 2017: “Drift Chamber Tracking for CLAS12”, (*by my former postdoc Dr. Latiful Kabir*).

### Proposals

- ◆ Jefferson Lab 12-GeV Program, Contact person/Co-spokesperson of approved experiment E12-06-106/E12-06-117, “Study of Color Transparency in Exclusive Vector Meson Electroproduction off Nuclei”/“Quark Propagation and Hadron Formation”.

### Publication Summary

- ◆ Co-author of 158 papers; 3 in Nature, 1 in Nature Communications, 1 in Science, and 38 in Phys. Rev. Letters. See my [full publications list](#).

### Citation Summary ([inSPIRE](#))

- ◆ *Total number of citations: 4730, average citations per paper: 29.7, with 8 cited as very well-known papers, 26 as well-known papers, 68 as known papers, 9 as unknown papers, and the  $h_{HEP}$  index: 40.*