EPS - EPSNA Virtual Summer School

August 6 - 8, 2021

American Physical Society

MasterCard Foundation Scholars Program
at McGill University

Schedule at a glance

Friday, August 6, 2021	
8:30 AM - 9:00 AM	**Welcome**, Dr. Dereje Seifu and Dr. Tesgera Bedassa
9:00 AM - 10:00 AM	**Quantum Mechanics and Quantum Materials**, Dr. Dereje Seifu
10:15 AM - 11:15 AM	**Probing Quantum Materials at the Nanoscale**, Dr. Yohannes Abate
11:30 AM - 12:30PM	**Emerging Quantum Technologies**, Dr. Tessema Guebre Xabiher
2:00 PM - 3:00 PM	**Laser Spectroscopic Techniques for Atmospheric Applications**, Dr. Solomon Bililign
3:15 PM - 4:15 PM	**Defects in Materials**, Dr. Sossina Haile

Saturday, August 7, 2021	
9:00 AM - 9:45 AM	**Development of quantum optics and information**, Dr. Tesfaye Gebremariam
9:55 PM - 10:40 AM	**Nanostructure materials**, Dr. Gashaw Beyene
10:50 AM - 11:35 PM	**Physics of charge transport in electrode materials for battery systems**, Gamachis Sakata
11:45 PM - 12:30 PM	**Artificial intelligence for physics applications**, Mesfin Diro
2:00 PM - 3:00 PM	**Tensor Calculus: Applications to special theory of relativity and relativistic electrodynamics**, Dr. Daniel Erenso
3:15 PM - 4:15 PM	**Introduction to Polymer Physics**, Dr. Mesfin Tsige

Sunday, August 8, 2021	
9:00 AM - 9:20 AM	**Research Experience for Undergraduates (REU)**, Dr. Fikadu Alema
9:20 AM - 10:30 AM	**Graduate School Application**, Zelalem Worku, Eden Aklile, Dr. Kassahun Betre
10:30 AM - 11:00 AM	**Opportunities After Graduate School**, Dr. Meron Tesfaye
11:00 AM - 12:00 PM	**Honoring Dr. Fesseha Kassahun**, Dr. Daniel Erenso
12:00 PM - 1:00 PM	**Feedback and Closing Remarks**, Dr. Tesgera Bedassa, Dr. Mulugeta Bekele, Dr. Chernet Amente, Dr. Dereje Seifu

* All hours are in Addis Ababa local time.

Participating universities

- Addis Ababa University
- Dambi Dolo University
- Adama Science and Technology University
- Arba Minch University
- Assosa University
- Bahir Dar University
- Debre Markos University
- Debre Birhan University
- Dire Dawa University
- Haramaya University
- Hawassa University
- Jimma University
- Wolkite University
- Woldia University

Registration and important links

Students are expected to register before the beginning of the first session of each day.

FILL DAILY ATTENDANCE HERE!

VSS Day 1: Friday, Aug 6, 2021

Ethiopia: 08:30 AM - 4:15 PM Addis Time (GMT+3)

North America: 01:30 AM - 8:45 AM EST

VSS Day 2: Saturday Aug 7, 2021

Ethiopia: 09:00 AM - 4:15 PM Addis Time (GMT+3)

North America: 02:00 AM - 8:45 AM EST

VSS Day 3: Sunday, Aug 8, 2021

Ethiopia: 09:00 AM - 1:00 PM Addis Time (GMT+3)

North America: 02:00 AM - 6:00 AM EST

Abstracts and Presenter Bios: VSS Full Schedule

Watch Live Stream (or recordings) : Youtube Channel

How to ask a question: Ask the Speaker OR use the Zoom chatbox

*Students and coordinators can **ask questions verbally** (speak loudly into the computer/microphone),*

*OR submit **written questions** using Slido or zoom.*

(You can also scan the QR code below or go to Slido.com and enter code: #653123)

Preface

Financial support for research in Ethiopian universities is very low. In 2011/12, for instance, research allocation of all universities accounted for 1% of their total budget. The Ethiopian government has focused on increasing access to higher education – opening on average two new universities per year over the past decade. Perhaps, the government's effort is justifiable given the fact that the higher education system in Ethiopia is still an "elite" system with 8.1% gross enrollment rate. While increasing access to education remains crucial, enhancing the quality and the research capabilities of the universities is of at most importance for sustainable economic and social development. To expedite the process, a coordinated effort is needed among students, faculties, and the diaspora community.

In 2015, only 15% of university instructors in Ethiopia had doctoral degrees. Not surprisingly, the 2015 action plan of the Ethiopian Ministry of Education identified the scarcity of personnel to conduct high-quality research in the higher education institutions as one of the major bottlenecks limiting the contribution of research to the development of the nation. In contrast, there have been reports indicating that a larger number of Ethiopian origin individuals with doctoral level of education reside outside of Ethiopia, which suggests that there is a huge potential in the Ethiopian diaspora community to contribute to the enhancement of education in Ethiopia.

The Ethiopian Physics Society in North America (EPSNA) strives to bridge this gap by creating opportunities for researchers in the diaspora community to directly interact with students and faculties in different Ethiopian universities. In 2019, EPSNA piloted its first week-long summer school at Addis Ababa Science and Technology University (AASTU). The summer school was attended by more than forty students from AASTU, Jimma University, and University of Gondar, and thirteen instructors from the US and Canada presented their research.

The virtual summer school this year will give students in Ethiopian higher education institutions a glimpse of the state-of-the-art research in their fields of studies. We hope this will motivate more students to pursue graduate schools and contribute to the advancement of research in Ethiopia. Furthermore, we hope that the VSS will create a conducive environment for collaboration among faculties, e.g., through co-advising graduate students in Ethiopia.

A short history of EPSNA

EPSNA was established officially as a section 501 (c) organization in the US as the North American Chapter of the Ethiopian Physics Society in 2008. However, Ethiopian physicists working in the US had formed an unofficial society and have been active on several projects in the preceding decade. The primary reasons that brought the community together were the desire to play a role in empowering the Ethiopian physics community in both Ethiopia and North America and also to help make physics research and education relevant to the needs of Ethiopia. Ethiopian physicists have met on the sidelines of the American Physical Society annual meeting since the 1980s, a tradition that has continued to this day. The first discussion of forming an official organization was held during the 1999 APS centennial conference in Atlanta with the leadership of Dr. Abebe Kebede and the participation of about fifteen physicists from across the USA. In the following decade, the community built a vibrant and well-known website. In addition, it held several workshops, such as the 2003 session on physics in Africa at the APS March Meeting and the 2007 space physics workshop in Addis Ababa, Ethiopia.

In 2007, the leadership board of the Ethiopian Physical Society in Ethiopia asked Dr. Solomon Bililign to reorganize and revitalize the Ethiopian Physicists Society in North America. As a result, an organizing committee led by Dr. Solomon Bililign was formed to draft bylaws and organize a meeting to formally establish the EPS-NA, leading to the organizational conference and workshop on August 2, 2008. About eighteen Ethiopian Physicists met for one day at ACP to officially approve the bylaws and conduct elections. Dr. Tessema, Guebre X (Professor of Physics, and currently a program officer at the National Science Foundation), was elected president unanimously. In the 12 years following its official founding, EPSNA has been actively promoting physics excellence through its annual EPSNA Scholarship awards for Ethiopian students, organizing meetings among EPSNA members during the annual APS conference, and advocating for recognition of prominent Ethiopian physicists. Recently, it has embarked on expanding its activities by organizing summer schools, graduate school application mentorship programs, and research experience for Ethiopian undergraduate students.

Mission of EPSNA

EPSNA is an organization that aims at promoting physics education and research among Ethiopians in Ethiopia and North America. Its missions are:

- To promote and support the education and training of Ethiopian Physics professionals by donating educational materials, field equipment, computing facilities, and other necessary resources.
- To promote and support the training of Ethiopian Physics professionals by providing scholarship, financial and mentoring assistance to Ethiopian students and educators.
- To inform Ethiopian students of career and scholarship opportunities that may exist in the physical sciences.
- To organize conferences and workshops on all aspects of physics in Ethiopia.
- To sponsor educational programs and to undertake coordinated research in Ethiopia.
- To provide a networking platform for Ethiopian physics professionals.
- To act as a liaison between members of this organization and other physical science organizations.
- To create or facilitate collaboration among universities in Ethiopia and North America.
- To organize and teach short courses in Ethiopia.

Current projects

In addition to the virtual summer school, EPSNA is currently working on two other projects; namely, Research Experience for Undergraduate (REU) students and mentorship for graduate school applications.

The main objective of the REU project is to give prominent undergraduate students the opportunity to engage in research activities in their field of studies. It allows professors in Ethiopian universities to solicit and recruit talented undergraduate students to assist them in their laboratories or computational facilities. EPSNA compensates the students for their work. Starting July 2021, seven students and five professors from Addis Ababa University, Bahir Dar University, Haramaya University, and Jimma University are engaged in the REU project.

The mentorship for graduate school application is designed to break the financial and information barriers that prevent academically gifted Ethiopian undergraduate students from successfully applying to graduate schools. EPSNA will provide guidance on preparation of the graduate school application materials and financial support to take standardized exams.

All members of EPSNA and the diaspora community are welcome to participate in these projects. Please feel free to contact the EPSNA executive committee members (or send an email at epsna-execs@googlegroups.com) to discuss potential contributions.

Message from the president of EPSNA

Welcome to the 2021 Virtual Summer School, the second summer school yet the first in a virtual mode delivered by EPSNA in partnership with EPS. EPSNA is an organization with the mission to advance physics education and research in Ethiopia and the North American diaspora. EPSNA uses vehicles, including summer schools, virtual summer schools, awarding high achieving physics students at the EPS annual meeting with cash prizes, mentoring students, and supporting a research experience program for undergraduate students to advance its mission. EPSNA needs help, and we would like many more active members; please participate and run for the EC office in 2022. The past two years have brought several challenges to our world, one being the COVID-19 pandemic, and science has proved once again how it came to the rescue by quickly inventing vaccines. It is my sincere hope that the VSS will increase students' interest in science and discovery to become one of the scientists to help the public and even rescue the world.

Dr. Dereje Seifu

EPSNA executive committee members

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Message from the president of EPS

Dear participants of the school, organizers of EPSNA-EPS Virtual Summer School 2021, welcome to the school.

One of the objectives of the Ethiopian Physical Society (EPS) is to motivate young Ethiopians towards the basics of physics, science and technology. Ethiopian Physical Society in North America (EPSNA) has been contributing to the goal of EPS through its support of selected talented Ethiopian physics students every year through the EPSNA Award.

EPSNA and EPS are collaborating in accomplishing the goal of the Society in various forms. Dr. Dereje Seifu, the president of EPSNA, initiated the idea of organizing summer school together. The collaboration between the two sister societies in organizing this year's school is significant. The school itself is significant to the young Ethiopian physics students. Due to COVID-19 pandemic it was difficult to get a common academic calendar among Ethiopian universities. Thus the students are busy during the 2021 Ethiopian summer session to compensate for the 2020/21 academic year programs. We hope such kind of collaboration will continue.

EPS thanks EPSNA for initiating the idea of conducting the summer school, raising the necessary funds and also for the continued support to selected students every year through the EPS-NA Award. The award creates healthy competition and has the ability to make students concentrate on their education.

Although the present political instability in parts of the country has limited the participation of students from some universities, EPS members in Ethiopia did their best for the implementation of this year's school via physics departments in public universities. EPS wants to thank coordinators at Addis Ababa, Adama Science and Technology, Arba Minch, Bahir Dar, Dambi Dolo, Debre Berhan, Debre Markos, Dire Dawa, Hawassa, Hamaya, Jimma, Walaita, Woldia and Wolkite Universities, who selected participants and organized the logistics for the virtual school at their centers.

I hope student participants of the school from the fourteen universities will get great experience from lectures given by presenters from North America. This year presenters from Ethiopian universities are also involved in giving lectures on the school. The lectures given on topics of various fields of physics and its applications in real life will help our students in their future career. I thank all the presenters for their time and interest to serve the Society.

Also, I thank EPS executive committee members for their support in organizing the school. I had consultations with Dr. Mulugeta Bekele and Dr. Chernet Amente and got valuable advice. Dr. Belayneh Mesfin and Dr. Lemi Demeyu were always available whenever needed for consultations.

I hope that you all enjoy the school lectures during the next three days and wish you all have a nice time. Thank you all!

Dr. Tesgera Bedassa

Abstracts

Quantum Mechanics & Quantum Materials

Dr. Dereje Seifu
Professor of Physics
Morgan State University, USA

In this presentation, an introduction to quantum mechanics for undergraduate students will be presented. [1] Interesting phenomenons in quantum mechanics, including dual nature, quantum tunneling, and spin-orbit interaction, will lead to our discussions of quantum materials and their applications, citing recent research at the nanoscience and nanotechnology laboratory Seifu Research Group (SRG). [2-6] This includes multilayered thin films to tunneling magneto-resistance (TMR) materials in the form of nanowires synthesized by filling vertical standing and substrate supported nanotubes and also by constructing nano-columns through glancing angle deposition. TMR materials with a high enough magneto-resistance (MR) ratio at room temperature can be used for several applications that include sensors, logic gates, and MRAM for quantum computers. TMR in nanowires / nano-columns form is applicable for components in NEMS (nano-electromechanical systems). [2] Lower dimensional systems with enhanced magnetic properties via ferromagnetic proximity induced ferromagnetism in a carbonaceous matter to develop nano-sensors. [3-6]

1) Quantum Mechanics in Amharic, (BB 2020), ISBN 978-1-09833-125-2 (**D. Seifu**)
2) "Nanowires of Fe/MgO/Fe Encapsulated in Carbon Nanotubes," **D. Seifu***, Nanowires, IntechOpen, 2018.
3) "Magnetostrictive particulates of $Tb_{0.3}Dy_{0.7}Fe_2$ integrated into carbon fiber reinforced polymer for structural damage monitoring," **D. Seifu***, A.J. Hall, D. Elbert, P. McGuiggan, O.J. Myers, R.C. Budhani, AIP Advances, 10, 075204, 2020.
4) "Cobalt ferrite nanoparticle intercalated carbon nanotubes for a nanomagnetic ultrasensitive sensor of Cr-VI in water," T. Mekuria, S. Khalid, K. Krycka, M. Bleuel, H. Verma, H. Hong, S.P. Karna, **D. Seifu***, AIP Advances, 10, 065134, 2020.
5) "Proximity effect tuned magnetic properties in composites of carbon nanotubes and nanoparticles of $CoFe_2O_4$," H. Verma, T. Mekuria, P. Seck, H. Hong, S. Karna, **D. Seifu***, Journal of Magnetism and Magnetic Materials, 2020.
6) "Multilayered graphene acquires ferromagnetism in proximity with magnetite particles," **D. Seifu***, S. Neupane, L. Giri, S.P. Karna, H. Hong, M. Seehra, Applied Physics Letters, 106, 2015.

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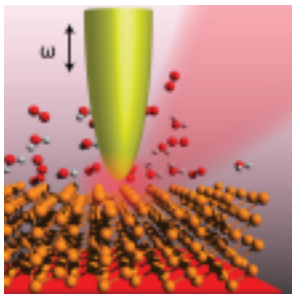
Probing Quantum Materials at the Nanoscale

Dr. Yohannes Abate
Professor of Physics
University of Georgia, USA



Interactions at the nanometer length scale in hard and soft condensed matter give rise to intriguing phases in correlated electron materials, lead to the design of exotic metamaterials, and offer enormous opportunities for the development of novel optoelectronic devices. In this talk, I will give representative examples of high-resolution probing of fundamental nanoscale physical phenomena and interactions in quantum materials at infrared (IR), terahertz (THz), and optical frequencies. At mid IR frequencies, we probe the local interaction of a heterostructure of isotopically enriched hexagonal boron nitride (hBN) in direct contact with the phase-change material (PCM) single-crystal vanadium dioxide (VO_2) and demonstrate a reconfigurable hyperbolic metasurface. Local metallic and dielectric domains in VO_2 provide spatially localized changes in the local dielectric environment, enabling launching, reflection, and transmission of hyperbolic phonon polaritons (HPhPs) at the PCM domain boundaries, and tuning the wavelength of HPhPs propagating in hBN. At THz frequencies, in the truly THz frequency range 13 cm^{-1} - 60 cm^{-1} we probe and quantify local charge carriers in correlated and complex oxides and heterogeneously doped semiconductors. We demonstrate a novel nanoscale THz hyperspectral imaging technique combined with a Drude model for measuring—noninvasively and without the need for Ohmic contacts—the local mobile carrier concentration of complex and correlated electron matter. In the visible spectral region we investigated 2D in-plane MoS2-WS2 heterostructures that exhibit nanoscale alloyed interfaces and map exotic interface effects during photo-degradation using a novel combination of hyperspectral tip-enhanced photoluminescence, Raman and near-field nanoscopy. Coupled with surface and interface strain, 2D alloy regions create localized potential wells that concentrate excitonic species via a charge carrier funneling effect.

Laser Spectroscopic Techniques for Atmospheric Applications

Dr. Solomon Bililign
Professor of Physics
North Carolina A&T State University, USA

This introductory lecture will cover many of the optical spectroscopic techniques, which have found applications far beyond the discipline of Physics. The lecture will mainly focus on classical and quantum-mechanical descriptions of the interaction of light with matter, major spectroscopic instrumentation for atmospheric applications, the fundamental principles of laser action, and some specific techniques of laser spectroscopy. In all applications, light must interact with matter of whatever origin. Thus, the major objectives will be understanding of light–matter interactions; the basic principles for different spectroscopic techniques; the kind of system information one can obtain from such methods. It is the objective of this class to provide the student with an in-depth knowledge of these topics so that spectroscopic methods can be successfully applied to the student's research projects.

Defects in Materials

Dr. Sossina Haile
Professor of Material Science and Engineering
Northwestern University, USA

Point defects control the charge, mass and even energy transport properties of a wide range of materials. Hence, extensive research activities to understand and exploit such defects are ongoing across the globe. Here we provide an overview of the materials physics and chemistry appropriate for describing defect formation in ionic and electronic materials. The description unifies traditional approaches used for studying and manipulating ion transport in wide band gap materials and electron transport in semi-conductors. Features of the surface defect chemistry are also discussed.

Development of quantum optics and information

Dr. Tesfaye Gebremariam
Assistant Professor
Arba Minch University, Ethiopia

In this EPSNA Virtual Summer School, I will present on devolvement of quantum optics and quantum information. Specifically, I would like to present on the second quantum revolution which shape the 21st century as much as the first quantum revolution shaped the 20th century. It provides unique orientation in today's latest progress on the interpretation of quantum physics and its further technological potential. Most recently, I will present on the area of quantum optics and quantum information application, i.e., quantum optomechanical system which is an emerging area of research, and it has attracted significant attention on the past years for allowing the test of quantum physics with massive objects and for their potential use in quantum information processing. Finally, I will also discuss on the application of hybrid optical micro cavity from experimental point of view including optomechanical force-sensing, continuous-variable entanglements, and macro-to-micro entanglement have almost exclusively operated in the regime where the light field oscillates at microwave frequencies. Finally, I will conclude and recommend the future research direction of quantum photonics for quantum information possess.

Nanostructure materials

Dr. Gashaw Beyene
Assistant Professor
Adama Science and Technology University, Ethiopia

Nowadays, low-dimensional nanostructured materials have attracted special interest due to their novel properties and potential applications in photo-catalysis, solar energy harvesting, electronics, biological and medical, cosmetics, and photonic devices. These novel properties and applications are highly dependent on morphology, size, constituents, host medium. Controlling these parameters of nanostructured materials is a day to day activity of nanoscience and nanotechnology. Nanostructure materials have their own drawback for a particular application. The drawback of these material modified and tuned by using different techniques, like making core-shell, alloying, doping impurity elements, making

hetero-structure. Nanocomposite materials are made of two or more constituent nanostructure materials having significantly different optical, plasmonic, catalytic, biological, physical, and chemical properties, that, when combined, produce a material with a characteristic different from the individual components. The new nanocomposite materials have combined or/and other unique properties neither shown by the components. These new or unique properties mainly arise from the interaction between the components. Nanostructures are extremely desirable for photocatalytic applications because of their enhanced surface-to-volume and substrate–support ratios. The drawback of nanostructure materials for photocatalytic application like wide band gap, high recombination rate of photo-induced charge, chemical and physical instability, non-recyclability, are modified and tuned by the above techniques. Photocatalytic solar energy conversion is considered one of the most promising pathways to address the global energy shortage and environmental crisis. Recently, bismuth oxyhalide (BiOX (X=Cl, I, Br)) based nanocomposites are becoming more preferable for photocatalytic application due to their proper band gap, layered structure, and high efficiency for visible light radiation.

Physics of charge transport in electrode materials for battery systems

Gamachis Sakata
Ph.D. Candidate
Addis Ababa University, Ethiopia

Electrochemical energy storage has been an important enabling technology for modern electronics of all kinds and will grow in importance as more electric vehicles and grid-scale storage systems are deployed. As one of the energy storage systems, batteries convert chemical potential energy into usable electrical energy. Today's state-of-the-art battery technology in portable applications and electric vehicles is the lithium-ion battery (LIB). At its most basic, a battery has three main components: the positive electrode (cathode), the negative electrode (anode), and the electrolyte in between. By connecting the cathode and anode via an external circuit, the battery spontaneously discharges its stored energy. The electrolyte is an electronically insulating but ionically conductive medium. It transports Lithium-ions in the case of LIB between the two electrodes without short-circuiting the battery. In this talk, we first briefly discuss the working principles of LIB and the basic concepts of batteries based on intercalation reactions. Then we summarize the physics of charge transport in these electrode materials based on your high school physics and/or chemistry concepts. For instance, how the critical performance metrics—energy density, power density, safety, and stability—relate to electrode materials properties, and how these materials properties are related to fundamental chemical and physical structure relationships.

Artificial intelligence for physics applications

Mesfin Diro
Ph.D. Candidate
Addis Ababa University, Ethiopia

Artificial Intelligence (AI) is a way to make machines think and behave intelligently to process information. Information is a concept that bridges machine learning and physics that have been mutually involving for a long time with many natural connections. Machine learning is a

subfield of AI with a dynamic area of modern research and applications. The algorithms in AI are providing powerful tools for physicists to extract essential pieces of information from a large number of datasets, either from experiments or simulations. The availability of these big datasets is a hallmark of modern physical sciences, including physics, where data analysis has become a central component of diverse areas, such as experimental particle physics, observational astronomy and cosmology, condensed matter physics, biophysics, and quantum computing. Hence, this work will significantly contribute to the Ethiopian Physical Society in North America(EPSNA) VSS 2021 participants by introducing the current ideas and novel concepts in subfields of artificial intelligence methods in the context of physics applications.

Tensor Calculus: Applications to special theory of relativity and relativistic electrodynamics

Dr. Daniel Erenso
Professor of Physics
Middle Tennessee State University, USA

This course introduces the mathematical methods to Einstein's theory of general relativity with a limited application. We begin with a discussion of the mathematical background that would include the necessary tensor calculus and differential geometry tools. These tools are the background to develop the topic of special relativity and general relativity. In this one-hour class, we can cover the outline that one should cover as an instructor to introductory tensor calculus course essential for a better understanding of general relativity. It is entirely impossible to teach tensor calculus in an hour effectively that one teaches for one semester. However, we are committed to providing access to the textbook draft currently under development intended to accomplish this course objective for those who participate in this course.

Introduction to Polymer Physics

Dr. Mesfin Tsige
Professor of Physics
University of Akron, USA

Polymers are a group of materials made up of long covalently-bonded molecules, that includes rubbers and plastics. Polymers, mostly synthetic, are all around us, from everyday plastics to functional components of electronic devices. Polymer Physics, mainly incorporating statistical mechanics and spectroscopy, is a branch of physics that seeks to understand the unique properties of polymer molecules and polymeric matter. I'll approach this topic from a Materials Science viewpoint, being principally concerned with the relationship between structure and property. While no prior knowledge of polymers is required to effectively participate in this lecture, a basic knowledge of mathematics, chemistry and physics is assumed for participants of this course.

Research Experience for Undergraduates (REU)

Dr. Fikadu Alema
Senior Scientist
Agnitron Technology, USA

EPSNA recently started a new program called research experience for undergraduate students (REU) to promote research in physics for undergraduate students in Ethiopia. In this program, EPSNA collaborates with research-active professors in Ethiopia to hire undergraduate students to work in their laboratories or computational facilities during summer times. EPSNA compensates the students for their work. The program is designed to benefit both the students and the professors who employ them. In this session, I will explain REU's objectives and highlight how interested candidates may apply to the program.

Graduate School Application

Zelalem Worku (Ph.D. Candidate, University of Toronto, Canada),
Eden Aklile (Ph.D. Candidate, Northwestern University, USA), and
Dr. Kassahun Betre (Assistant Professor of Physics, San Jose State University, USA)

In this session, we will discuss some of the important steps required to successfully apply to graduate schools abroad. The difference between applications to secure admission and financial assistance will be explained. We will outline the documents required for the applications and give guidelines on how to prepare them. We also highlight steps to select the right program and university for you. We will end the session by pointing out potential scholarship opportunities and online resources.

EPSNA Graduate School Mentorship Application

Zelalem Worku
Ph.D. Candidate
University of Toronto, Canada

EPSNA will be recruiting a few STEM undergraduate students from different universities in Ethiopia for a mentorship program on graduate school applications. In this session, we will announce how students can apply for the program and the type of support that EPSNA will offer. Participants of this VSS program who meet the eligibility criteria are encouraged to apply for the mentorship program.

Honoring Dr. Fesseha Kassahun

Dr. Daniel Erenso
Professor of Physics
Middle Tennessee State University, USA

Dr. Fesseha Kassahun is professor emeritus of Physics at Addis Ababa University (AAU), Addis Ababa, Ethiopia. He was born and raised in the Northern part of Ethiopia in the ancient historical city, Axum. He joined AAU in 1980 after he received his B Sc. Degree in physics in 1980. Dr. Fesseha had received an M Sc. (1983) in physics from Addis Ababa University and a Ph.D. in theoretical physics from Warsaw University (1992). He had also attended several summer schools in quantum optics at the Abdul Salam International Center for Theoretical Physics (ASICTP), Trieste, Italy. For more than four decades, Dr. Fesseha has served in AAU teaching, research, and mentoring. EPSNA recognizes his outstanding contribution to physics in Ethiopia.

Opportunities After Graduate School

Dr. Meron Tesfaye
Senior Policy Fellow
Carbon180, USA

Paths after graduate school can look vastly different. Approximately, one-third of PhD graduates in the US stay in the academic track including postdoctoral positions that lead to academic careers. Others choose to continue to stay in basic-science research at publicly and privately-funded research at different institutions and companies. Many more PhD holders pursue a range of careers in project management, data science, journalism, consultancy, banking, pharmaceuticals, public policy, patent and intellectual law, environmental protection, epidemiology, etc. In this talk, we will review post-graduate career possibilities and discuss some of the common skills, disciplines and preparation needed to traverse any path.

Speakers

Dr. Dereje Seifu

Dereje Seifu is a professor of physics at Morgan State University in Baltimore, Maryland, USA. He received his B.Sc. in 1982 and M.Sc. in 1985 from Addis Ababa University in Ethiopia. He completed his M.Sc. in 1989 and Ph.D. in 1994 in physics at the University of Cincinnati, Ohio, USA. The title of his doctoral dissertation was "Total Energy of Cu_cAu_{1-c} alloys". He is working at Morgan State University since 1994 as a lecturer, then in 1998 as a tenure track assistant professor. He was promoted to associate professor and tenured in 2003 and was promoted to a full professor in 2013. In addition, he served as acting department chair, from 2007 to 2009 and from 2013 to 2015. He has worked at NASA AMES Laboratory in California with the nanotechnology research group during the summer of 2004 and with the nanotechnology research group at the Army Research laboratory in Aberdeen, Maryland as a guest researcher since 1995. In addition, he has worked as a summer faculty researcher at the Brookhaven National Laboratory during the summers of 2009, 2010, and 2012. He has authored 40 peer-reviewed full-length publications, 60 abstracts, one book, two book chapters, presented at 40 national and international conference presentations, and has applied for two patents. His research interest is in nanoscience and nanotechnology, in particular, in nanomagnetic. Recently his research is evolving into quantum materials. He has received research grants from the US National Science Foundation and the US Army Research Laboratory. Since 2003 he has served as a contributor of questions to the physics GRE, and since 2018 he is a committee member as one of the six physics faculty members from US universities. He is also serving the Ethiopian Physics Society in North America (EPSNA) from 2018 to 2020 as a vice president. From 2020 to the present, he is the president of the Ethiopian Physics Society.

Dr. Yohannes Abate

Yohannes Abate is the Susan Dasher and Charles Dasher MD Professor of Physics at the University of Georgia. Abate's condensed matter physics research interests include fundamental nanoscale physical phenomena and interactions in nano- and quantum- materials. His group implements various quantum-optics and nano-optics spectroscopy and imaging techniques with diffraction unlimited spatial resolution. His awards include NSF Career Award (2016), Scialog Collaborative Innovative Award, Research Corporation for Science Advancement (2015), Most Valuable Professor, California State University, Long Beach (2014), Luis Alvarez Award for Best Experimental Research (American Physical Society CA Section) (2008) and The 2000 International Publication Award (University of the Philippines, Diliman) (2000).
Professor Abate joined the University of Georgia (UGA) as an associate professor of physics in August 2017. He received BSc (physics) degree at Addis Ababa University, MS (physics) at the University of the Philippines, Diliman and PhD in Physics at the University of Iowa. From 2006-2009 he was a postdoctoral research fellow at the University of California, Berkeley and Lawrence Berkeley National Laboratory. In 2009 he was a visiting scientist at the Max-Planck-Institut für Biochemie, Martinsried, Germany. Before joining UGA faculty, he was a member of the faculty (2014-2017) at Georgia State University and (2009-2014) California State University.

Dr. Solomon Bililign

Dr. Solomon Bililign is a professor of Physics and Applied Sciences and Technology at North Carolina A&T State University, and he has been active in research and education since joining NCA&T in 1993. He did his undergraduate and MS work in Physics at Addis Ababa University, Ethiopia, PhD at the University of Iowa and a two year postdoctoral research fellowship at the University of Utah Department of Chemistry. He conducted research at several national laboratories including Los Alamos, Oak Ridge and Joint Laboratory Astrophysics (JILA). His area of specialization is in Experimental and Theoretical Atomic, Molecular and Optical Physics /and Chemical Physics. He served as the Department Chair from 2001-2006. Using NSF funds, he provided international experience to NCA&T students in South Africa, France, Botswana, and Ethiopia and continues to collaborate with East African Scientists on Air Quality research. His current research uses laser and other spectroscopic tools for atmospheric applications to measure chemical and optical properties of aerosols emitted from biomass burning and their impact on air quality and climate. Bililign received over $25 million in grants during his tenure at NCA&T the most significant is the $12 million funding to establish the NOAA Interdisciplinary Scientific Environmental Technology (NOAA-ISET) Center in 2006. He has published over 55 refereed publications and made over 180 presentations at local, national, and international conferences. In 2001 and 2017 he was named "Outstanding Senior Researcher" for NCA&T. In 2010 he is nominated as the University of Iowa College of Liberal Arts Alumni Fellow, and He is the recipient of the Presidential Award for Excellence in Science, mathematics, and Engineering mentoring in 2011. In 2012 he won the Interdisciplinary research team award for NCA&T. He was teacher of the year for his college in 2006, 2013 and 2017.

Dr. Sossina Haile

Sossina M. Haile is the Walter P. Murphy Professor of Materials Science and Engineering at Northwestern University, a position she assumed in 2015 after serving 18 years on the faculty at Caltech. Prior to that she served for three years on the faculty of the University of Washington. She earned her Ph.D. in Materials Science and Engineering from the Massachusetts Institute of Technology in 1992 and spent two years, 1991-1993, at the Max Planck Institute for Solid State Research in Stuttgart, as a Fulbright and then a Humboldt Fellow. Prof. Sossina's research broadly encompasses materials for sustainable energy technologies. Amongst her many awards, she received in 2008 an American Competitiveness and Innovation Fellowship from the U.S. National Science Foundation in recognition of "her timely and transformative research in the energy field and her dedication to inclusive mentoring, education and outreach across many levels." In 2010 she was awarded the Chemical Pioneer Award (American Institute of Chemists), in 2012 the International Ceramics Prize (World Academy of Ceramics), and in 2020 the Turnbull Lectureship of the Materials Research Society. She is a fellow of the Materials Research Society, the American Ceramics Society, the African Academy of Sciences, and the Ethiopian Academy of Sciences, and serves on the editorial boards of *Joule* and *Annual Review of Materials Research*.

Dr. Tesfaye Tesfahannes

Tesfay Gebremariam Tesfahannes (Ph.D.); He received the B.Sc. Degree in Physics, from Haramaya University, Haramaya, Ethiopia, in 2006, and the M.Sc. Degree in Physics, from Addis Ababa University, Addis Ababa, Ethiopia in 2010, and Ph.D. degrees in Theoretical Physics from the Dalian University of Technology, Dalian, China in 2018, respectively. Moreover, I published more than 19-SCI papers, and participated in more than 19-Conferences and International Workshops. In February, 2020 i was one of the top awards of the ICTP training on winter college on optics: quantum photonics and Information in recognition of his outstanding research work in the area of quantum optics and Information, and presented a poster in the ICTP, Italy. Up till now, I am serving as a community services coordinator for the college of Natural Sciences Arba Minch University, Ethiopia. Beside of my up-to-date research interests include quantum optics, quantum information, quantum cavity optomechanics. Specific topic of interest is on the new research areas such as; quantum information processors that exploit the quantum features of superposition and entanglement applications, optics and photonics with hybrid systems.

Dr. Gashaw Beyene

Dr. Gashaw Beyene Kassahun is assistant professor of physics at Adama Science and Technology University. He obtained his doctor of philosophy in March 5, 2021 by condensed matter physics from Addis Ababa university. His current area of research interest is modeling, fabrication and characterization of nanostructured materials and the nanocomposite materials for photocatalytic application.

Gamachis Sakata

Gamachis S. Gurmesa is a PhD candidate (Condensed Matter Physics) in the department of Physics at Addis Ababa University, Ethiopia. He received a Master of Science degree in Quantum Physics from Mekelle University in 2011 and the Bachelor of Science degree in Physics Education from Debre Markos University in 2009. Before joining Addis Ababa University, he has been a lecturer of Physics in Mettu University where he highered to Assistant Professor position since March, 2017. His doctoral research focuses on Computational design of Cathode materials for Alkali-ion Batteries. He has some collaborations from USA, Sweden, Italy, China, and India. The recent active research areas through this collaborations include Battery cathode materials, Photovoltaics, Optoelectronics, Photocatalysis for Water-splitting, Catalysis, Spintronics, and Pedagogy (STEM education). He gave some invited talks and/or poster presentations at national and international level:

1. (EPS 2021 (Wolkite University) and EPS 2018 (Addis Ababa University), Ethiopia,
2. Mini-workshop(for Msc and PhD students from Addis Ababa University and Addis Ababa Science and Technology University) on Electronic Structure calculations (2021, Addis Ababa University)), Ethiopia,
3. Yancheng Institute of University (zhangqf.ycit.edu.cn/tdcy.htm), China,

4. March Meeting (usafricainitiative.org/APS2021/), USA,
5. June Meeting (usafricainitiative.org/blog/_site/JuneWorkshop2021/), USA,
6. Flatiron Institute (https://www.simonsfoundation.org/international-workshop-on-recent-developments-in-electronic-structure-es21/), USA.

He has some published and under-review articles as author and co-author on the potential peer reviewed journals. He has a deep interest in working with undergraduates and post graduates in the area of STEM at national and international level from basic to applied science.

Dr. Mesfin Diro

Mesfin Diro is a PhD candidate at Addis Ababa University. His research focuses on Novel Organic Materials Discovery for Redox Flow Battery applications using Machine Learning and ab-initio methods. Before joining Addis Ababa University in 2016, Mesfin completed his masters in Computational Science at Addis Ababa University. He also holds a bachelor's degree in Physics from Mekelle University.

Dr. Daniel Erenso

Dr. Daniel Erenso is a professor of Physics at Middle Tennessee State University (MTSU), Murfreesboro, Tennessee, USA. He joined MTSU in 2003 after he received his Ph.D. in theoretical physics from the University of Arkansas. Before he came to the USA, Dr. Erenso had received a B.Sc. (1990) and M Sc. (1997) in physics from Addis Ababa University in his native country Ethiopia. He had also received Advanced Diploma in Condensed Matter Physics from Abdul Salam International Center for Theoretical Physics (ASICTP), Trieste, Italy, in 1999. For more than two decades, Dr. Erenso has served in teaching, research, and mentoring at different universities in his native and adapted counties.

Since he began his service at MTSU, Dr. Erenso has taught several introductory and upper-level physics courses. These include Algebra-based and Calculus-based introductory physics, Mathematical methods in theoretical physics, Electricity and Magnetism, Quantum Mechanics, and General relativity. For the excellence and dedication that Dr. Erenso demonstrated, he has received the MTSU, College of Basic & Applied Sciences Excellence in Teaching award in 2011. More recently, Dr. Erenso has demonstrated his dedication and hard work "by going above and beyond to serve students" during the COVID19 pandemic.

At MTSU, Dr. Erenso has also maintained an active research program with undergraduate students. He has been the research advisor for several undergraduate students. His research interest includes theoretical and experimental physics: Although by training Dr. Erenso is a theoretical physicist in quantum optics since he came to MTSU, he has extended his research to experimental biophysics and quantum optics/quantum information. Dr. Erenso has published more than 35 and presented over 60 research works at national and international venues. For his outstanding research accomplishment, Dr. Erenso received Sigma Xi the Scientific Research Society Aubrey E. Harvey Outstanding Graduate Research Award from the University of Arkansas in 2003, MTSU Foundations Special Project Award in 2005, MTSU, College of Basic & Applied Sciences Distinguished Research Award in 2016 and a nomination for APS Prize for a Faculty Member for Research in an Undergraduate Institution in 2020.

Dr. Erenso is a member of several professional societies such as the American Physical Society (APS), the Optical Society of America (OSA), Ethiopian Physical society in North America (EPSNA), and serves as an invited reviewer to several international journals. His excellence in teaching and research has also earned him the Fulbright Scholar Award in 2016.

Dr. Mesfin Tsige

Mesfin Tsige is a Professor in the Department of Polymer Science at the University of Akron, Ohio. He received the Ph.D. degree in condensed matter physics from Case Western Reserve University in Cleveland, Ohio and then went to Sandia National Laboratories at Albuquerque, New Mexico as a postdoctoral fellow. After four years of postdoctoral research, he joined the faculty in the department of Physics at Southern Illinois University at Carbondale, Illinois achieving the rank of Associate Professor before moving to the University of Akron in 2010. Tsige's group research interest is focused in the area of interfacial science. His group uses different types of simulation techniques and theory to study fundamental problems in diffusion, adhesion, wetting, self-assembly, and rheology. For details, check out his group's website: blogs.uakron.edu/mtsige/

Dr. Fikadu Alema

Fikadu Alema is a senior scientist at Agnitron Technology in Minnesota, USA. He received his Ph. D in Materials and Nanotechnology from North Dakota State University (NDSU) in 2014. His research at Agnitron focuses on the MOCVD growth, characterization, and device processing of wide bandgap epitaxial materials, including Ga2O3, III-Nitrides, MgZnO, and related alloys, for applications in high power electronics and solar blind photodetectors. He is currently one of the leading epitaxial Ga2O3 film growers with ultra-pure material qualities. Before joining Agntrion, Alema was a graduate research assistant at the Center for Nanoscale Science and Engineering at NDSU. He studied multicomponent barium strontium titanate (BST) thin films for tunable microwave applications in his Ph.D. He applied RF magnetron sputtering-based combinatorial thin film synthesis method to speed up the discovery of suitable dopants that increase the tunability but reduce the dielectric loss of the BST thin films. Alema has over 35 peer-reviewed publications, 20 conference presentations, five invited talks, and contributed two book chapters. He is a member of various professional organizations, including EPSNA, APS, MRS, and SPIE. Currently, he serves as a public relations officer in EPSNA.

Zelalem Arega Worku

Zelalem is a PhD candidate at the University of Toronto institute for Aerospace Studies (UTIAS). His research focuses on investigation and design of robust numerical methods for fluid flow problems governed by the Navier-Stokes equations. Before joining UTIAS in 2018, Zelalem completed his masters in mechanical engineering at McGill University under the MasterCard Foundation Scholars Program. He also holds a bachelor's degree in mechanical engineering from Addis Ababa University. Zelalem is currently serving as the vice president of the Ethiopian Physics Society in North America.

Eden Aklile

I was born and raised in Ethiopia and came to the US in 2002. I lived and went to school in San Diego before moving to Chicago/Evanston to pursue a Ph.D. at Northwestern in materials science and engineering. For my doctoral research I focus on 2D material synthesis, characterization, and transfer using scanning probe and related methods in addition to ultra-high vacuum systems. Outside of the lab, I enjoy discussions about global supply-chain systems in tech and African history. I am joining the ESPNA executive team as Auditor and I look forward to contributing to the team's initiatives and programming. I hope to be a resource and serve in a mentorship role for upcoming graduate, undergraduate and high school students interested in STEM. I also hope to learn from ESPNA board and general members.

Dr. Kassahun Betre

Dr. Kassahun Betre is Assistant Professor of Physics at San Jose State University. Prior to that he was faculty at Pepperdine University for three years. He completed his PhD in Theoretical High Energy Physics from Stanford University focusing on numerical and theoretical methods for detecting signatures of physics beyond the Standard Model. His current area of research interest is background independent quantum gravity. He studies ways in which General Relativity might emerge as an average property of graph-theoretic quantum systems.

Dr. Meron Tesfaye

Born and raised in Addis Ababa, Meron has a B.S. and Ph.D. in Chemical Engineering. Her dissertation research was focused on understanding material properties for clean energy application. Meron is currently working as a Senior Policy Fellow at the climate think-tank Carbon180, where she is applying her technical background to advocate for federal policies for clean climate and energy.

Advertisement

Dr. Iwnetim Abate, founder of SciFro, and Dr. Sossina Haile, Professor of Material Science at Northwestern University will be holding a webinar on applying to programs in the US on August 23, 2021.

Registration: https://northwestern.zoom.us/webinar/register/WN_8naVYPxvR2Ctsflu-bcmew

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