NOVEMBER 2019, VOL.2 ISSUE 2

EPSNA Newsletter

EPSNA Pilot Summer School

The EPSNA Pilot Summer School was held June 26 - July 2nd at Addis Ababa Science and Technology University in Kilinto. 13 instructors from US and Canada and 40 students fro AASTU and Adama University participated in the summer school. Though the original plan to hold the summer school at the University of Gonder had to be changed due to the political unrest that occured in Bahir Dar and Addis Ababa on June 21, a parallel session of lectures, discussions, and mentorship was run at the University of Gonder by Professor Mesfin Tsige.

In this issue:

— Kassahun Haileyesus Betre

Community News

- EPSNA Successfully completed its pilot summer school in Ethiopia in June, 2019.
- Ethiopia has submitted a bid to host the 2022 African School of Physics summer school. The proposal was prepared by an organizing committee composed of AAU, EPS, EPSNA, EAC, MoE, MoSHE, and various other universities in Ethiopia.
- Dr. Daniel Erenso was invited by the Vice President of Addis Ababa Science and Technology University to teach a Ph.D. course, Quantum Optics III that will run December 1 - 30. He has accepted the invitation.
- The Ethiopian Scientific and Academic Network (ESAN), headed by Dr. Abebe Kebede, is nominated as one of three finalists for "the most impactful organization among Ethiopian communities" by Your Ethiopian Professionals (YEP) network.

- Dr. Dereje Seifu received a grant on Cooperative Research and Education from the US Army Research Laboratory to study novel flexible MR materials for sensors and devices, $750,000 for three years.

- EPSNA Public Relations Officer Iwnetim Abate (PhD Candidate at Stanford University) has stepped down from his position in EPSNA on November 1, 2019. Tim cited increased workload from research, personal reasons, and involvement in other new initiatives outside EPSNA as reasons for his decision to step down. He will serve as a volunteer till the end of his term in March. Tim has served as EPSNA Public Relations Officer since March, 2015. He also led the EPSNA Pilot Summer School initiative together with Loza Tadesse. We want to thank Tim for his many years of dedication and service to the EPSNA community.

- **Publications by EPSNA Members**

    1. Manuscript co-authored by Dr. Daniel Erenso (Professor of Physics at Middle Tennessee State University) and Endris Mohamed (PhD Student at AAU) was accepted for publication in Nature/Scientific Report.
    2. Paper co-authored by Dr. Haile Ambaye (Scientific Associate at Oak Ridge National Lab), “Exploiting Symmetry Mismatch to Control Magnetism in a Ferroelastic Heterostructure" was published on PRL in May, 2019.
    3. Paper co-authored by Ephraim Bililign (PhD candidate at University of Chicago), “The odd free surface flows of a colloidal chiral fluid" was published on Nature Physics.
    4. Dr. Bekele Gurmessa (Assistant Professor at Becknell University) is the first author of a recent paper, "Counterion crossbridges enable robust multiscale elasticity in actin networks" published on Physical Review Research.
    5. Manuscript co-authored by Dr. Dereje Seifu (Professor of Physics at Morgan State University), and his former postdoc Dr. Suman Neupane (Assistant Professor at Middle Tennesse State University) is accepted for publication on Springer Nature Applied Science.

My Fulbright Experience (During and after the Award)

by BY DR. DANIEL ERENSO

I arrived in my birthplace, Addis Ababa, on August 31, 2016 filled with ambition, energy, and the hope that I would accomplish many things. My host institution was Addis Ababa University (AAU) - the university where I earned both my bachelors and masters degrees in physics. During my ten months service as a Fulbright scholar at the AAU physics department, I have done all that I could to realize my goals. I had faced some challenges along the way, and difficulties that I choose to ignore. In counterpoint to some of the negative things we wrestle in life, it is always better and constructive to focus on the good things. That is what I would like to tell you about.

Teaching: Mathematical Methods of Theoretical Physics I and II were two consecutive courses I proposed in the project statement of the Fulbright grant application. Fortunately, I had the opportunity to teach both. The other teaching activity was Physics Teacher Training: A Modern Approach to Teaching Introductory Physics. Though, this was not part the teaching component in the project statement, I would like to talk about this experience as it had a well-recognized impact, at least to one high school in Addis.

This training introduces teachers to a modern approach to introductory physics as taught in America (at least at my home institution). This modern approach is founded on an experiment with two integrated theory-based subcomponents. The first subcomponent is based on “virtual labs", and the second on “real labs". The virtual labs use freely downloadable computer simulations of the real labs from the PHET center at the University of Colorado, Boulevard. The real labs use technologically advanced lab equipment that I brought from the US. This equipment, worth $5000, was purchased with funds obtained from MTSU and other sources. Unlike in the US, introductory physics courses are offered at preparatory (senior high) schools in Ethiopia. To introduce this new modern approach, I offered a pilot training course to the physics teachers at Cruise School [Fig 1a]. More than a dozen physics teachers have successfully completed the training, receiving certificates on March 4, 2017 from Ms Li Ping Lo, the Cultural Affairs Officer at the US embassy in Addis Ababa Fig(1b)

During the training, teachers were introduced to a modern approach to teaching introductory optics, modern physics, and electronics, which fully integrated theory and experiment. In the two integrated subcomponents of the experiment, the teachers were trained to use 15 “real labs" and 18 “virtual labs". Feedback from these teachers indicated that the training made a significant difference to the teaching and learning processes in their classroom.

Research: The research that I proposed in my Fulbright grant was entirely for theoretical physics, focusing on a

Figure 1: (a) Cruise School physics teachers at the training session; (b) The teachers receiving certificates from Ms Li Ping Lu.

Figure 2: (a) AAU physics graduate students (three PhD and three MSc); (b) 2nd year physics major AAU undergraduate and 11th grade Cruise High School student (2016/2017).

study of quantum optical devices that are capable of producing quantum entangled photon pairs utilizable for quantum encryption and teleportation. Prior to my departure to Ethiopia, I was involved in experimental physics research at my home institution, where I prepared experimental data focused on biomedical optic research. Six very bright graduate students (three PhD and three MSc, Fig. 2a) began working on different biomedical optic research projects using the experimental data I brought with me. Of these, two dropped out, while the remaining four stayed on. One of the MSc student (Mr. Deresse Ahmed) successfully defended his MSc thesis on the project in question, in June 2017. The second MSc student (Mr. Bekalu Tesfaye), who was in his first year at the time, has continued working on the project and successfully defended his thesis in July 2019. PhD graduate students at AAU can apply for funding to gain research experience outside their country. While I was at AAU, the two PhD graduate students (Mr. Endris Mohamed and Mr. Mulugeta Seta) wrote proposals under my supervision and applied for this funding. These students were approved and able to carry out their PhD dissertation project in my research lab at MTSU for three months. I have been working with Mr. Endris since he returned back to Ethiopia. Mr. Endris work has been suburb. We have been able to present and publish our work at the FIO-LS 2019 OSA annual meeting. Furthermore, part of Endris's work has been submitted for publication at Nature/Scientific Report journal and has been accepted for publication. He is currently working on two more manuscripts and getting ready for his PhD thesis defense.

(a)

(b)

Figure 3: (a) Cruise School high school students setting up the Radio Java antenna; (b) Students with their physics teacher taking measurement with Radio Java antenna. The project was moved from AAU campus to Cruise school and were completed in 2018. Since then Cruise school has been using Radio Java antenna to promote Astronomy education and research in Addis.

As a Fulbright scholar, I also wanted to introduce excellence in undergraduate research within the Department of Physics at AAU. To help achieve this, I brought a Radio Java kit that is useful for educational research at undergraduate level. Two students, a very bright second year undergraduate physics major (Kidanemariam) and another very bright and very young 11th grade high school student at the time (Bisrat), began working on this project in the middle of the spring semester in 2017. I would say that Kidanemariam is an exceptional student, as he is probably one of the few who came to AAU with the purpose of studying physics, even though he could easily attend any of the medical or engineering schools in the country. The Radio Java kit provides all the parts for a radio receiver that measures radio waves emitted by the planet Jupiter and solar bursts. These two students were able to successfully build the receiver in an impressively short period of time.

Outreach: The US embassy encourages Fulbright scholars to conduct outreach activities outside of their host institution. There is small fund ($1,600) for each scholar, and individuals can apply by submitting a short proposal to the public affairs office at the Embassy. I was approved for this fund, and shared my experience through a research seminar and a teaching workshop that was made available to faculty and students at seven universities across the country. The teaching workshop introduces a modern approach to teaching introductory courses. In this workshop both physics faculty and students were given a foundation course in ways to further explore and integrate virtual labs for optics, electronics, and modern physics into their classroom. I provided free copies of the materials that would facilitate this integration. The research seminar was focused on the application of laser trapping techniques in biomedical research. The seminar introduced the ways in which a laser can be used to study the biophysical properties of micron-sized living objects, such as human red blood cells and cancer cells, via trapping and manipulation. I initially planned to visit 11 universities. However, unfortunately, after I visited Ambo, Jimma, Debre Berehan, Hawassa, Adama (Nazareth), Welkita, and Dre Dawa universities, I had to cancel my visit to the remaining four universities (Bahr Dar, Debre Tabor, Gondar, and Mekele universities). The universities I visited, especially those new institutions established in the last five to ten years (e.g. Ambo, Welkite, Debre Birhan), were very receptive.

I treasure my trips to these universities as it has opened up collaborations with faculties and students in some of these new and young universities. I have been collaborating with Mr. Shunke Kebede who is a PhD candidate and Dr. Mesfin Asfaw who is the Head of the Department of Applied Physics at Adama Science and Technology University. Mr. Shunke under the supervision of me and Dr. Mesfin, has submitted a proposal that would allow him to join the Quantum optics/Quantum information group at MTSU.

Cultural or social experiences: I had two memorable social activities: (a) A motorbike ride to the 101-year anniversary of an Ethiopian Orthodox church in the Oromia region (established by a Muslim governor of the state) (b) the “Talaku Erucha" (translation: “the big run") in Addis, which is a 10 km competition that most people do for fun. I did not break a record but I had managed to complete the 10Km race! (Fig. 5).

Figure 4: Outreach activities at universities across Ethiopia: Ambo, Debrebrahn, Hawassa, Jimma, and Adama universities

Figure 5: (a) A motorbike ride to the 101-year anniversary of an Ethiopian Orthodox church in the Oromia region (established by a Muslim governor of the state); (b) “Talaku Erucha".

EPSNA Pilot Summer School

by BY KASSAHUN BETRE

I participated in the EPSNA pilot summer school in Ethiopia in June, 2019. This is a report of my experience with the summer school.

There are many highly accomplished scientists of Ethiopian origin who live and work in the United States and Canada. These Ethiopian diaspora scientists mostly maintain strong ties with Ethiopia, and do a lot of impactful outreach every year to improve the quality of education in Ethiopia. EPSNA has a vision of rallying together the North American Physics community and friends behind a project that will combine a visit to Ethiopia with educational outreach. A short summer school would be the perfect venue to do this. We can bring together Ethiopian diaspora scientists who go there regularly with their friends and colleagues who might be interested to visit Ethiopia. If we combine such a visit with a week or two-weeks long summer school, and do it in a sustained manner, it can make an important contribution. The first test of this idea was implemented over summer, 2019. The goal was to do a sort of show and tell to test the idea and use the pilot summer school as a catalyst for similar efforts in the future. Though organized by EPSNA, we were not too strict on the topics covered; breadth, not depth, was the focus. The goal was to expose top undergraduate students all over Ethiopia to a wide array of cutting edge research, and provide them information and mentorship about the process for applying to Masters and PhD programs abroad.

The power couple of Iwnetim (Tim) Abate, PhD candidate at Stanford University in Material Science and EPSNA Public Relations Officer, together with his wife Loza Tadesse, also PhD candidate in Biophysics at Stanford University and the Secretary of EPSNA, took the lead in organizing the pilot summer school. Planning the Summer School On a previous trip to Ethiopia, Tim and Loza had toured University of Gonder (UoG), where they met with the president and other members of the leadership. During their meeting, the idea of organizing a summer school was discussed. The leadership of UoG was very supportive of the idea. So when EPSNA decided to organize the pilot summer school, a natural place to host the effort appeared to be University of Gonder where there is already strong support and commitment. Over a period of a year, Tim and Loza put together a plan for the pilot summer school. They met regularly with UoG representatives to sort out the logistics. They recruited instructors and TAs, they raised funds from private donors and institutions alike. They successfully applied for funding from APS, Stanford University and with the help of Dr. Mesfin Tsige from NSF. About 15 PhD candidates, postdocs and professors from US and Canada originally volunteered to participate in the summer school. Eventually thirteen instructors traveled to Ethiopia. Those who were able to travel were:

1. Iwnetim Abate (PhD Candidate at Stanford),
2. Loza Tadesse (PhD Candidate at Stanford),
3. Mesfin Tsige (Professor of Polymer Science at University of Akron)
4. Peter Attia (PhD from Stanford),
5. Victoria Attia (BA from ORU),
6. Philipp Muscher (PhD Candidate at Stanford),
7. Chibuaze Amachunkwu (Assistant Prof. at University of Chicago),
8. Meron Tesfaye (PhD from UC Berkeley),
9. Zelalem Worku (PhD Student at University of Toronto),
10. Tsegab Mekonnen (PhD Candidate at University of Minnesota),
11. Jelani Nelson (Professor of Electrical Engineering and Computer Science at UC Berkeley)
12. Kimmy Wu (KICP Postdoctoral Fellow at University of Chicago),
13. Kassahun Betre (Assistant Professor at Pepperdine University)

Figure 6: EPSNA Pilot Summer School instructors

Zelalem Worku, PhD student in Aeorospace Engineering at the University of Toronto was delegated to lead a nationwide recruitment of students in Ethiopia who will participate in the summer school. Several universities across Ethiopia were contacted to find recruits for the program and positive responses were received from Adama University, Bahir Dar University, Hawassa University, Addis Ababa University and Addis Ababa Science and Technology University. Including UoG students, in total, around 40 highly talented students were recruited.

University of Gonder arranged for all the facility needs of the students and the instructors. They covered the cost

of room and board and meals for all the students, as well as all meals, room, and incidentals for all the instructors who were to be hosted at a nearby international standard hotel.

Major Hurdle

There were several challenges and hurdles along the way, too many to list here. I will highlight just a few of the major challenges. One of the main challenges while the pilot summer school was still in the planning stages was finding suitable time. Final examination schedules are not standardized across all universities in Ethiopia. In fact, they are not even similar across the different departments within the same university. Early in the planning stage, the date of June 24 - July 1st were set in consultation with UoG since the students would have been done with their final examinations the week before, and because they could just stay on campus an additional week. However, a month before the summer school was to begin we learned that the final exam schedule for physics students were changed due to delays and school closures. The new schedule overlapped with the time of the summer school and as a result UoG students would not be able to attend many of the programs. Students from some of the other universities were also finding that either the program overlapped with their final exams, or they would have to attend the summer school before finishing final exams and returning. Zelalem did his best by contacting chairs and deans of universities to get special exemption to the students who are already recruited, but it was no easy task.

But the most significant challenge that almost forced the cancelation of the summer school did not happen until the day we arrived in Addis. Tim, Loza, Mesfin, myself and my wife Kimmy arrived in Addis on Saturday the 22nd of July. Our plan was to fly to Gonder on the afternoon of Sunday the 23rd to begin the summer school on Monday the 24th. However, early Sunday morning I got a call from my sister saying that she just heard on the news that there was unrest in Bahir Dar, and I should consider not flying to Gonder that afternoon until things settle down. I immediately tried to get more news from the internet, but all internet had been taken down by the government. In our failure to anticipate potential things that can go wrong, we did not exchange local phone numbers for Ethiopia among co-instructors because we assumed we will be able to use WhatsApp and email. In particular, I couldn't even call Tim and Loza to discuss what to do. None of us anticipated that there would be a total internet shutdown.

As the day progressed, news of what happened started to trickle in. We learned that among other people, the president of the Amhara regional state, Ambachew Mekonnen, Chief of the General Staff Seare Mekonnen, and his aide Major General Gizae Aberra had been killed in what was billed an attempted coup d'etat.

The only phone number I had was that of Dr. Gizachew Manahelohe, Dean of the College of Natural Science at UoG. I called him to discuss the conditions at Gonder. He told me that there was no unrest in Gonder and that they are ready to receive us and the students according to the original plan. I explained our predicament and how we are not able to communicate amongst ourselves. I asked him to give my local phone number to Tim and Loza when they call him as I figured they will call there soon. Indeed, I got a call from Tim soon afterwards. Tim and Loza had been in damage control mode all morning. They had learned that students who were enroute to Gonder from Adama were stuck in Addis Ababa because the roads were closed. Furthermore, none of the students from Bahir Dar were able to leave campus. In short, none of the students who were traveling or about to travel to Gonder were going to be able to make it.

In addition, Tim and Loza contacted the US Embassy in Addis to ask if there are any guidelines from the State Department regarding travel to Gonder. They were told in strong terms not to leave Addis that day. So the decision was made to at least not fly to Gonder that afternoon and perhaps reschedule our flights to Monday or Tuesday as the situation stabilizes. But immediately we had another significant problem; we had no way of reaching the other instructors. When we called Ethiopian Airlines, we were told that flights in and out of Addis as well as to Gonder were proceeding without interruption. That meant a serious problem since some of the instructors who booked their flights to Gonder were going to fly there by default and we have no way of reaching them by phone and telling them to wait in Addis. So, Tim and Loza decided to physically go to Bole airport in person and intercept instructors before they board their Gonder flights; and that's what they did. For instance, they had to catch Chibueze after he had already boarded the Gonder flight. They managed to get him and his carryone off the plane, but his luggage that was checked in ended up flying to Gonder by itself. Chibueze did not get his luggage back for another week. Tim and Loza were mostly successful in their interception effort. They caught everyone who was about to fly to Gonder that day. However, they weren't able to get a hold of Prof. Mesfin Tsige. We learned later the reason; he had decided to delay his flight so he was not at the airport on Sunday.

Having controlled the damage somehow for the time being, we faced a significant decision; do we proceed with the summer school or do we scrap it? Clearly anybody would understand if we had made the decision to cancel amidst this completely unforeseen catastrophe. However, I don?t think Tim and Loza seriously entertained cancelation as an option. They had worked so hard for over a year on this, and they were determined to find a way to make this work. While we are waiting for the situation to stabilize and potentially start the summer school at UoG with a few days of delay, they began working on a plan B. It would be desirable to possibly relocate the summer school to somewhere in the vicinity of Addis as that will enable students to travel and not go counter to US Embassy advice to not leave Addis for our guests. So Tim started pulling the levers and contacting all the people he knows from Addis Ababa University and

Addis Ababa Science and Technology University (AASTU) to see if it might be possible to relocate the summer school.

Figure 7: Waiting for Dr. Tarekegn Berhanu, VP for Academic Affairs at AASTU. His kind staff allowed us to wait inside his personal office.

Moving the Summer School to AASTU in 2 days

That ended up being a frantic day and half of activity, phone calls, and meetings. By the end of the day on Sunday, AASTU leadership has expressed willingness to help us relocate the summer school to their campus. They invited us to a meeting on Monday morning to discuss details.

When we met with Dr. Tarekegn Berhanu, Vise President for Academic Affairs at AASTU Monday morning, he was already aware of our situation and sympathetic to our challenges, but wanted to know more details about the program and the kinds of assistance we are needing. After our discussion we composed and submitted an official letter requesting help in hosting our summer school at AASTU that he presented to the AASTU Management Council meeting that afternoon at which a decision would be reached whether or not they will give us aid. Thankfully, they decided to help us and provide all we asked: dormitory to students, two lecture halls, and a projector. But they also wanted us to bring a letter either from the Ministry of Education or from some Ethiopian Institution showing that we are a recognized entity and not some scam. Immediately we saw how challenging it would be to get a letter from the Ministry of Education since we anticipated a long process. We explained that we are known to UoG and we had planned the whole summer school with UoG. The AASTU leadership was willing to accept a letter from UoG explaining that we are known to them, had organized the summer school with UoG, and that we need help in relocating it now due to the recent unrest.

Thankfully, UoG was willing to write us the letter. But something as simply as getting a letter was not so easy. They couldn't email the letter to us since there was no internet. Regular mail will take too long. Fax is the best way, but we couldn't find a store or shop with a fax machine. Tuesday morning, we roamed around Mebrat Hail, which is close to the Hotel where the instructors were staying, looking for a store with a fax machine. Eventually we saw a sign of a travel agency that has fax number written. We boldly went inside and begged them for help. They were gracious and told us that UoG can fax the letter to their number. We called UoG and told them the fax number of the travel agency. But just when we thought we had finally lucked out and while waiting for the fax to be transmitted, the power went out. I was close to throwing my hands in exasperation, but very fortunately, there is a generator at the building of the travel agency. The generator kicked in within five minutes, the letter got faxed, and we had all we needed. After buying some stationery for our students we immediately headed to AASTU. We gave them the letter and were told that we can begin our classes that same afternoon.

While the rest of us instructors finally relaxed and planned our lunch, Tim took off to solve yet another problem. Most of the original student participants of the summer school had no idea about the relocation. All they know is that the summer school has been indefinitely postponed. Zelalem had to personally call 25 of them on Sunday and explain the situation. So, from the original list of close to 40 students, only about 4 students from Adama and a few more from AASTU were present. The rest had either decided to cancel their participation altogether or were unable to travel to Kilinto due to road closures (those from the North). So Tim went personally from department to department at AASTU, asking the department chairs the contact information of their top 3 students, personally calling these students, and inviting them to the summer school. By the time the first session of the summer school started at 2PM, there were around 30 students.

In the meantime, on Tuesday Professor Mesfin Tsige had flown to Gonder having sensed that the situation has stabilized enough and thinking that we were all already there. Dr. Gizachew from UoG called us to tell us that Dr. Mesfin has just arrived safely. That was the first news we received of Dr. Mesfin and the relief was palpable. We told him that we had relocated the summer school to AASTU. After a short discussion, we figured the best thing to do, since he is already there, is to give parallel lectures and do all he can to have a one-instructor summer school at UoG. He went on to hold a parallel summer school at UoG with seminars, mentorship meetings, and consultation with UoG leadership about their programs. Running the Summer School at AASTU and UoG At AASTU, we began the first session with introductions and ice breaker games. Immediately, the two and a half days of frantic activities to resuscitate the summer school began to feel worth all the effort. The students were extremely bright, very polite, and full of eagerness and curiosity. The first session was given by Dr. Kimmy Wu on cosmology and her research on the Cosmic Microwave Background Radiation. Even though most of the students who attended the summer school were from AASTU, and their interests and backgrounds were in the

various Engineering fields (chemical, mechanical, electrical, etc.), they paid rapt attention to what was at times technical discussion in pure physics with little or no Engineering application. In a hot mid-afternoon in a fully packed classroom with no air conditioning, there was not a single student who was nodding off.

The level of engagement and eagerness seen at the first session was the general experience with every single lecture. Since the topics of the summer school spanned a broad range of subjects, with the exception of a few lectures on chemical engineering there were no topics that was repeated twice. So each student has at most one lecture that covered their specific area of interest. But regardless of whether the topic is in their area or not, the students were always fully engaged, curious, and paid rapt attention.

The program had lectures/presentations, hands on activities with the foldscope – a $1 foldable microscope designed at the Prakash lab at Stanford University in which Loza works. In addition, there were info sessions on graduate school application process for US and Canada, and an outing to the National Museum of Ethiopia. The lectures given were in Cosmology, Particle Physics, Chemical Engineering, Aerospace Engineering, Fuel Cells, Batteries, Material Science, Biophysics, and Computer Science. The last day of the summer school included two lectures on algorithms by Professor Jelani Nelson who at the time was transitioning from Harvard University to UC Berkeley. He flew in to Addis the day before his lecture and flew back to the US the day after. All the instructors and students were awed that he would come all the way here just to teach them for a day. His selfless action and generosity certainly made an indelible mark on all who witnessed it, especially the students.

(a) (b)

Figure 8: (a) Students showing off their successfully assembled foldscopes (b) Outing to the National Museum of Ethiopia

Reflections from the Instructors and Students

For the instructional team, this was quite an experience to say the least. To many, it was quite an unusual but highly rewarding experience. Those of us who have a more direct tie to Ethiopia were motivated to do the summer school by a desire to give back and do what we can to help students find opportunities. Zelalem Worku describes what motivated him this way: “I understand the lack of information (and misinformation) regarding graduate studies can have devastating impact in being able to convert opportunities into realities. Despite the resources available online it is still difficult to have a clear picture of what graduate studies abroad look like and how one successfully apply to a graduate program. When I was doing my undergraduate studies at Addis Ababa University, I run into the same problem. If it wasn’t to the people who guided me (including Iwnetim), I wouldn’t have been able to pursue graduate study in one of the top universities in the world. I want everyone who dream to pursue the same path to learn how to ‘do it’ early on." Those who visited Ethiopia for the first time were motivated to come from a combination of the opportunity to visit Ethiopia being part of a meaningful service, and the persuasive and convincing invitation extended to them by Tim and Loza. Peter Attia, now Senior Battery Analyst at Tesla, was busy finishing his PhD at Stanford when he was invited by Tim to join the summer school, and he eagerly accepted the invitation.

The incident that transpired the weekend of June 22nd was troubling and saddening for those of us with direct ties to Ethiopia. “It was a sad incidence to experience as an Ethiopian" said Tsegab Mekonnen. “Besides, it gave us additional work to find a new venue." Zelalem added, “To me, the coup was by far the craziest experience from the trip. It changed all our plans and this included calling more than 25 students who were preparing to go to Gonder on

Sunday morning." But to all of us, the challenge of the political crisis was not what stood out. Tsegab added, “I learnt how small moves meant a lot for others. The students’ feedback was so touching that made me consider doing this for the years ahead." In fact, a sentiment commonly shared by the instructors is put succinctly by Meron Tesfaye this way: “Being in the country and trying to make a conference happen while there is a serious political situation unfolding in the country was very unexpected. What was even more unexpected was that we were able to resume our instruction with only a short delay to schedule. This is both the challenge and opportunity of working in such a dynamic, young country i.e. there are many unexpected challenges that may arise but on the other hand if one is persistent there are many alternatives that one could take. In the US, it would have been near impossible to change venue from one part of the country to another in a matter of 24hrs but this is possible in Ethiopia."

Those who were visiting Ethiopia for the first time expressed surprise at the political incident. However, beyond that, the trip gave them a deepened sense of gratitude for the privileges we enjoy in North America, admiration for how capable the Ethiopian students are, and appreciation for the country and the culture. “I was certainly not expecting a coup on the first night we landed" said Peter Attia, but later added “The students were genuinely some of the most intelligent, motivated, and resourceful that I’ve encountered, and I’m confident many would thrive at top US grad schools if given the chance. Their technical accomplishments given limited resources were simply inspiring. From Tim and Loza’s families to the students, drivers, restaurant workers, and everyone else, I was blown away by the hospitality we received. I also enjoyed learning about Ethiopia’s rich and unique history at the National Museum and through talking with others."

At the end of the program we asked the students to fill out anonymous feedback addressing 1. What they liked the most about the program, 2. What they found the most useful, 3. What should be improved, and 4. How the program has informed or influenced their future plans and goals. Almost all students began with a polite and sincere appreciation for what we did. They expressed hope that this will be a regular and ongoing program. The two things they appreciated and enjoyed the most were the interaction with the teaching team, and the mentorship on graduate school application. ?What we liked about this experience is that you guys told us about your hardship and things you experienced so we could easily relate...? commented one student. Many of them said that the orientation on graduate school application abroad and the opportunity to receive mentorship has inspired and motivated them to seek these opportunities. Here is a comment from a students, “Really really this program has inspired and encouraged us to work hard to plan to be competitive international students. We love all your advice and encouragement. We wish to see you [again] next year. We will be waiting for you next summer."

The students also appreciated the exposure to topics outside of their majors, some even expressed an interest in pursuing graduate degrees in different fields than their major. A student commented “Wow, it was so interesting. For example, I am Industrial student, but now I have decided to study Aerospace in my future. And also my friend has decided to study Material Science in his phd."

As to what should be improved, the most consistent feedback was that the program should be longer and that the lectures should go into more depth. “It would be more helpful if the program took a longer time span for us to learn more. After the introductory lectures given, if maybe you can give a relatively detailed classes in specific fields for groups of students interested in those particular subjects?" was a comment that eloquently captured the sentiments shared by a number of students.

These two areas of improvement were also brought up in a meeting we had from representatives of the President?s office at AAU. After the conclusion of the summer school, through the introduction of Tsegab Mekonnen we had the opportunity to meet with Dr. Satishkumar Belliethathan, Director of University Industry Linkage and Technology Transfer and Innovation Hub at AAU. Dr. Belliethathan has served at AAU for more than a decade, speaks fluent Amharic, and has an infectious enthusiasm and optimism. The essence of our discussion boils down to the importance of making the summer school more intensive and institutional so that there will be continuity instead of it being a one-off thing.

It is indeed one thing to start something, and a whole different thing to sustain it over many years and make it part of the institution of EPSNA. There are many highly talented, accomplished, and motivated Ethiopian physicists and their friends who would like to be part of and ongoing effort like this. What will be crucially needed going forward is leadership in EPSNA, as was demonstrated by Tim and Loza, to take this effort and sustain it. The experience of this pilot summer school gives us hope that if we can run the summer school while contending with a political crisis, in more normal times it will will be less challenging and more predictable. A lot will depend on the next leadership of EPSNA and what direction they will take the organization. It is my sincere hope that the summer school will become part of our institution.

Figure 9: Group picture of instructors and students at the conclusion of the summer school.

Who-is-who Bio

The Who-is-who bio for in this newsletter features Dr Solomon Duki, reasercher at the National Institute of Health (NIH) who was also EPSNA executive member from 2011 till 2015 serving as Public Relations Officer and Auditor.

Dr. Solomon F. Duki

Dr. Solomon Duki

My name is Solomon F. Duki. I was born and raised in Addis Ababa, the sixth child of my parents, among ten siblings. I am a theoretical condensed matter physicist by training, where I got my degrees from Addis Ababa University (BSc, MSc), the Abdus Salam International Center for Theoretical Physics, Trieste, Italy (Diploma) and Case Western Reserve University, in Cleveland, Ohio (MA, PhD). Currently I am working as a researcher at the National Institute of Health (NIH) for the National Center for Biotechnology Information (NCBI).

As a child, I have always been interested in math and science. I developed a great deal of interest in physics when I was a tenth-grade student. I give credit to two people who inspired me in this endeavor. One is my older brother Endeshaw (also a physicist) and another is my then tenth-grade physics teacher, Amare Hailu. Normally the tenth-grade curriculum at the time was only on the basics of Electricity and Magnetism for the entire year. However, Amare's class included special sessions on some advanced topics that he taught in between, without any detailed math, from modern physics and special theory of relativity. These include $time - dilation$ and $length - contraction$; wave nature of particles, Compton scattering, and concepts like discrete energy (without mentioning any quantization). By the end of my thenth-grade, I knew I had already developed a passion for physics to pursue it as a career.

My first research paper was from my master's thesis at AAU, where we studied the non-equilibrium dynamics of Brownian particles in the presence of a position-dependent temperature background. This was one of the classic problems that were first suggested by Landauer (the blow-torch problem) where he argued that local dynamics matter for entropy production at the macroscopic level. In our work, we analyze the relaxation behavior of a bistable system when the background temperature profile is inhomogeneous due to the presence of a localized hot region (blowtorch) on one side of the potential barrier. Since the diffusion equation for the inhomogeneous medium is model-dependent, we considered two physical models to study the kinetics of such a system. We found the similarities and differences of the escape rates and, hence, exposed the common and distinct features of the two known physical models in determining the way the bistable system relaxes. Though my first work, this paper is being cited more, as we were the first to confirm that the blowtorch effect on the escape and equilibration rates of such a system are model-dependent.

In my graduate studies at Case Western, I first worked on strongly correlated systems mainly involved in the physics of low dimensional and low temperature effects in different systems. These include the tunneling and Fano resonance of electrons on the surface of liquid helium, generation of Hawking radiation in superfluid helium, charge fractionalization in one and two dimensional structures, Fano resonance in photonic crystals, Kondo resonance in one and two dimensional structures that have novel symmetries in their spin and orbital sectors and quantum adiabatic approximation.

To give you brief descriptions of my thesis work on the correlated system I pick two of my works; one is a problem of electrons on the surface of liquid helium in the presence of a perpendicular magnetic field. In this system, we applied a small in-plane magnetic field to study Fano resonance. Certain states that were bound to the helium surface then dissolve into the continuum turning into long-lived resonances.

As a result, microwave absorption lines acquire an asymmetric Fano line-shape that is tunable by varying the microwave polarization or the in-plane magnetic field. Electrons trapped in a formerly bound state will tunnel off the surface of helium; we show that under suitable circumstances this “radioactive decay” can show damped oscillations rather than a simple exponential decay.

Another one is a single channel one dimensional Kondo Model where the impurity spin is replaced by a $SU(n)$ spin. Using Bosonization and canonical transformation we explicitly shown that such a system has an exactly solvable point and the solvable point is universal for all values of the integer n.

In the later part of my graduate studies, I worked more on modeling and simulations of soft matter systems where we devised new techniques by which the glass transition temperature of any polymer can be predicted with minimal computational effort. To test our hypothesis, we studied several polymers using atomistic molecular dynamics simulations and the mean squared displacements of their molecules have been analyzed by our new techniques. These techniques, which utilize the convoluted-velocity autocorrelation and the curvature of the mean squared displacement, efficiently predict the glass transition temperature of the polymers from short-time simulations.

Building on what I learned in soft matter systems in my graduate school I applied for a postdoctoral position at the University of Pittsburgh to develop the model for viscoelastic nanogels, and that of synthetic cilia using Lattice Boltzmann methods. One of the biggest projects I worked on at Pittsburgh was that I developed a new model and simulated a self-healing material composed of dually crosslinked nanogels. In such materials, permanently crosslinked nanogels particles are bound together through two kinds of cross-links, namely, the stable and labile ones. Under sufficiently high stress, the strong, stable bonds undergo irreversible rupture, whereas the weak, labile bonds can reform after breakage. We demonstrate that the presence of the labile inter-particle bonds makes possible the structural rearrangements inside the deformed material. As a result, the catastrophic failure of the material is postponed, and the defects (cavities) in the strained material heal themselves when the stress is released. We developed a mathematical model used in the simulations through a bottom-up approach that utilizes finite element methods in the lattice-spring model, and it captures the viscoelastic properties of the material under various deformation regimes.

Following my postdoctoral experience, I took a two-year visiting assistant professor position at the Department of Physics $\&$ Astronomy at Rowan University in New Jersey. While teaching different undergraduate courses at Rowan, I continued to work on modeling and simulations of soft matter systems by collaborating with my colleagues at Rowan and the University of Akron.

One of the studies (with Rowan group) is in the designing of protein alloy materials for Biomedical applications. Using Lattice Spring Model, I modeled and simulated Resilin, the type of elastic proteins found in the flight and jumping systems of most insects. These proteins are perfect super rubber with an elastic efficiency of more than 95$\%$ under high-frequency motion. Incredibly, they could be stretched over 300$\%$ of their original size with a low-elastic modulus of 0.1-3 MPa. Since the network in Resilin is formed by crosslinking of tyrosine-residues as di- and trityrosine complexes we modeled them as crosslinked nanogels and predicted the correct elastic behavior of the system.

Another project I was involved while I was at Rowan is the one, I worked with my long-time mentor (since my high school days 30 years ago!) and collaborator at the University of Akron, Mesfin Tsige. The problem we worked was on the studies of the phase behavior of water at low temperature and high pressure. Motivated by an experimental finding on the density of supercooled water at high pressure we performed atomistic molecular dynamics simulations study of bulk water in the isothermal-isobaric ensemble. By cooling and heating the water cyclically (at different isobars and isothermal compression) for a range of pressure, we were able to pinpoint a strong concave down curvature observation between the temperatures 180 K and 220 K. However, below the glass transition temperature, which is around 180 K at 1GPa, the volume turns to concave upward curvature. Since there was no crystallization observed for the supercooled liquid state below 180 K, even after running the system for a very long time, our work strongly supported the existence of the long-held view of the “no-man land zone" of supercooled water.

Accepting the chance to get back to the physics of low dimensional correlated systems; in the fall of 2013 I joined the quantitative molecular biological physics group (QMBP) at NCBI/NIH as an IRTA fellow to work on quantum magnetism. At QMBP I have been working on quantum spin-chain models to understand magnetic sensing in animals. The idea that animals can detect the magnetic field has traveled a long way from being fiction to a well-established fact in the last six decades. A lot of experimental evidence has

now shown that many migratory animals, such as birds, whales, sea turtles, etc. use the detection of the earth's magnetic field to sense the direction of their migrations. Despite the clear experimental evidence, however, the biological mechanisms of magnetic sensing are poorly understood. Our theoretical work is to shed light on this mechanism through quantum magnetism.

In this regard, one of the problems we studied was to understand the robustness of the Hund's rule in a spin chain system to force higher spin moments in the low energy excitation spectrum. For example, quantum spin chains with composite spins have been used to approximate conventional chains with higher spins. This is to say, for instance, a chain with two spin $\frac{1}{2}$ per site can sometimes approximate a spin 1 chain. However, the little examination has been given as to whether this approximation, effectively assuming the first Hund rule per site, is valid and why. Our work investigated the validity of this approximation numerically by diagonalizing the Hamiltonians of spin chains with a spin 1 per site and with two spin $\frac{1}{2}$ per site. The low energy excitation spectrum for chains with two spin $\frac{1}{2}$'s per site is found to coincide with that of the corresponding conventional spin 1 chain, with one spin 1 per site. It turns out that as the system size increases, an increasingly larger block of consecutive lowest energy states with maximal spin per site is observed, robustly supporting the first Hund rule even though the exclusion principle does not apply, and the system does not possess Coulomb repulsion. As for why this approximation works, we show that this effective Hund rule emerges as a plausible consequence when applying to composite spin systems the Lieb-Mattis theorem, which was first elucidated for the ground state of ferromagnetic and antiferromagnetic spin systems. Currently, we are exploring many other features of antiferromagnetic systems using composite spin $\frac{1}{2}$ model.

At the same time, I have also been working with another long-time colleague of mine, Mesfin Taye, on the non-equilibrium noise-induced thermally activated stochastic process to study stochastic resonance and first arrival time for excitable systems. In these models, we explored the thermally activated barrier crossing rate of a Brownian particle system in the presence of time-varying signals. We explored the dependence of signal to noise ratio (SNR) as well as the power amplification (η) on model parameters. In the presence of N particles, η is considerably amplified as N steps up showing the weak periodic signal, which plays a vital role in controlling the noise-induced dynamics of the system, a model that gives a crucial step to understand the intracellular calcium dynamics in a cardiac system.

To wrap it up, I have enjoyed working on a verity of problems in soft and hard condensed matter physics, by collaborating with different colleagues (see some of them in this links of my research papers and specific chapters of books). What gets me jazzed about science and research is the joy of solving physical problems and learning new methods in the process, which is a great deal of my life. If I was not doing what I am doing now, I might have pursued a career in pure mathematics, which is my second passion.

Aside from research, I enjoy reading history books and spending more time with my family. I enjoy playing basketball with my son (and watch him as he gets better at it), watching my daughter swims at a higher level, and run my long-distance course while everyone is sleeping!

ANNOUNCEMENTS

- **Become a Member of EPSNA**

  All undergraduate students can join EPSNA for free. The yearly membership fee for graduate students is $25. However, we have scholarship available for the first seven graduate students to become members of EPSNA with the first year fee waived. Scholarship is available until it lasts. If you would like to join, please follow the link Become EPSNA member. If you are not a student please make the yearly membership fee payment of $100.

- **Consider becoming EPSNA Exec Member**

  EPSNA will hold its biennial election to select the executive committee who will serve for the next term. Nominations and the election will take place at the beginning of the new year. In the mean time, please think about nominating yourself or a colleague to serve on the executive committee.