Application Details

Manage Application: CTL/BP Junior Faculty Teaching Excellence Award - 2018

Award Cycle:	2018
Internal Submission Deadline:	Friday, February 2, 2018

Application Title:	Cohen
Application ID:	002114
Nominator's First Name:	Raheem
Nominator's Last Name:	Beyah
Nominator's Title:	Interim Steve W. Chaddick School Chair and Motorola Foundation Professor
Nominator's Primary Organization:	College of Engineering, School of Electrical and Computer Engineering
Nominator's Email Address:	rbeyah@ece.gatech.edu
Nominator's Phone Number:	404-894-4468
Nominee's First Name:	Morris
Nominee's Last Name:	Cohen
Nominee's Title:	Assistant Professor
Primary Organization(s):	ECE - Electrical and Computer Engineering
Nominee's Email Address:	morris.cohen@ece.gatech.edu

January 25, 2018

Center for Teaching and Learning and BP America

Dear Chair and Members of the CTL Institutional Awards Committee,

On behalf of the School of Electrical and Computer Engineering, I am pleased to nominate **Professor Morris Cohen** for the **CTL/BP Junior Faculty Teaching Excellence Award**. Professor Cohen is an Assistant Professor in the School of Electrical and Computer Engineering (ECE) at Georgia Tech. He received his B.S. and Ph.D. degrees in Electrical Engineering from Stanford University in 2003 and 2010, respectively, and served as a research scientist until August 2013. From September 2012 until August 2013, Dr. Cohen was appointed as AAAS Science and Technology Policy Fellow at the National Science Foundation. In Fall 2013, Dr. Cohen joined the faculty in the School of ECE at Georgia Tech. He is a recipient of the NSF CAREER Award in 2017, the ONR Young Investigator Award in 2015, and was chosen for the Santimay Basu Prize in 2014, an award given once every 3 years to an under-35 scientist by the International Union of Radio Science (URSI).

Dr. Cohen has committed himself to excellence in teaching with a dedication that has profoundly influenced students both at Georgia Tech and in outreach to K-12 students. He has introduced innovative methods of interaction in a flipped classroom setting in the core required Electromagnetics course (ECE3025) for Electrical Engineering majors. Most notably, he has developed and refined the use of challenging "think-pair-share" questions to allow students to work on difficult problems, first independently, and then in small discussion groups to solve the problems collaboratively. Dr. Cohen has received an average 4.2 CIOS Teaching Effectiveness score over the four times he has taught this class. This is remarkable, given that this undergraduate course is a large-enrollment required course for EE majors, redesigned in the flipped/blended format, which requires an adjustment on the part of students (and instructors) to the new learning style.

Dr. Cohen has shared his flipped classroom techniques with colleagues and graduate students by recording a video on team-based flipped classroom learning and by running a teaching practicum for ECE graduate students. His innovations reach beyond Georgia Tech. For example, he has presented a conference talk (with Prof. Alenka Zajic) on flipped classroom techniques in electromagnetic education at the IEEE AP-S Symposium and URSI North American Radio Science Meeting in 2015.

Dr. Cohen has caught the imagination and interest of countless students (not only at the undergraduate and graduate levels but also K-12) by integrating his research and teaching in an intriguing Vertically Integrated Projects (VIP) team project that includes educational outreach to the public. His "Lightning from the Edge of Space" VIP team studies the effect

of lightning and solar flares on the ionosphere, which is the electrically charged region of the upper atmosphere that forms a border between earth and space. This research is important in understanding how low frequency radio waves (e.g., from lightning) travel long distances around the earth by reflecting off of the ionosphere and how they affect aviation/undersea communication and GPS navigation signals. Dr. Cohen's team has launched high-altitude balloons to collect sensor data, including a special launch during the August 2017 solar eclipse, in which they involved children at a summer camp, called Ramah Darom in North Georgia. The eclipse provided a unique opportunity to model atmospheric effects because of its predictable path and timing for causing a temporary "patch disturbance" in the ionosphere similar to what is seen during a lightning strike. This also provided Dr. Cohen with an opportunity to share his research with the public and answer questions from curious young citizen scientists. The *Atlanta Journal and Constitution* featured this event in a full length article "Why the eclipse was a good time for science" on Wed. 23 August 2017.

At Georgia Tech, Dr. Cohen has also reformulated the senior-level undergraduate course ECE4390 (Radar Systems) in which students work in 2-3 person teams to research radar topics of interest. On his own, he developed a new graduate course "Radio Wave Propagation in the Earth and Space" (ECE8832) which also gives students the opportunity to work in small teams on projects. Dr. Cohen has taught each of these once so far, with CIOS teaching effectiveness scores of 4.9 and 4.7, respectively.

The attached letters from Dr. Cohen's students and colleagues show the enormous impact Dr. Cohen as already had both in the classroom and beyond. The letters are from the following.

- Taylor Eyre took Dr. Cohen's ECE3025 and graduated with a BS in EE in 2016.
- Manuel (Kimo) Ocanas was in Dr. Cohen's VIP team for 3 years and graduated last May.
- Martin (Sebastian) Fernandez is currently an undergraduate who took Dr. Cohen's ECE3025 flipped classroom last semester.
- Lee Thompson took Dr. Cohen's ECE3025, then went on to join his research group as a graduate research assistant. He just completed his MS thesis and will be graduating soon.
- Jesse Khan took two of Dr. Cohen's upper level courses, graduated with his BS degree and will finish his MS this Spring. He interned for SpaceX last semester.
- Professor Bonnie Ferri, Vice Provost for Graduate Education and Faculty Development, who has observed Dr. Cohen's work in the flipped classroom for ECE3025 and who performed an assessment on the course, in her previous role as Associate Chair in the School of ECE for Undergraduate Affairs. She invited Dr. Cohen to give a teaching practicum on these techniques to ECE graduate students last year.

I'd like to highlight a comment from one of these letters, from Taylor Eyre, who writes:

> *Not only does Dr. Cohen maintain a positive and equitable learning environment, but he puts forward the effort to truly involve people in course concepts and content. Empowering people with the knowledge of how to approach, comprehend, and manipulate new information is far more valuable than simply sharing information… Dr. Cohen exemplifies not only the values of the Georgia Tech community with his passion for progress and service, but also the goal of higher education itself through his refreshing approachability and transparency, both personally - and as a leader, mentor, community member, teacher, and colleague.*

I whole-heartedly agree. I believe that Professor Cohen is deserving of recognition for his pioneering approach to electromagnetic education, which makes challenging electrical engineering courses accessible to students by appealing to their broad range of learning styles. He integrates his research exploration into teaching activities for students at all educational levels, even demonstrating esoteric atmospheric radio wave concepts to elementary and middle school citizen scientists. Dr. Cohen has a passion for sharing the joy of discovering and understanding electromagnetic phenomena in our environment with students of all ages. He possesses enormous enthusiasm for his work and exudes an irrepressible joy in the discovery process that is hard to resist. He is an intelligent yet accessible and down-to-earth ambassador for the science and engineering community. I am very pleased to nominate him for this award.

Sincerely yours,

Raheem A. Beyah

Raheem A. Beyah
Interim Steve W. Chaddick School Chair and Motorola Foundation Professor
(Letter prepared by Professor L. Wills, ECE Faculty Honors Committee)

Reflective Teaching Statement

Morris Cohen, Assistant Professor, Electrical and Computer Engineering
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1. Background

When I was a student, I never felt completely comfortable with typical classes. My GPA in courses within my major was 3.0 - fairly low for a PhD applicant, but I was accepted mostly on the strength of the research I had done as an undergraduate.

I worked hard but generally had trouble focusing for a full lecture period. I often felt I understood the material but did poorly on certain types of exams, particularly the ones that are time pressured. I almost never attended a professor's office hours.

The bright spot for me, though, was always homework. Through many late nights, I would do most of my learning while solving homework problems, and often checked answers in a group with a few friends which made it both more effective and fun. It was not uncommon for me to skip the majority of an instructor's lectures, but I still did fine in the class because of homeworks.

I know many other students had this kind of experience, but very few went to graduate school, and by extension, into an academic career. As I approached teaching, I searched for a way to create the classroom environment that I might have thrived in myself, and in this way reach some of those struggling students.

Here are the problems that I am trying to solve based on my own memories of being a student:

- Lectures are a passive experience for the student, and let's face it, only some professors are good lecturers.
- Students do not all utilize office hours; many feel that professors are not approachable.
- Students focus on problem solving "tricks" that are not helpful beyond the course at hand.
- There is too much focus on memorization and time-pressured questions, neither of which replicate what students will face in a technical career.
- Students skip lectures, fall behind, and then make up for it by cramming before tests.
- Skills such as communication, leadership, self-awareness, confidence, are not covered well.

Below I describe my efforts to address these problems through my teaching. First, I describe a flipped classroom approach I've helped pioneer within ECE at Georgia Tech. I then describe an undergraduate research team I lead under the Vertically Integrated Projects program, called "Lightning from the Edge of Space."

2. The Flipped Classroom

When I first heard the idea of a flipped classroom – to move lectures out of class time and replace them with interactive activities – it really resonated with me. I resolved to try it in the very first course I taught at Georgia Tech: "Electromagnetics" (ECE3025). This is a required class for electrical engineering majors, but has a very mixed reputation due to the mathematical rigor.

There are many ways to flip a classroom, so let me describe the key elements of mine. Online lecture videos and readings are assigned in weekly batches. Students take a short (7-minute) reading quiz to ensure they have done them.

Class time consists of a series of challenging think-pair-share questions (TPS). The process is:

1. Students have 2 minutes to think and then answer via a clicker.
2. I view the results privately. I aim for ~2/3 of the class to get it *wrong*.
3. I ask the students to discuss the question in groups of 4, and try to reach a consensus. Groups are assigned randomly, kept for 3-4 weeks to build a rapport, then re-drawn.
4. After 5-10 minutes, students submit answers again, at which point I reveal the distribution of results and then explain the answer.

My TPS questions are usually very challenging conceptually but require only simple calculating. I previously noticed that too many students were skilled at very complicated mathematical problems, but paradoxically failed to answer much simpler conceptual questions. I aim to shift focus to concepts, as they are more extendable beyond the course and into other disciplines, whereas the problem-solving tricks are only useful in that course.

My goal of 2/3 of the class getting it wrong initially sounds harsh, but without that strategy, the group discussion is boring. If most get it right, no one learns anything. This type of question is usually not found in textbooks, so I have spent a lot of time making them up myself. Amazingly, even if most get it wrong on their own, in groups they usually converge on the right answer. And asking a question that most get wrong means I am asking tougher questions.

The advantage to the "two-stage" process is that students emotionally invest in an answer on their own, which makes the group discussion very lively. Students get grade credit for answering, and additional credit for answering correctly, so there is incentive to participate and get it right.

During the TPS discussion, myself and a TA roam around the room, listen into the discussions, and poke in. This more intimate way of approaching the students seems to elicit many "I just don't get it" type questions that would not have been asked in a lecture.

I have noticed that my flipped classroom draws many more people to my office hours than when I have taught a class in a lecture style. I interpret this to mean that students feel more comfortable approaching me as a result of the course style, and particularly the TPS discussions when I can talk to them more individually.

To make sure that time commitment is the same for the flipped version as for a traditional lecture model, homeworks are reduced in half. Additionally, selected homeworks are solved twice, once on their own, then students spend some class time re-solving certain problems in groups.

Midterms are also done in two stages, with 40 minutes for students to work on their own, then the same problems are re-solved by the groups.

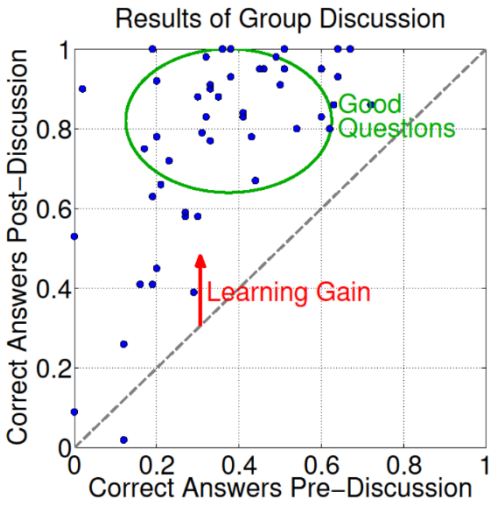
I'll add that the class is not curved: The thresholds for A/B/C/D are declared on the syllabus, so students do not feel like the need to compete, and know where they stand at any time.

a. <u>Assessment of the Flipped Classroom</u>

I have now taught ECE3025 (Electromagnetics) as a flipped classroom four times. I have observed the following.

- Attendance in class is >95% on average. Of the remaining 5%, most are for excused absences, and the student will notify me beforehand to make separate arrangements.

- One of the neat things I get from the TPS questions is data about how well each TPS question is working. This helps me adapt the class from one semester to the next and improve the questions I use. In the figure to the right, I plot the results of each two-stage TPS question (this is from the second time I offered 3025). The horizontal axis is the fraction that got the question right on the first try, and the vertical axis the fraction that got it right after the group discussion. Anything above the gray dashed line is good, in that it means an improvement. I aim for questions in the green circle, meaning the majority get it wrong initially, but after discussion, most get it right. And I must admit, it's really fun as an instructor to see that happening in real time as I roam around the room.



- Having screened questions by this point and armed with past data, I can also assess whether students are struggling with a certain concept, and if they are, I can ask an additional question on that topic, or post a handout later to clarify. If students seem to "get it," then we move on.

- In Spring 2014, an assessment was conducted by Bonnie Ferri and Jill Auerbach in ECE, in which a focus group was conducted in class with the instructors not present. The assessment found generally very positive thought son the course structure, though it did identify some issues that needed to be addressed, which were subsequently fixed.

- As my flipped classroom focuses on concepts, I had some concern that students were falling short on numerical problem-solving ability. To quantify that students, I came up with a final exam that was half conceptual (multiple choice) and half numerical (midterm-like questions). I gave this same final exam to a colleague (Andy Peterson) teaching ECE3025 in a lecture format. The results were very similar between the two classes, so no evidence that students in the flipped classroom were failing to learn numerical problem-solving skills.

b. Broader Impacts of the Flipped Classroom

In addition to student impacts, I have tried to help colleagues both at Georgia Tech and externally in my field who may be interested in trying a similar approach. Flipped classrooms have a lot of buzz but it is difficult to find good suggestions about how to implement them.

- I have recorded a video discussing our approach to team-based learning, which is now available on ECEs website (the link is here: https://www.ece.gatech.edu/faculty-teaching-and-learning-resource-page)
- I have, on two occasions, run a session on team-based learning as part of ECEs teaching practicum, a semester-long course for graduate students who are interested in teaching methods and possibly teaching careers.
- I have submitted and prepared a conference talk at an IEEE conference on the topic of flipped classrooms for electromagnetics course:
    - Cohen M. B., A. Zajic (2015), Revitalizing Electromagnetics Education with the Flipped Classroom, Oral presentation at 2015 IEEE AP-S Symposium and URSI North American Radio Science Meeting; Vancouver, Canada; Abstract WE-AS.1P.6, 19-25 July

3. VIP Team on High Altitude Balloons

The Vertically Integrated Projects (VIP) program is a campus-wide effort to integrate teaching with research with large student-led design teams led by faculty mentors/coaches. VIP teams can last for years as students cycle on and off, and veteran student mentor newer students.

My team, called "Lightning from the Edge of Space" has existed 3.5 years and focuses on building high-altitude balloons as a scientific payload for lightning, thunderstorms and other upper atmospheric phenomena. The teaching experience is very fulfilling as it better mimics the self-driven and team-based experience that real engineers face. Here are some highlights:

- The students have had four successful launches and retrievals.
- The team did a special balloon launch before the recent August 2017 solar eclipse, at a summer camp where hundreds of people across all ages were in attendance many watching the launch. The video can be found on YouTube.
- The eclipse launch had an entire article published by the Atlanta Journal Constitution

- The VIP team was a critical component of a recently funded NSF CAREER proposal.
- Former students of have cited their VIP experience as a significant part of marketing themselves to potential employers and landing a job.
- The interdisciplinary team included students from ECE, ME, AE, Physics, and CS

I count my VIP experience as very fulfilling and fits in with my teaching goal of teaching both the technical and intangible skills that will be needed in any future career.

Teaching Excellence and Impact on Student Learning

1. Student Feedback of the Flipped Classroom

ECE3025: Electromagnetics

- Average CIOS Teaching Effectiveness scores (from the four times I taught the course): 4.2
- Here are some selected CIOS comments from the flipped classroom:
    - Fall 2017
        - The best aspect was sitting in groups all semester which facilitated talking to peers…I think this really modeled industry work.
        - Very enjoyable course since many concepts that were handwaved in previous engineering and physics classes were finally explained and derived.
        - I think the format helped me to learn conceptual ideas better.
        - You could tell the instructor deeply cares about whether or not students learn the material
        - I loved that the exams and clicker questions had group components.
    - Fall 2015
        - The structure of the class was different from any course I've taken here and I liked it a lot
        - The class was stress free in terms of failing the class or not. If you applied yourself, even a below average (like myself) can do well.
        - Dr. Cohen is one of the most personable and respectful instructors I've ever have. He makes emag doable and a huge reason I made it through this coarse. He has great ideas for teaching.
        - This is probably the best professor I have had. He cares about teaching and it really shows. I think his enthusiasm for making the material accessible for all types is his greatest strength
    - Fall 2014
        - The greatest strength is the layout of did course and how it taught such the group work make student learned the material very well, especially the students were able to learn from other students, as well
        - The way Dr. Cohen is teaching it is very creative and effective. I love it.

        - Instructor greatest strength… Leading the discussion in the right direction to get the answer without giving away the answer. Will spend a lot of time in office hour if you need help.
        - The enthusiasm is contagious when everyone is on par and comfortable with the class.
    - Spring 2014
        - He seemed very interested in the topics and made analogies and used other methods to make hard to grasp ideas more understandable
        - The course style really made me learn a lot every time I attended class. I really didn't need to cram or study a lot before tests because I had already learned the material.
        - Was very good example of how class time can be better used than just lectures. Teacher's greatly emphasized the importance learning over grades which was helpful in the focus on material
        - Was able to present information on a subject that I cared nothing about in a way that made it interesting to me.

2. <u>Upper Level and Graduate Course</u>

I have taught two senior and graduate level courses in electromagnetic waves

ECE4390: Radar Systems (a pre-existing course that I significantly reformulated)

- CIOS Teaching Effectiveness Score: 4.9
- Highlights of student comments:
    - One of the few classes I went to not because I needed the notes for the test or to get a grade, but because of how much I'd learn each lecture
    - He was very enthusiastic which helped promote interest in the subject
- Students undertake a project in teams of 2-3 to research any radar they find interesting

ECE8832: Radio Wave Propagation in the Earth and Space (a new course I developed)

- CIOS Teaching Effectiveness Score: 4.7
- Highlights of student comments:
    - The course was incredibly interesting, I'd rank it as my favorite course at Tech
    - This course and Dr. Cohen's teaching have actually shifted my career search into attempting to go into this area of electromagnetics
- Projects that include both a written and oral component are pursued in teams of 2-3

Taylor Eyre
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January 8th, 2018

Dear Center for Teaching and Learning and BP America award selection committee:

It is my pleasure to offer my full support for the nomination of Dr. Morris B. Cohen for the 2018 Junior Faculty Teaching Excellence Award. I obtained my B.S. in Electrical Engineering from the Georgia Institute of Technology in 2016, and am currently an Engineering Innovation Specialist and Autonomous Vehicle Validation Engineer for General Motors, as well as a part time Instructor for Kaplan Test Prep.

My personal experience with Dr. Cohen began in 2015, in his ECE3025 – Electromagnetics class. Dr. Cohen's novel flipped classroom environment and his innovative approach to sharing information with students, rather than merely presenting information to the room has proven to be one of the most positive classroom experiences I have had.

Not only does Dr. Cohen maintain a positive and equitable learning environment, but he puts forward the effort to truly involve people in course concepts and content. Empowering people with the knowledge of how to approach, comprehend, and manipulate new information is far more valuable than simply sharing information – as so many other, more traditional classroom experiences have shown me.

Dr. Cohen has a true passion for the pursuit of knowledge, which shows in his interactions with students both inside the classroom and out. I had the chance to meet with Dr. Cohen numerous times, when I wanted to explore concepts more in-depth and while in need of help or guidance. He was always eager to help, and to work alongside me in order to help me grasp the concepts fully rather than simply point out what is correct and what is not.

As a result, not only has my own understanding of the material covered in his class benefitted, but so has my approach to sharing information with others. I better understand the difference between helping people learn, as an active and collaborative process, versus simply presenting information as a passive process. This, I feel strongly, is one of the most valuable concepts I have learned over my entire academic career.

It is my personal, as well as my professional opinion that Dr. Cohen exemplifies not only the values of the Georgia Tech community with his passion for progress and service, but also the goal of higher education itself through his refreshing approachability and transparency, both personally - and as a leader, mentor, community member, teacher, and colleague.

Sincerely,

As a former Undergraduate student of Dr. Cohen's I would like to support his nomination for this teaching excellence award. His research and teaching style has had a positive impact on my education and career.

I joined Professor Cohen's Vertically Integrated Projects team my first semester as a Junior, after transferring from Armstrong Atlantic State University. Due to my prior involvement in a research project as an RETP student at Armstrong Atlantic State University, I was extremely interested in Dr. Cohen's VIP research team. Throughout my time as a VIP team member, I learned many valuable skills that continue to help me in my professional growth. These skills were also always one of the main talking points that employers asked me about during interviews. Also during my time as part of Professor Cohen's curriculum, I was able to identify my personal strengths and weaknesses and learn how to address them in order to become a better professional.

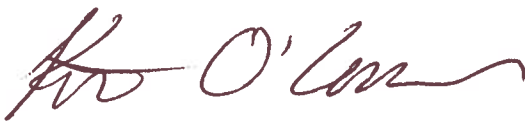
Being a member of Professor Cohen's VIP research team from its inception up to the point that I was able to use it as my Senior Design Project was very beneficial. I learned how to meet with a team weekly that was made up of multiple engineering disciplines. The weekly meetings taught me how to be a part of a multi-disciplinary team that has to successful communicate with each other in order to complete tasks critical to the project. Dr. Cohen's VIP team was a real world objective based classroom experience which translates directly into the skills I am expected to have as an Engineer in Industry.

During my time with Dr. Cohen's team I found myself being a team member of all the teams that were relevant for the research we were doing. This has aided me in job interviews as well as helping me to be a leader within projects that I am now a part of after college. I learned extremely valuable skills during my participation with his VIP research team. Aside from working with multiple teams that were a part of the overall project, I gained considerable knowledge in effective communication, the importance of good documentation, and how to set realistic achievable goals.

As a member of his VIP team I also gained considerable hands on/real world knowledge and experience. Most of the curriculum at Georgia Tech is theoretical, but during my time as his student, I learned many relevant skills related to my profession that aren't a part of other traditional classes. The skill of evaluating and using specific electrical parts, components, and equipment that I would not have worked with if I was not conducting research was only a small part of this. There were many skillsets that I obtained during my time such as how to troubleshoot hardware, how to interpret drawings and previous written code, and the use and integration of Embedded systems are among the biggest skill sets I learned.

Looking back at the student I was before participating in Dr. Cohen's classes and the person who I've become is quite profound. I doubt I would be where I am today without his generous help and his commitment to identify my strengths and weaknesses. During interviews and public speaking events, I went from a reclusive person to someone who is very confident and competent. I also got to meet some extraordinary individuals while being part of his research team. This includes individuals who were part of the NASA Juno program, as well as other PhD students. The participation in Dr. Cohen's classes has been one of the most rewarding parts of my Georgia Tech education.

Kimo O'Canas



Dear CETL Selections Committee,

I am writing to recommend Professor Morris Cohen for the CETL/BP Junior Faculty Teaching Excellence Award. I had the pleasure of being one of his students in his ECE 3025 Electromagnetics course this past semester and as an award-winning undergraduate TA, I truly admired and appreciated all of his effort into facilitating an exceptional learning environment for a notoriously difficult course.

My first impression of Professor Cohen came from reading his syllabus a week prior to beginning the fall semester. He immediately established how the course will be flipped (the student was to view lectures at home and then come to class to solve problems) which caused many students to be alarmed that they would need to teach themselves the entire course. However, as I read the syllabus, it was obvious that Dr. Cohen was not going to take this task in a light manner. He carefully noted which topics we will cover every class, precise goals he hopes each student takes away from his class, and he was welcoming enough to give us his personal cell phone number to contact him for any help with the course material.

Moving on to classroom activities, Professor Cohen would first introduce the concepts at a basic level and then ask the class Think-Pair-Share Questions which involved the students individually answering the questions on their clicker devices and then talking to their three other groupmates on what they answered to respond again with a collective answer. This proved to be fruitful since the class suddenly became a debate room and 40 young engineers, all with differing opinions and backgrounds, would present their reasons for their selected answers. This was powerful since many students find it hard to recall subtle details from hour long lectures but can immediately remember the five minute disputes with their colleagues about the same material.

As the material grew more difficult, Dr. Cohen's dedication to his students truly differentiated him from his colleagues. As the course begins to explore field theory, the class became very split in terms of understanding due to much of this material depended on the student's mastery of Physics II and Multivariable/Vector Calculus. Dr. Cohen dealt with this issue in an elegant manner. He stepped back from the electromagnetic theory and presented the tools needed to complete the electromagnetic problems through questions that did not involve any electromagnetic principles. For example, he succinctly demonstrated how to set up volume integrals for complicated geometries by asking his students to think about how they would calculate the total wind energy captured by a wind turbine. Then, he would introduce sources of charge into a similar geometry, which made this extension seem not as intimidating given the easier wind turbine problem.

The final aspect of Professor Cohen's course that I would like to comment on is the quality of the resources he provided his students to help them throughout the course. He was clever in the way that he anticipated common questions his students might have about certain types of problems and so his solution was to create original documents that would simplify many of the issues that students had. Furthermore, his ability to reduce months of course material into a few pages helped me and many of my colleagues capture the essence of electromagnetic theory which further led to a deep appreciation for the theory presented in this course.

Professor Cohen's passion for teaching, care for each of his student's understanding, and his addiction to success makes him an ideal candidate for this award. As a final note, not only has his teaching benefitted me and my colleagues directly but also my own students since I was able to incorporate many of his methods into my own classroom and have thus enjoyed similar results as him. I hope Dr. Cohen is recognized for his efforts and that his future students appreciate his teaching as much as I have.

Respectfully,

Sebastian Fernandez
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To whom it may concern,

I am writing this letter to share my experiences with Dr. Morris Cohen, and his capacity to be an outstanding teacher, mentor, and person.

Dr. Morris Cohen and I first met in ECE-3025 Electromagnetics in which he was my professor. This was my first encounter with the flipped classroom style of teaching. Admittedly, I found this approach to be unconventional and a bit confusing in my first few classes. I had a few initial grievances with this approach, however, I came to realize that it helps the students take greater advantage of the resources available to them. In the conventional classroom learning style, reading the text is typically optional. This is not the case in the flipped classroom approach to learning, and ensures that the student has a basic understanding of the material before arriving to class. The flipped classroom approach places a student with peers to solve problems. When learning with a group of peers, everyone comes from relatively the same place of understanding. This is in stark contrast to learning purely from an expert in the material, such as a professor. The flipped classroom approach allowed the professor (Dr. Cohen) to drive home points that were missing or unclear in the text, and ultimately helped me understand the material far more thoroughly in my opinion.

Beyond the flipped classroom approach, Dr. Cohen found ways to keep the class interesting. Dr. Cohen always took the time to link the theoretical material to real world applications. I remember a specific in-class problem which concerned communicating with submarines deep underwater, and how the skin effect plays a role in this scenario. Dr. Cohen also took the time to link the subject material to his own research, which motivated me to contact him in hopes of working with him.

When I expressed interest in Dr. Cohen's research, he was quick to respond. After meeting with him initially in his office, he gave me a tour of the lab and introduced me to his graduate students. Dr. Cohen suggested research projects that would not only benefit his lab, but also develop me as an engineer. I believe Dr. Cohen has a sincere appreciation for young engineers, and wants to see the best for those he interacts with. Dr. Cohen was an excellent mentor to me during my time working with him. He would always give career advice and offer to be a reference for internships and scholarships. The Georgia Tech Electrical and Computer Engineering program is the largest of its kind in the country. In such a large program, it is easy for a student to feel as if they are just a number in the system. I can speak from personal experience that Dr. Cohen has made a difference in these regards. Dr. Cohen made me feel important and valued, and contributed greatly to my decision to specialize in electromagnetism.

If there are any further questions, please do not hesitate to contact me. I fully recommend Dr. Morris Cohen for this prestigious teaching award.

Lee Thompson
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lthompson@gatech.edu
Incoming RF Engineer - SpaceX

To whom it may concern,

It is with great pleasure that I write this letter of support for the nomination of Professor Morris Cohen for this Georgia Tech Excellence Award. I have taken both Dr. Cohen's undergraduate and graduate courses during my time here as a Georgia Tech student and can, in part, attribute where I am today to the concepts learned in those courses.

Dr. Cohen's *ECE 4390 Radar and Electromagnetic Sensing* course portrayed a culmination of electromagnetic concepts and theory that is vital to the field that I intend to work in. The course material was advanced enough to be a challenge to undergraduate students, yet was explained in a way that also highlighted the fundamental theory that it was built off of. Professor Cohen was also able to tie in real-world applications by introducing some more of the physical functional aspects of the subject material through a reverse-engineering project of an existing radar system.

Dr. Cohen's graduate special topics course *ECE 8823 Radio Wave Propagation in Earth & Space Environments* was also a significant help in understanding the field that I am in. This course delved deep into electromagnetic theory in order to present the physics of wave propagation as well as the effect that the transmission and reception environment has on it. The in-depth analyses that Dr. Cohen explored were crucial to anyone wishing to go into advanced electromagnetic/RF designs. This class showed not only Professor Cohen's expansive electromagnetic knowledge, but also emphasized his ability to easily communicate the high-level subject material.

Throughout my undergraduate and graduate studies here at Georgia Tech, Dr. Cohen's courses have been some of my favorite and most interesting. His ability to convey both basic and advanced electromagnetic concepts effectively, as well as tying them to real-world applications have been hugely beneficial to me during the last few years. I have used theories and techniques learned in those courses directly to: a yearlong senior design project with JPL, other courses at Georgia Tech, and in the industry during internships with The Aerospace Corporation, Northrop Grumman Corporation, and most recently as an Electromagnetic Environmental Effects Associate Engineer at SpaceX.

Dr. Cohen has been an excellent professor and I would highly recommend him for this award.

Sincerely,

Jesse-David Khan

Georgia Institute of Technology

BS 2016 - Electrical Engineering
MS 2018 - Electrical and Computer Engineering

Georgia Tech Graduate Education and Faculty Development
Office of the Provost

January 16, 2018

To: CTL Awards Committee Bonnie McFerri

From: Bonnie Ferri, Vice Provost for Graduate Education and Faculty Development

Subject: Recommendation of Morris Cohen

I am very pleased to recommend Professor Morris Cohen for the CTL/BP Junior Faculty Teaching Excellence Award. I worked with Morris extensively while I was the Associate Chair for Undergraduate Affairs in ECE. I did an assessment of his classroom teaching when he was experimenting with flipping his electromagnetics course. He later presented his results on that electromagnetics course at the IEEE APS/URSI Conference in 2015. I was so impressed with Morris, that I asked him to participate in the Teaching Practicum that I ran for graduate students who were first-time instructors of record. Morris did a segment on "Team-based Teaching," which he used in his flipped electromagnetics class. Moreover, I asked that he develop a training video to be used for other faculty and have recently put it on the resources page of the ECE website. Students in the Teaching Practicum enjoyed his segment very much, and a couple of them wrote about Morris's techniques as being the most influential part of the practicum course. Morris's other activities in education relate to his work with undergraduates in research. He is an advisor to VIP team entitled "Lightning from the Edge of Space," since Fall 2014. This particular team is very popular with students because they are able to design and build an instrumentation system containing sensors and cameras that they launched with balloons to high altitude (100,000 ft). Similarly, I was impressed with his work with these students and highlighted it an exhibits booth that I ran at the ECE Department Heads Meeting held in Hilton Head, NC.

My own background in educational innovation gives me some expertise to assess Morris's qualifications (I received the CTL Junior Faculty Teaching Excellence Award many years ago and more recently received the 2016 Regent's Award for the Scholarship of Teaching and Learning from the University System of Georgia and the 2017 IEEE Undergraduate Teaching Award). Morris Cohen has my highest recommendation for this award.

ASTRONOMY

Why the eclipse was a good time for science

One experiment aimed to learn how GPS could become more accurate.

By Bo Emerson
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Monday was a big day for amateur astronomers and umbraphiles.

It was also a good time for basic science. Georgia Tech electrical engineering professor Morris Cohen ran an experiment Monday that linked the astronomical, the esoteric and the practical.

His work took him to the middle of a softball field in a rolling, 122-acre Jewish summer camp/event facility called Ramah Darom, a green and pleasant spot in Rabun County that happened to be on the line of totality.

There Cohen sent a weather balloon aloft with a payload of instruments to get a bird's-eye view of the moon's shadow as it raced eastward. In the meantime, he was also collecting information from listening stations around the country as they measured the scattering of low frequency radio waves, bouncing off this peculiar temporary blackness.

In a nutshell, Cohen wants to use radio waves to examine the ionosphere, with the goal of replacing or supplementing our vulnerable global positioning system.

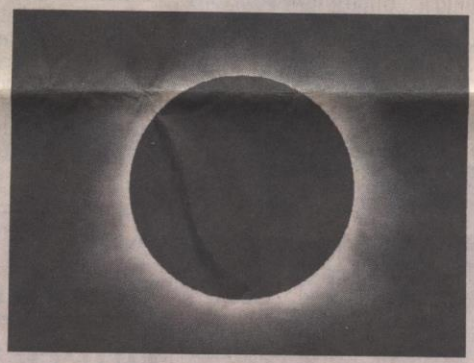
Before GPS, low frequency radio waves served as a kind of GPS called Omega. Omega wasn't precise, partly because "we didn't understand the upper atmosphere," Cohen said.

The eclipse offered an unusual window into that region. Here's why: The ionosphere is created when the sun's radiation shatters molecules at high altitude. Radio waves bounce off this layer and come back to Earth, though they travel higher at night before they bounce.

The eclipse creates a temporary instant night, with a sharp border. Collecting information

Eclipse continued on **D5**

Georgia Tech engineering students prepare to launch a balloon to 100,000 feet for an experiment that involves low frequency radio waves during Monday's total solar eclipse at Ramah Darom, a Jewish summer camp/event facility in Rabun County in North Georgia.
CURTIS COMPTON PHOTOS / CCOMPTON@AJC.COM



Rabun County was on the line of totality during Monday's eclipse. This view is from Ramah Darom, where several hundred gathered to watch the event.

LIVING

Eclipse

continued from D1

on their behavior during the event should help scientists know the upper atmosphere better.

For that reason, Cohen, 36, brought his gear early to Rabun County, and offered a few well-attended classes at Ramah Darom in the days leading up to the eclipse, to explain what he and his graduate students were up to.

The Tech crew inflated the 8-foot balloon as the moon was making its transit, releasing it about a half hour before totality. Hanging below the balloon was a package of measuring equipment, duct-taped into a small Styrofoam cooler. The balloon slowly disappeared into the darkening sky, rising to 100,000 feet, shooting 360-degree video all the while. The balloon was expected to explode, and a parachute would lower the cameras and other gear back to the ground many miles away. A chase crew, leaving from a location in North Carolina, tracked it down, but as of Tuesday afternoon, it was stuck in a tree.

"They will go back soon and retrieve it," Cohen said Tuesday. "The property owner is very friendly."

Cohen's students have used weather balloons before, successfully retrieving the black box each time. Some have flown 200 miles, though this one actually landed close to Rabun County, said former grad student Kimo Ocanas, 34, now an engineer at Northrop Grumman, who returned to help Cohen with the event.

Most of Monday's several hundred visitors came to Ramah Darom for the spectacle, but Ocanas and others were attracted by the science.

David Baron, author of "American Eclipse," writes that the eclipse of 1878 attracted scientists from around the country and in some ways helped the nation heal the wounds of the Civil War. "It reminds us that our differences are tiny compared to what we have in common," he told CNN, "and I think it's exactly what we need right now."

Rafael Harpaz, 64, a medical epidemiologist at the Centers for Disease Control and Prevention, stood on the softball field and watched Cohen at work, and echoed Baron's words. "I don't know if an eclipse can bring us together," he said as the sun was whittled down to a fingernail, "but the antifa and the alt-right are both going to be looking at the same sun."

There are practical dividends from Cohen's research, which was among several eclipse-related projects supported by grants from the National Science Foundation. Low frequency radio waves could be fashioned into a newer, more accurate and less vulnerable GPS. There are also intangible payoffs in seeing him interacting with an interested public, explaining his work, answering wild questions, veering off into discussions of lightning and solar flares.

C. Alex Young, a heliophysicist with NASA, said this kind of interaction is the tonic for a strong scientific ecology. He offered an analogy: "Not everybody can be an artist, but lots of people can appreciate a good painting," he said.

He wanted to see people excited by science. "I'm hoping there will be people with goose bumps all over the country."

Ilana Weismark of Atlanta and her children Kinneret, 12, Amishai, 10, and Kedem, 7, watch Monday's total solar eclipse during a solar eclipse Shabbat at Ramah Darom in Rabun County. CURTIS COMPTON PHOTOS / CCOMPTON@AJC.COM

Alex Levingston of Sandy Springs uses a pair of solar binoculars to look at the sun during Monday's solar eclipse Shabbat at Ramah Darom.