Professor Jonathan Makela

By Andy Kong (EE ’11)

Could you briefly describe your childhood, teenage years, and college experience?

I was born and raised in a suburb of Cleveland, Ohio called Shaker Heights. I was well aware of the academic lifestyle from a young age because my father was a history professor. I attended Cornell University as an undergraduate in applied and engineering physics, but later decided to pursue an undergraduate degree in electrical engineering. I also completed my PhD at Cornell.

What first made you interested in electrical engineering?

I had always played with circuits growing up. I played with a 50-in-1 circuit board; plugging and unplugging things for hours on end until my parents realized I might electrocute myself. So I always had thoughts of electricity in the back of my head. This was a large factor when I was deciding which department to choose at Cornell.

When did you arrive in the ECE Department at Illinois?

I arrived here in November 2004. Prior to arriving here, I was in a postdoctoral position at the Naval Research Lab in Washington D.C.

What kind of work was done at the Naval Research Lab?

I was working in the space sciences division. I was developing a miniaturized camera system which I use in a lot of my research now to study the upper atmosphere from locations around the world. The postdoctoral position was a great opportunity to expand on what I had done as a graduate student and to start thinking about some new areas to conduct research in.

Why ECE Illinois?

As we are all aware, ECE Illinois has one of the best electrical engineering departments in the world. ECE Illinois also has one of the strongest remote sensing and space sciences programs, dating to when Professor Emeritus George Swenson first started tracking Sputnik the day after it was launched. When I was at Cornell as a graduate student, I knew and respected the faculty members here. So when I was looking for faculty positions, ECE Illinois was at the top of my list. I knew that I would not only have excellent colleagues to interact with here, but that the student quality here would be fantastic.

What area of electrical engineering do you research in?

My research group studies the upper atmosphere, the ionosphere. It is an interesting blend of electromagnetic, signals processing, and physics. We study how radio waves propagate through the ionized plasma, which is primarily an electromagnetics and physics problem. However, we collect a lot of data from various optical and radio instruments on the ground, satellites, and rockets. This requires signal processing to get the most information out of the data as possible.

Are there any undergraduate research opportunities in your area of research?

Yes. I consistently have about 2-3 undergraduates working in my research group each semester. The type of work varies depending on the student's academic background. I have worked with students through the PURE (Promoting Undergraduate Research in Engineering) program as well as on independent and senior thesis projects.

How should a student interested in your area get involved?

PURE is a good way to get involved with research. Another way to get involved in my research is to send me an email, and if I have an idea and the student is interested, something can be arranged.

What are some prerequisites needed to have the background to participate in your area of research?

It is essential to have a basic background in electromagnetism (ECE 329). Completion of ECE 450 would allow the student to tackle more interesting research topics. Other courses that would be useful include signal processing courses such as ECE 410, ECE 420, and image processing. Due to the large amount of data analysis, having a working knowledge in Matlab would also be useful.

What kind of student do you look for to help with your research?

Having a strong academic record is important, but more importantly, the student needs to be self-motivated. The student needs to be persistent because with research, answers are not found in textbooks. Sometimes research problems will arise that seem impossible to solve at first, but they become clear and intuitive after some persistence and dedication.
How is the weekly workload for undergraduate researchers in your lab?

Typically, the weekly workload for undergraduate researchers is between 5 to 10 hours. Students usually take out a portion of a day or two to do research.

What are some of the courses you have taught in the past?

In the past, I have taught ECE 329, ECE 450, ECE 445, and ECE 437. I have been developing a lecture/laboratory course on global navigation systems such as GPS. In this course, students learn about global satellite navigation systems, orbital dynamics, and data analysis and retrieval from these systems. In the lab, students develop a software-based receiver. It will probably be offered again next fall semester as an ECE 498 course.

Which course was your favorite to teach?

The ECE 498 course on global navigation systems is one of my favorite courses to teach because it is related to my area of research. ECE 445, the senior design course, is another favorite course because I get to see what our ECE Illinois students are capable of accomplishing after they have gone through the undergraduate curriculum.

Do you have any hobbies or interests outside of academics?

I like photography. One of the perks of my area of research is that I travel a lot to set up equipment. I always bring a camera with me. Between research activities, I try to take an afternoon to take pictures of the local environment. I have pictures that I have taken during some of my field experiments all around my office.

What kinds of places do you travel to?

Currently, I am running experiments in Hawaii, Brazil, Chile, Puerto Rico, Trinidad, and Bonaire. My research area is highly dependent on the orientation of the Earth's magnetic field. I study phenomenon where the Earth's magnetic field needs to be more horizontal, which is what occurs near the equator. I am currently expanding my research area to more mid-latitude regions of the Earth.

Do you enjoy reading books or watching movies?

Yes I enjoy reading books when I get a chance. My wife and I will go out to watch or rent a movie every now and then. I believe the last movie that I saw was The Informant! with Matt Damon which was kind of funny. I also go to Krannert Center frequently to see performances there. They have a lot of variety in their performances, and I always see students and colleagues there. It's a good place to mingle in an informal setting.

Are you a sports fan?

Yes, I like sports. I actually have Illini football season tickets this year, but the games haven't been too fun to watch this year. Having grown up in Cleveland, I still support teams like the Cleveland Cavaliers basketball team, but it's been disappointing to see them unable to win a title even with LeBron James. Whenever there is a Cleveland team playing, I may sit down and watch the game.

Do you have any suggestions for students?

I tell all of my students to look ahead academically because nothing substitutes for good planning. I always tell the first year students to take courses south of Green St. The university experience is the only time that people generally have a chance to take a course in romantic literature or whatever you are interested in. Get involved with activities on campus, live your life, but at the same time, work hard.