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ESA Newsletter

Electrostatics Society of America - The Friendly Society

President's Message

Awkwardness or Acceptance:

When I was asked to write an editorial article for the IEEE Electrical Insulation Magazine, I wanted to share my experience in reviewing/editing technical documents. Then I thought to share it with my ESA community as it has enough to offer for our writers and reviewers. Enjoy experiencing the feelings while reading this article.

Writing is part of our profession; and many of us are not only writers but also "editors". I use the term editors for educators/researchers for whom editing others' work has become standard practice. We are not professional editors per se who have established careers on the skill, such as editors for magazines and newspapers, but as supervisors and committee members, we do in fact edit works such as research proposals, papers, theses, and reports, in addition to reviewing articles. What I would like to share here with readers is how to help reduce some of the editorial burden. I am not trying to correct anyone's writing; I simply wish to raise concerns about the misuse of units, notations, significant figures in measuring and reporting, and improper citations. Although taught in schools/colleges, accompanied by standards that provide guidelines, these mistakes are often ignored or even overlooked.

Let us first look at units. In scientific work symbols notating units named after a person (for instance, a great scientist) must be identified in upper case. For example, the unit of electrical potential – the volt – is named after Alessandro Volta; the symbol representing the volt is V. Likewise, the notations A for ampere, W for watt, H for henry, etc., are case sensitive. Next, we should look at multipliers – e.g. kilovolts or megavolts; many of us have edited KV at some point. I have noticed that many people forget that kilo is represented by a lower case letter k as in kV (10^3 V). These days, even communiques and literature distributed by large companies often ignore the difference and use KV for kV. Am I too picky? It is after all just a letter k. On the other hand, if this happens for millivolt (mV) and megavolt (MV), then it is not just a difference between lower and upper case, rather it is a difference of nine orders of magnitude.

Another commonly found mistake is the inconsistent use of decimal place values in the positional notation system. In a single table, even within a column representing the same variable or parameter, I have seen some data presented with two decimal places to the right of a decimal point, and other data presented using three to four decimal places. Data is being reported verbatim; it is based on what a computer or calculator displays, rather than paying attention to the physical meaning. How awkward it would be to say, "Today's temperature is 28.007 °C"! This improper use does not end with data presented in tabular forms; it occurs in graphs and plots as well. For instance, it is easier to present a dataset demonstrating distance using millimeters, rather than using a basic unit meter to three decimal places. Similarly, within a single paper either scientific notation, $m\times10^n$ or E-notation mEn, can be used, but not both. It takes a few extra steps to fix such oddities and errors in tables and figures, but they are integral corrections to ensure a well-written scientific paper.

I will admit my eyes are getting older and font size is becoming more of a concern. Unfortunately, these days, the assumption is that everyone uses large monitors to read articles, and it is easy to zoom in. This is simply not true. Many documents are archived in print and some individuals, like myself,

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President's Message (cont'd.)

prefer to read hardcopy. We need authors to be kind on our tired eyes and use an appropriate font size. Unless journal/magazine editors request a specific typeset font or ask for resubmission with such specific corrections, this problem will continue. This may sound inconsequential to some, but remember that all elements of illustrations, including letters, numbers, and symbols, must be legible at their final size in print, not only on screen. This particular issue is an on-going struggle for me with my young research engineers (hey folks you might be upset with me, but this is true).

The discussion would be incomplete if I did not talk about the poor use of references. Incomplete citation information, not following formats required by specific journals, and inadequate or missing references are not uncommon. I am unhappy to see such bad practices from researchers who have extensive publication records. Sometimes you even see authors citing only their group's work. Also for young students, remember that IEEE Xplorer is not a sole source of scientific information. Science exists beyond IEEE.

Lastly, the ways in which abbreviations are defined seems to be of less importance these days. For example, scanning electron microscope (SEM) vs Scanning Electron Microscope (SEM). Which one is correct? I think the former usage is correct. On a related note, another commonly found omission is failure to expand abbreviations upon first mention within a text, as well as failure to identify trademarks or registered marks. Plus, the use of jargon like EHV and UHV without explanation; maybe only a few working in the field know what these words mean, as extra high voltage and ultra high voltage. Having seen these types of omissions quite frequently, I ask myself, do we really need to pay attention? I would like to think we do; if research is not presented and articulated carefully and precisely, shouldn't the reader question the credibility of the research itself? As a final thought, just like they say the "cure for littering is you", the solution for the concerns expressed is "us".

For the Friendly Society
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Calendar

- Electrostatics 2017, April 10-13, 2017, Frankfurt/Main, Germany, *http://www.dechema.de/en/electrostatics2017.html* Contact: Nadja Strein, *strein@dechema.de*
- ESA 2017 Annual Meeting, June 13-15, 2017, University of Ottawa, Ottawa, Ontario, Canada *http://www.electrostatics.org* Contact: Poupak Mehrani, *poupak.mehrani@uottawa.ca*

Current Events

Auroras Make Weird Noises, and Now We Know Why

Andrew Fazekas

Arctic wilderness tales often wax poetic about dazzling displays of northern lights painting the skies. But for at least the past century, some of those stories have also mentioned eerie noises associated with especially powerful auroras. Witnesses say the sounds are comparable to radio static, like a faint crackling, light rustling, or hissing heard for a few minutes during a strong display. While the weird sounds were long considered folklore, Finnish scientists have not only shown that they really happen, but now the team thinks they know why.

The answer can be traced to charged particles trapped in a layer of the atmosphere that forms during cold nights. These particles rapidly discharge when bursts of material from the sun slam into Earth, producing clapping sounds and other noises, the team reported on June 22 at the Baltic-Nordic Acoustic Meeting in Stockholm, Sweden.

CRACKING GOOD SHOW

Charged particles are constantly streaming from the sun in the solar wind, and auroras occur when these particles interact with Earth's magnetic field. The particles are funneled toward the poles, where they slam into the atmosphere and set off colorful light shows.

Sometimes, the sun flings off major *(cont'd. p. 4)*

2017 Annual Meeting of the Electrostatics Society of America

University of Ottawa, Ontario, Canada
June 13-15, 2017

The Electrostatic Society of America (ESA) invites papers in all scientific and technical areas involving electrostatics for the 2017 Annual Meeting of the ESA. Contributions range from fundamental physics and new developments in electrostatics to applications in industry, atmospheric and space sciences, medicine, energy, and other fields.

Anticipated Technical Session Topics

- Breakdown phenomena and discharges
- Electrically-induced flows and electrokinetics
- Contact charging and triboelectric effects
- Gas discharges and microplasmas
- Atmospheric and space applications
- Biological and medical applications
- Materials synthesis, processing, and behavior
- Measurements and instrumentation
- Safety and hazards

Keynote Speakers

We are excited to have confirmed an excellent slate of keynote speakers:

- **Dr. Elyse Rosenbaum,** *Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, USA*
- **Dr. Charles Fan,** *Global Research & Development, General Motors Company, USA*
- **Dr. Karen Aplin,** *Department of Physics, Oxford University, UK*
- **Dr. Philip Kwok,** *Department of Pharmacology and Pharmacy, University of Hong Kong, Hong Kong*

Conference information, including, registration and lodging, will be updated and available at *http://www.electrostatics.org*

Student Presentation Competition

Presentations by undergraduate and graduate students are eligible for the Student Presentation Competition. Please indicate student presenter when submitting abstract.

Important Dates

January 1, 2017	*Abstract submission open*
March 1, 2017	*Abstract submission deadline*
March 17, 2017	*Notification of abstract acceptance*
May 1, 2017	*Early registration deadline*
May 15, 2014	*Final manuscript deadline*

Abstract Submission

Online submission at *http://www.electrostatics.org*

Contact Information

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Technical Chair: Prof. Shubho Banerjee, Rhodes College, USA (banerjees@rhodes.edu)

About University of Ottawa

Located in Ottawa, Canada's capital city, within walking distance of Canada's Parliament Hill, uOttawa is the largest bilingual (English-French) university in the world. uOttawa has a student population of over 42,000 and has more than 450 programs in 10 faculties.

bursts of particles that, when aimed at Earth, can set off disturbances in the planet's magnetic field known as geomagnetic storms. These storms can interfere with orbiting satellites and even the electrical grid, but they also produce the most dramatic auroral displays.

Previously, one of the leading theories for aurora noise suggested that tree needles or pine cones may be involved. During geomagnetic storms, the atmosphere can hold abnormally high electric fields, creating a difference in charge between the air and objects on the ground. Anything pointy, like leaves and pine cones, would offer the perfect surface for electricity to discharge, like a static shock jumping from a doorknob to your finger, and that might set off an audible cracking sound.

But back in 2012, Aalto University researcher Unto K. Laine was able to prove that auroral sounds were emanating from above the treetops—230 feet (70 meters) above Earth's surface—during the times of the most intense displays. Now, his team's follow-up study proposes a specific explanation for the auroral snap, crackle, and pop. The key is something called an inversion layer, a region of the atmosphere where the air temperature increases with altitude instead of experiencing the usual decrease. Such layers can develop after calm, sunny days, says Laine. After sunset, warmer air rises while the surface cools, and continuing calm conditions mean the two temperature regions don't mix.

According to Laine and his team, this inversion layer then acts like a lid, trapping negative electrical charge in the region below it and positive charge in the air above. When a geomagnetic storm hits Earth, the lid breaks and the charge is released, creating the weird sounds.

PHOTOGRAPH BY SERGIO PITAMITZ, NATIONAL GEOGRAPHIC CREATIVE

This theory matches nicely with the team's previous observations. They showed that 60 of the loudest recorded sounds originated about 250 feet (75 meters) above the ground. That's the same altitude as a typical inversion layer, according to independent measurements conducted by the Finnish Meteorological Institute.

"Auroral sound is a phenomenon that is dismissed by many people, scientists and otherwise, as originating in the imagination of the observer," says Dirk Lummerzheim, an aurora researcher at the University of Alaska, Fairbanks. "I think this is the first time that the sounds are not only observed to actually be an acoustic signal—as opposed to something that is manufactured in the human brain, for example, similar to synesthesia—but Doctor Laine also has proposed a physical process that provides a good explanation."

(excerpted from *http://news.nationalgeographic.com/2016/06/auroras-sounds-noises-explained-earth-space-astronomy/*)

How plants sense electric fields

Robert Emmerich

An international group of researchers has pinpointed the sensor plants use to sense electric fields. A beneficial side effect: Their work could contribute to the understanding of how the Ebola virus enters human cells.

The cells of plants, animals and humans all use electrical signals to communicate with each other. Nerve cells use them to activated muscles. But leaves, too, send electrical signals to other parts of the plant, for example, when they were injured and are threatened by hungry insects. "We have been asking ourselves for many years what molecular components plants use to exchange information among each other and how they sense the changes in electric voltage," says Professor Rainer Hedrich, Head of the Chair for Molecular Plant Physiology and Biophysics at the University of Würzburg.

This question has been intriguing Hedrich since the mid 1980s when he was still a postdoc in the laboratory of Erwin Neher at the Max Planck Institute in Göttingen. "Back then, we used the patch clamp technique to make the first-time discovery of an ion channel in plants which is activated by calcium ions and an electric field." In 2005, other scientists then found the gene underlying this ion channel (name: TCP1). And now it has been Hedrich's team again that has identified that part of the channel which functions as a sensor for electric voltage and activates the channel.

The discovery of the voltage sensor was made by international teamwork. Initially, Hedrich got support from Professor Thomas Müller of his own department. The structural biologist created a three-dimensional model of the TPC1 channel protein. This allowed areas in the protein to be localised that are eligible as voltage sensors. "Our model clearly showed that the TCP1 channel is made up of two interconnected, nearly identical protein units each capable of forming a potential voltage sensor," Müller explains.

An analysis of the evolution of the TCP1 gene shed even more light on the matter. The Würzburg scientists Jörg Schulz, Professor of Computation Biology, and Dirk Becker, a team leader at Julius von Sachs Plant Research Institute, found out that the gene first occurs with the evolution of cells that have a nucleus. Since then, all living beings, humans included, seem to have had it. "During the analysis, we noticed that the second unit of the TPC1 protein has hardly changed in millions of years. It is almost identical from simple protozoa to plants and humans," Becker further.

So they had to look for the voltage sensor in the second protein unit. The work group of Würzburg electrophysiologist Irene Marten then delivered the decisive experimental cue: Plants that carry a mutation in a special subunit of the channel have lost their ability to respond to the electric field. "Together with the former Würzburg biophysicists Gerald Schönknecht, presently researching at Oklahoma State University in the USA, and Ingo Dreyer, currently at University Talca in Chile, we then developed a mathematical model. This model can explain how the electric switch in the TPC1 channel protein works at the molecular level," Hedrich explains.

(excerpted from *https://www.sciencedaily.com/releases/2016/07/160708082037.htm*)

Study Provides a New Method to Measure the Energy of a Lightning Strike

Florida, often recognized as the "lightning capital of the United States," is a great place to study the amount of energy released by a lightning strike. Just ask University of South Florida School of Geosciences Associate Professor Matthew Pasek and his colleague Marc Hurst of Independent Geological Sciences, Inc. who have developed a unique method to measure the amount energy expended by a bolt of cloud-to-ground lightning.

According to Pasek, one of the more difficult things to measure is the amount of energy in a lightning strike. While atmospheric physicists can approximate lightning bolt energy by measuring the electrical current and temperature of bolts as they occur, the numbers are usually approximations. The team of Pasek and Hurst is the first to investigate the energy in lightning strikes by using geology "after-the-fact" research, rather than measuring energy during a strike. By conducting this lightning strike "archaeology," the researchers were able to measure the energy in a bolt of lightning that struck Florida sand thousands of years ago.

"When lightning strikes the sand, it may generate a cylindrical tube of glass called a fulgurite, explained Pasek. "The structure of the fulgurite, created by the energy and heat in a lightning strike, can tell us a lot about the nature of the strike, particularly about the amount of energy in a single bolt of lightning." The team collected more than 250 fulgurites - both recent and ancient - from sand mines in Polk County, Fla., at a site that is believed to have recorded thousands of years of lightning strikes, providing a way to measure the lightning strike history of what is today called the I-4 Corridor, a region near Tampa and Orlando. "Everyone knows there is a lot of energy in a lightning bolt, but how much?" Pasek explained. "Ours is the first attempt at determining lightning energy distribution from fulgurites and is also the first data set to measure lightning's energy delivery and its potential damage to a solid earth surface."

"While we presented a new method for measuring by using fossilized lightning rocks, we also found - for the first time - that lightning strikes follow something called a 'lognormal trend," explained Pasek. "A lognormal trend shows that the most powerful lightning strike happen more often than would be expected if you made a bell curve of strikes. This means that the big lightning strikes are really big." According to Pasek, a bolt of lightning can carry extremely high voltage and heat the air temperature around the strike to more 30,000 degrees Kelvin – that's over 53,000 degrees Fahrenheit. When lightning strikes sand, soil, rock or clay, the current flows through the target and heats the material to above its vaporizing level. Rapid cooling produces the fulgurite. Lightning strikes the Earth about 45 times per second, with 75 to 90 percent of the strikes over land masses. "About a quarter of these strikes occur from a cloud to the ground, so the fulgurite-forming potential is great, with up to 10 fulgurites formed per second globally," said Pasek.

(excerpted from *http://news.usf.edu/article/templates/?a=7453&z=224*)

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