Nov/Dec 2007 • No. 188

ESA Newsletter

Electrostatics Society of America - The Friendly Society

President's Message

"Kelly, nothing stays the same." My honored mentor, friend and former supervisor said this about 10 years ago when he told me that he was to be laid-off in a corporate downsizing. I watch him closely during his final 6 weeks of employment at our company. He was a model of efficiency, hard work and courtesy right through his last day. Nothing stays the same.

Perhaps it is just the time of year to take stock and reflect on our accomplishments and on the challenges that we face. The ESA was formed in 1971 "to unify and integrate the varied, diversified, and often isolated areas of electrostatic researches and applications by bringing together the workers in these areas … ." We are a successful professional organization in part because we honor the wisdom of our founders and stay true to our purpose and mission. While we respect tradition, we must also acknowledge the challenges that we face, find the opportunities, and embrace new ideas.

One business trend or strategic vector is the strong emphasis on accountability and transparency. This is a move away from shared resources such as central engineering and a move towards product specific business organizations. For example, organizations with names like "Corporate Engineering" are giving way to departments with a clear mission such as "Printer Development." The parallel within professional societies is illustrated by the new journal titles in the IEEE. While "traditional" journals with titles such as "Industry Applications" and "Dielectrics and Insulation" remain, newer titles attracting interesting electrostatics publications include "Biomedical Engineering," "Display Technology," "Microelectromechanical Systems", "Nanotechnology," and "Sensors."

I see two challenges for our organization. First is the greater emphasis on applications and implementation rather than the foundational principles that we seek to unify. Second is the growing number of conferences and publications where work on electrostatics is presented and published. In this trend towards accountability and organization by end product, how shall we present our society as the destination of choice for presentations and publications?

The ESA Student Paper Competition at our Annual Meetings has attracted a number of fine presentations on emerging technologies by students just starting their professional careers. And, our Invited Speakers have introduced these technical leaders to our society and opened opportunities to exchange information.

I invite you to share your reflections and thoughts on our fine society, our future, and how we can act now to remain strong and successful.

Kelly Robinson,
ESA President

Electrostatics Society of America

CALL FOR PAPERS

2008 ANNUAL MEETING OF THE ELECTROSTATICS SOCIETY OF AMERICA

The 2008 Annual Meeting of the Electrostatics Society of America will be held June 17-19, 2008. The venue is the Ramada Mall of America in Minneapolis, MN, USA.

Technical program

We invite papers in all scientific and technical areas involving electrostatics. Contributions can range from fundamental investigations of electrostatic phenomena to studies of the implications, mitigation, or utilization of electrostatic phenomena in diverse settings. Technical sessions will include:

I. Atmospheric and space applications
II. Biological and medical applications
III. Breakdown and discharge
IV. Flows, forces, and fields
V. Materials behavior and processing
VI. Measurement and instrumentation
VII. Particle control and charging
VIII. Safety and hazards

Abstract submission: Abstracts should be submitted online, at http://www.electrostatics.org

Student paper competition: Presentations by students (undergraduate and graduate) are eligible; please indicate if a student will present when submitting abstract.

Important dates

February, 2008	Detailed conference information available at http://ww.electrostatics.org
March 1, 2008	Abstract submission deadline
March 17, 2008	Notification of paper acceptance
April 18, 2008	Final manuscripts due
June 17, 2008	Reception and late registration, 11 AM. Conference begins, 1 PM
June 19, 2008	Conference ends after evening banquet (Banquet: 7 PM – 10 PM)

Contact information

For questions about the technical program and abstract submission, contact the Technical Chair:
Prof. Daniel Lacks, Dept. of Chemical Engineering, Case Western Reserve University
daniel.lacks@case.edu, (216)368-4238

For other questions, contact the General Chair:
Dr. Albert Seaver, aseaver@electrostatics.us , (651)735-6760

ESA-2008 Annual Meeting

Read, See and Hear Technical Papers – Your Thoughts Please

The ESA is good, but is it modern and efficient? In the next few years, if ESA is to remain at the forefront, it will need to change how it runs its Annual Meeting. Essentially, I believe the ESA needs to develop a method to allow anyone who has an interest in electrostatics to read, see, and hear any paper presented at an ESA Meeting. Yes, you read that correctly, not just read, but SEE and HEAR a technical paper.

There are many reasons why we go to a conference, but one of the major reasons is to attend the technical sessions. A Conference Proceedings gives us the technical papers presented at a conference, but the technical presentation usually gives us more information than we can get out of just reading a paper. The presenter highlights the key points of the paper and often gives further information, diagrams, and thoughts not found in the paper. It is that synergy of the written paper coupled with the sights and sounds of the presentation that often invokes the "extra spark" in our own thought process.

The ESA Proceedings have served us well in the past, but each of us has to allocate some library space at home or office for their storage. Talk about redundant! Wouldn't it be nice if we could share our libraries? Better yet, wouldn't it be great if we could bring back that actual presentation from the past which helped spark some present thought? Well those ideas are at the core of this little essay on "Read, See and Hear Technical Papers" and the technologies to put the concept in place are now available.

Here is how it would work for the ESA in regards to our Annual Meeting Proceedings. A Virtual Central Library for the ESA would be placed on an ESA Web page containing an index page listing the various years of the conference. Click on the desired year and it sends you to the Table of Contents for that year, listing the papers' Titles and Author(s). Below each Title and Author(s) would be three links: 1) Abstract, 2) Full Paper, and 3) Presentation. If you click on the abstract, you get to read just the abstract (stored in pdf format). If you click on the full paper, you get to read the paper (stored in pdf format). If you click on the presentation, you get an AVI file that you can play on your computer (using, for example, Windows Media Player); and it will display the presentation with voice and mouse-pointing movements just as it was originally presented. If you desire, you can freely download at no cost any or all of the three (Abstract, Full Paper and Presentation). But, why bother, you can get to the information any time. Now that is what I would call a good ESA library.

And where would we store all this information? Well, after having your abstract accepted, when you finished writing your paper you would first submit the abstract and paper to ArXiv *http://arxiv.org/* , an Open Access depository. On the ESA web site a single pdf document titled "Proceedings ESA-20XX" would list Titles and Authors for that year along with links to the ArXiv abstracts and papers. By the way, up to this point the above procedure is a simple way for an e-Proceedings of the ESA conference to be handled. The SEE and HEAR presentations would be recorded in an AVI format at the conference during the time they are presented and then stored at the ESA web site as well as linked on the document titled "Proceedings ESA-20XX." Presenters would be required to use a wired head-mike (for good audio clarity) and mouse-point rather than laser pointer during their PowerPoint presentation. Storage needed is about 0.5 GB per hour of presentation (10 GB per 2.5 day conference).

So, what do you think? As your General Chair for ESA-2008, it would be up to me to initiate the SEE and HEAR part. Please let me know your thoughts by sending them to *aseaver@electrostatics.us*

For the Friendly Society – Al Seaver, 1995-1999
Past President of ESA

Current Events

Research overturns accepted notion of neutron's electrical properties

Vince Stricherz *vinces@u.washington.edu*

For two generations of physicists, it has been a standard belief that the neutron, an electrically neutral elementary particle and a primary component of an atom, actually carries a positive charge at its center and an offsetting negative charge at its outer edge.

The notion was first put forth in 1947 by Enrico Fermi, a Nobel laureate noted for his role in developing the first nuclear reactor. But new research by a University of Washington physicist shows the neutron's charge is not quite as simple as Fermi believed.

Using precise data recently gathered at three different laboratories and some new theoretical tools, Gerald A. Miller, a UW physics professor, has found that the neutron has a negative charge both in its inner core and its outer edge, with a positive charge sandwiched in between to make the particle electrically neutral.

Current Events (cont'd.)

The discovery changes scientific understanding of how neutrons interact with negatively charged electrons and positively charged protons. Specifically, it has implications for understanding the strong force, one of the four fundamental forces of nature (the others are the weak force, electromagnetism and gravity). The strong force binds atomic nuclei together, which makes it possible for atoms, the building blocks of all matter, to assemble into molecules.

The findings are based on data collected at the Thomas Jefferson National Accelerator Facility in Newport News, Va., the Bates Linear Accelerator at the Massachusetts Institute of Technology and the Mainz Microtron at Johannes Gutenberg University in Germany. The three labs examine various aspects of the properties and behavior of subatomic particles, and Miller studied data they collected about neutrons. His analysis was published online Sept. 13 in Physical Review Letters. The work was funded in part by the U.S. Department of Energy.

"A particle can be electrically neutral and still have properties related to charge. We've known for a long time that the neutron has those properties, but now we understand them more clearly," Miller said.

He noted that the most important aspect of the finding confirms that a neutron carries a negative charge at its outer edge, a key piece of Fermi's original idea.

The strong force that binds atomic nuclei is related to nuclear energy and nuclear weapons, and so it is possible the research could have practical applications in those areas. It also could lend to greater understanding of the interactions that take place in our sun's nuclear furnace, and a greater understanding of the strong force in general, Miller said.

(for more info go to *http://uwnews.washington.edu/ni/article.asp?articleID=36620*)

Digital Droplet Sorting

American Institute of Physics, Number 846 #3
November 12 , 2007
Phil Schewe

A new microfluidic lab-on-a-chip setup forms tiny droplets, passes them through a pair of electrodes which can perform an identification of the droplets, passes them through a second pair which gives them a charge, and then through a third pair which sorts the drops according to their properties. Basically the charge imparted to the droplet is proportional to the droplet size, and the charge is gauged by the effect it has when passing through the first set of capacitor electrodes.

Scientists at the Hong Kong University of Science and Technology form a supply of drops moving in a microchannel by having the fluid of interest (in one channel) merge with a running rivulet of oil (silicon or sunflower oil) in a second channel (see the figure below or at *http://www.aip.org/png/2007/290.htm*). By regulating the flow rate of the fluid and the oil, droplets of many sizes and rates can be formed. The Hong Kong Scientists currently can look at droplets smaller than a pico-liter (10^{12} liter) in size with a capacitive sensitivity of a pico-Farad (10^{12} F).

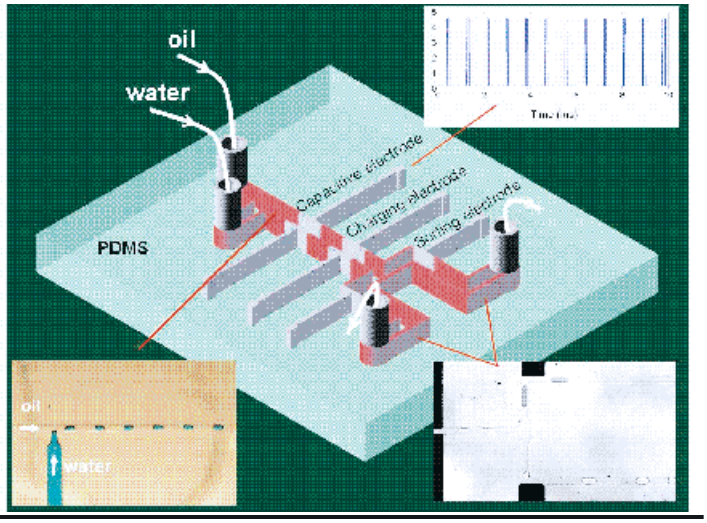
The detection rate right now is about 10,000 drops per second, which is already pretty high. According to one of the researchers, Weijia Wen (*phwen@ust.hk*), this capacitance-based detection rate is better than that can be accomplished with optical means (such as with a CCD camera), and the capacitance method is intrinsically cheaper than the optical equivalent.

In the Hong Kong approach the detection and the sorting are both performed electrostatically: sorting happens when an electric field sends the higher-charged drops into one channel, and the lesser-charged drops into another channel. In this way nano- or micro-particles can be sorted digitally. The goal is to furnish a useful digitally-controlled bio-chemical chip for performing various experiments with nano-liter volumes of reactants or biological samples. (Niu et al., Biomicrofluidics, Oct-Dec 2007)

(*http://www.aip.org/pnu/2007/split/846-3.html*)

(find paper at

http://scitation.aip.org/vsearch/servlet/VerityServlet?KEY=BIOMGB&smode=strresults&sort=chron&maxdisp=25&threshold=0&possible1=Niu&possible1zone=article&OUTLOG=NO&viewabs=BIOMGB&key=DISPLAY&docID=1&page=1&chapter=0)



Current Events (cont'd.)

Lightning Bolts within Cells

A new nanoscale tool reveals strong electric fields inside cells.

Katherine Bourzac

Using novel voltage-sensitive nanoparticles, researchers have found electric fields inside cells as strong as those produced in lightning bolts. Previously, it has only been possible to measure electric fields across cell membranes, not within the main bulk of cells. It's not clear what causes these strong fields or what they might mean. But now that it's possible to measure them, researchers hope to learn about disease states such as cancer by studying these electric fields.

University of Michigan researchers led by chemistry professor Raoul Kopelman encapsulated voltage-sensitive dyes in polymer spheres just 30 nanometers in diameter. When illuminated with blue light, the voltage-sensitive dyes emit a mixture of red and green light; the exact frequency of light emitted is influenced by the strength of local electric fields, allowing the researchers to measure those fields. Testing these nanoparticles in the internal fluid of brain-cancer cells, Kopelman found electric fields as strong as 15 million volts per meter, perhaps five times stronger than the field found in a lightning bolt.

Voltage-sensitive dyes are not new. For decades, neuroscientists have used them to measure voltages across cell membranes in studies of how nerve cells generate and respond to electrical charges. But Kopelman says that it's not possible to control the placement of these dyes in cells. They are hydrophobic and aggregate in cell membranes, so it has not been possible to use them to study the cytosol, the bulk of the interior of the cell. Kopelman also says that these dyes might be reacting with enzymes and other molecules in cells. His encapsulated dyes aren't hydrophobic and can operate anywhere in the cell, not just in membranes. Because it's possible to place his encapsulated dyes in a cell with a greater degree of control, Kopelman likens them to voltmeters. "Nano voltmeters do not perturb [the cellular] environment, and you can control where you put them," he says.

The existence of strong electric fields across cellular membranes is accepted as a basic fact of cell biology. Maintaining gradients of charged molecules and ions allows for many cellular functions, from control over cell volume to the electrical discharges of nerve and muscle cells. The fact that cells have internal electric fields, however, is surprising. Kopelman presented his results at the annual meeting of the American Society for Cell Biology this month. "There has been no skepticism as to the measurements," says Kopelman. "But we don't have an interpretation."

(more info. at *http://www.technologyreview.com/Biotech/19841/*)

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CALENDAR

- ESA-2008, June 17-19, 2008, Minneapolis, MN, USA Contact: Al Seaver, Tel: 651-735-6760, *aseaver@electrostatics.us*, or Daniel Lacks, Tel: 216-368-4238, daniel.lacks@case.edu, website: http://www.electrostatics.org
- 16th Int'l. Conf. on Diel. Liquids, June 30-July 4, 2008, Poitiers, France, Contact: H. Romat, Tel: 33-(0)5-49-49-69-31, *icdl2008@lea.univ-poitiers.fr*, (abstracts due Oct. 15, 2008), info at *http://lea.sp2mi.univ-poitiers.fr/icdl/*
- 6th Conf. of the French Electrostatic Society, July 7-9, 2008, Gif-Sur Yvette, France, Contact: Philippe Molinie, Tel: 33-(0) 1-69-85-15-25, *sfe2008@supelec.fr*, (title due Dec. 15, 2007), website: *http://www.supelec.fr/invi/sfe2008/Welcome.html*
- 11th Int'l. Conf. of Electrostatics. May 27-29, 2009, Valencia, Spain, Contact: Dr. Pedro Segovia, Tel: (+34) 96 136 66 70, *pedro.llovera@ite.es*, website: http://electrostatics.ite.es (abstracts due Feb. 29, 2008)
- ESA-2009, June 16-19, 2009, Boston, MA Contact: Mark Horenstein, Tel: 617-353-5437, *mnh@bu.edu,* website: http://www.electrostatics.org

Current Events (cont'd.)

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