Jan/Feb 2015 • No. 229

ESA Newsletter

Electrostatics Society of America - The Friendly Society

President's Message

Dear ESA Colleagues,

I hope you all are enjoying the beginning of spring!

The ESA Annual Meeting will be held June 16-18, 2015, at Cal Poly Pomona in Pomona, California. The meeting is being hosted by Keith Forward, from the Department of Chemical Engineering at Cal Poly Pomona. Peter Ireland, from the University of Newcastle (Australia), is the Technical Program Chair for the meeting.

As usual, the 2015 Annual Meeting will have a much broader geographical reach than implied by the "America" part of our name. While two of the Keynote Speakers come from opposite corners of the country – Kim Woodrow (Univ. of Washington) and Zhong Lin Wang (Georgia Tech) – the other two Keynote Speakers come from opposite corners of the world – Matti Murtomaa (Univ. of Turku, Finland) and Leslie Yeo (RMIT Melbourne, Australia). And we will have talks given by speakers coming from every continent.

We look forward to seeing many students at the meeting. We have been keeping our student registration fees very low to make it easier for them to attend. And we will continue holding our annual student paper competition, with cash prizes. But this year we are doing even more – we are offering student travel grants. These grants are awarded on a competitive basis, and students will need to submit applications to be considered for the grants. The applications, which are due April 1, are available at the conference website: *http://electrostatics.org/conferences.html*.

Another important part of the ESA Meeting is the presentation of the ESA Awards. Please start thinking about nominating a colleague for an ESA Award. The ESA Distinguished Service Award recognizes outstanding service to the ESA and the electrostatics community, the ESA Lifetime Achievement Award recognizes outstanding contributions to the field of electrostatics, and the ESA Honorary Life Member Award recognizes exceptional and sustained contributions to both the ESA and to the field of electrostatics. More complete descriptions of these awards, as well as the nominating instructions, are given on page 4 and at *http://electrostatics.org/esaawards1.html*. Nominations must be submitted by April 15.

I hope to see you at Cal Poly Pomona in June!

Regards,
Dan Lacks
President, Electrostatics Society of America
daniel.lacks@case.edu

ESA Officers

President:
Dan Lacks, Case Western Reserve Univ.
Vice President and Awards Chair:
Shesha Jayaram, Univ. of Waterloo
Executive Council:
Sheryl Barringer, Ohio State Univ.
Kelly Robinson, Electrostatic Answers, LLC
Rajeswari Sundararajan, Purdue Univ.

Calendar

- Electrostatics 2015, April 12-16, 2015, Southampton, Solent Univ., Southampton, UK, *http://elec2015.iopconfs.org/home* Contact: IoP Electrostatics Group, +44 (0)20 7470 4800, *conferences@iop.org*
- 33rd EIC (Elec Insul Conf, IEEE-DEIS), June 7-10, 2015, Seattle, WA, USA, *http://sites.ieee.org/eic/* Contact: Bill McDermid, *wmmcdermid@hydro.mb.ca*
- ESA 2015, June 16-18, 2015, California State Polytechnic University, Pomona, CA, USA, *http://www.electrostatics.org/conferences.html* Contact: Keith Forward, *kmforward@csupomona.edu*
- 3rd ISNPEDADM, Oct. 25-30, 2015, Le Recif Hotel, Saint Gilles les Bains, Reunion, *http://isnpedadm2015.conference.univ-poitiers.fr/* Contact: Gerard Touchard, *gerard.touchard@univ-poitiers.fr*

Current Events

Electrospray thruster makes small satellites more capable

Rob Matheson

Small satellites are becoming increasingly popular tools for Earth-imaging, communications, and other applications. But they have major control issues: Once in space, they can't accurately point cameras or change orbit, and they usually crash and burn within a few months. What these satellites lack is a viable propulsion system, says MIT aeronautics and astronautics alumna Natalya Brikner PhD '15, co-founder and CEO of Accion Systems. "You can make a satellite the size of a softball with a surprising amount of capabilities, but it can't maneuver properly and falls from orbit quickly," she says. "People are waiting for a solution."

Now Accion has developed a commercial electrospray propulsion system — their first is about the size of a pack of gum — made of tiny chips that

(cont'd. p. 4)

Election of ESA Council Members

The ESA Bylaws provide for the election of officers every two years. Members vote for a complete slate of candidates at the annual meeting, and anyone is eligible to nominate or be part of a slate.

At this time, we have one nominated slate of candidates for this years election:

Slate of ESA Officers for 2015-2017
President
Shesha Jayaram, Univ. of Waterloo
Vice President
Maciej Noras, Univ. of North Carolina
Executive Council
David Go, Univ. of Notre Dame
Poupak Mehrani, Univ. of Ottowa
Rajeswari Sundararajan, Purdue Univ.

If anyone would like to nominate an alternate slate, pleaseinform me well before the June conference so that we can prepare election materials for the business meeting.

Absent an alternate slate, we will likely approve the current nominated slate by acclamation.

Dan Lacks, ESA President
daniel.lacks@case.edu

ESA Elections By-Laws - New Council Slates Are Sought

Based on Article 4 of the ESA Constitution, the term of the present ESA Council ends on June 30, 2015 and the new Council term of office begins on July 1, 2015. It is now time for the Secretary (address found on back page of this ESA Newsletter) to receive slates of nominees for the upcoming (7/1/15 - 6/30/17) term.

Since the Council shall be nominated as a full slate, the presenter of that slate is responsible for checking with all the members of that slate to insure each nominee is willing to serve. A slate consists of five members: the President, the Vice-President and three Council Members.

If more than one slate is presented to the Secretary, a ballot will be mailed out about April 30 (or as soon as reasonably possible) with the deadline for receipt of the ballots by the Secretary being May 31, 2013. If only one slate is presented (then as tradition has held) no ballots will be mailed, and the Membership present at the ESA Annual Meeting will be asked to vote on the slate. If no slates are presented, then, as Article 4b states, "If extraordinary circumstances prevent the election of a new Council, the existing Council shall continue in office, year by year, until an election can be held."

2015 Annual Meeting of the Electrostatic Society of America

California State Polytechnic University, Pomona
Pomona, CA
June 16 - 18, 2015

California State Polytechnic University, Pomona (Cal Poly Pomona) is proud to be hosting the 2015 Annual Meeting of the Electrostatic Society of America (ESA). The meeting will bring together experts across the diverse field to present the latest developments in electrostatics.

Anticipated Technical Session Topics

- Contact charging and triboelectric effects
- Gas discharges and microplasmas
- Breakdown phenomena, safety and hazards
- Electrically-induced flows and electrokinetics
- Atmospheric and space applications
- Biological and medical applications
- Electrospinning and material processing
- Measurements and instrumentation

Important Dates

March 15	Notification of abstract acceptance
May 10	Early registration deadline
May 17	Final manuscript deadline
June 16	Conference begins (9 AM)
June 17	Conference banquet (evening)
June 18	Conference ends (noon)

Keynote Speakers

- **Dr. Matti Murtomaa**, University of Turku
- **Dr. Zhong Lin Wang**, Georgia Institute of Technology
- **Dr. Kim Woodrow**, University of Washington
- **Dr. Leslie Yeo**, Royal Melbourne Institute of Technology

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

Conference Chair
Prof. Keith M. Forward
kmforward@csupomona.edu
Cal Poly Pomona

Technical Chair
Prof. Peter Ireland
peter.ireland@newcastle.edu.au
University of Newcastle

ESA Award Nominations

The ESA is accepting nominations for the following awards:

The E**SA Distinguished Service Award** recognizes outstanding service to the ESA over an extended period of time, with a demonstrated long-term commitment to the growth and continued well-being of the Society (requirement: 10 years as ESA member).

The **ESA Lifetime Achievement Award** recognizes outstanding contributions to the field of Electrostatics, as shown by the pervasiveness of the contributions in understanding certain problems or important practical benefits resulting from the work (requirement: 10 years working in field of Electrostatics).

The **ESA Honorary Life Member Award** recognizes exceptional contributions to both the ESA and to the field of Electrostatics, sustained over much of a career (requirements: 10 years as ESA member, 20 years working in field of Electrostatics).

The **Teacher of the Year Award** recognizes outstanding teachers who use Electrostatics to stimulate learning, inspire students, or otherwise encourage and energize the learning process in a formal educational setting in grades K-12 (requirement: 3 years teaching Electrostatics).

The **Student of the Year Award** recognizes middle or high school students who demonstrate outstanding achievement in Electrostatics, as showcased in laboratory projects, papers or presentations.

The ESA is also accepting nominations for induction to the Electrostatic Hall of Fame. This honor recognizes and records for posterity those individuals who have made extraordinary contributions to the field of Electrostatics. Nominees do not need to be still living. The Hall of Fame has three categories: (1) advancement of the fundamental knowledge of Electrostatics; (2) promotion of interest in the field of Electrostatics; (3) innovations using Electrostatics technology in industry.

Nominations should be submitted electronically to the ESA Award Chair, , Prof. Shesha Jayaran at *jayaram@uwaterloo.ca*, by April 15. The nomination should be in the form of a letter from an ESA member that includes a description of how the accomplishments of the nominee satisfy the award requirements (including citations of publications or patents when relevant), the contact information of the nominator and nominee, and the names and contact information of 3 other ESA members who endorse the nomination. For the Teacher and Student awards, endorsements from two faculty members of the nominee's should substitute for the ESA member endorsements

Current Events (cont'd.)

provide thrust for small satellites. Among other advantages, Accion's module can be manufactured for significantly less than today's alternatives. This technology could enable low-cost satellites, such as those known as "CubeSats," to become more viable for various commercial and research applications, including advanced imaging and communications, where numerous satellites could provide global coverage. "That requires propulsion, but something so small that it won't interfere with the small volume and resources a small satellite already has," says Accion technical advisor Paulo Lozano, an associate professor of aeronautics and astronautics who invented the underlying technology.

Ultimately, he adds, the technology could give small startups — and even countries without well-funded space programs — the opportunity to use low-cost satellites for space exploration. "It's what other people have called the 'democratization of space,'" Lozano says. "I think this will contribute to making that a reality." The other Accion co-founder is Louis Perna '09, SM '14, who co-invented the system and now leads product development.

Accion's first commercial system is MAX-1, a module comprising eight chips — each about 1 square centimeter, and 2 millimeters thick — that can be applied anywhere on a satellite. On Earth, it provides enough thrust to "move around a sheet of paper," Brikner says. But in space, it can push around a CubeSat, or a slightly larger satellite. The module has a plastic tank that stores a nontoxic, nonvolatile, liquid-salt propellant. Above the reservoir are the chips, which each have a porous substrate with about 500 pointed tips and, above that, an extractor grid with small holes. (Capillary forces cause the propellant to flow from the reservoir to the substrate tips.)

When a high voltage is applied between the tips and

grid, charged ions burst through the holes. "When you extract and accelerate these ions, that momentum exchange propels the spacecraft in the opposite direction," Brikner explains. Accion is on target to launch MAX-1 in July, and plans to start shipping the system to customers by the end of the year.

Because the module doesn't have pressurized tanks, bulky valves, or neutralizing cathodes, it has a higher thrust-to-mass ratio than low-power, plasma-based ion engines — meaning it packs a punch. In January, Accion tested a miniature version of MAX-1, called MIN-0, inside a vacuum chamber at MIT. The team measured the emitted current of the released ions after applying certain levels of voltage. From that experiment, and others, they conclude the MAX-1 can provide about 100 micronewtons of force per square meter. This is enough thrust, for example, to stabilize a CubeSat launched from the International Space Station, and to compensate for atmospheric drag, "which is the force that pulls [small satellites] into the atmosphere prematurely, where they burn up," Brikner says.

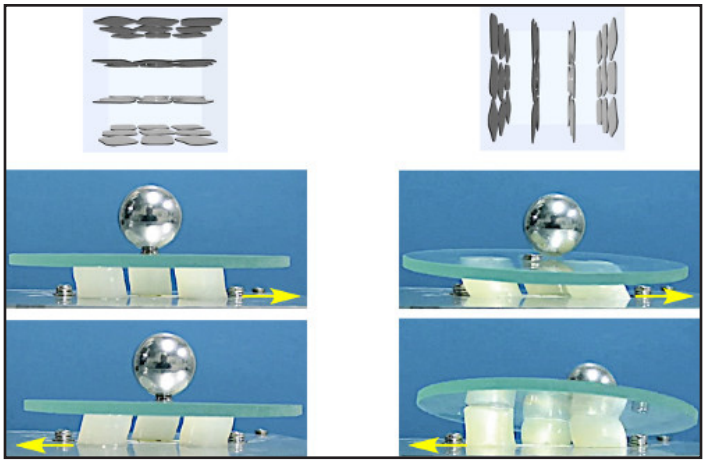
(excerpted from *http://newsoffice.mit.edu/2015/accion-systems-thruster-for-small-satellites-0311*)

A repulsive material: New hydrogel properties dominated by electrostatic repulsion

In a world-first achievement, scientists from the RIKEN Center for Emergent Matter Science in Japan, along with colleagues from the National Institute of Material Science and the University of Tokyo, have developed a new hydrogel whose properties are dominated by electrostatic repulsion, rather than attractive interactions.

According to Yasuhiro Ishida, head of the Emergent Bioinspired Soft Matter Research Team, the work began from a surreptitious discovery, that when titanate nano-sheets are suspended in an aqueous colloidal dispersion, they align themselves face-to-face in a plane when subjected to a strong magnetic field. The field maximizes the electrostatic repulsion between them and entices them into a quasi-crystalline structure. They naturally orient themselves face to face, separated by the electrostatic forces between them.

To create the new material, the researchers used the newly discovered method to arrange layers of the



sheets in a plane, and once the sheets were aligned On a mechanical oscillator, a glass stage featuring a metal sphere on a tee was supported by three cylindrical pillars of magnetically structured hydrogel containing cofacially oriented TiNSs (0.8 wt%) in parallel (g) or orthogonal (h) direction to the cylinder cross-section.

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in the plane, fixed the magnetically induced structural order by transforming the dispersion into a hydrogel using a procedure called light-triggered in-situ vinyl polymerization. Essentially, pulses of light are used to congeal the aqueous solution into a hydrogel, so that the sheets could no longer move. By doing this, they created a material whose properties are dominated by electrostatic repulsion, the same force that makes our hair stand end when we touch a Van de Graaff generator.

Up to now, manmade materials have not taken advantage of this phenomenon, but nature has. Cartilage owes its ability to allow virtually frictionless mechanical motion within joints, even under high compression, to the electrostatic forces inside it. The resultant new material, which contains the first example of charged inorganic structures that align co-facially in a magnetic flux, has interesting properties. It easily deforms when shear forces are applied parallel to the embedded nano-sheets, but strongly resists compressive forces applied orthogonally.

(excerpted from *http://phys.org/news/2014-12-repulsive-material-hydrogel-properties-dominated.html*)

ESA Information

ESA Home Page: *http://www.electrostatics.org*

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