International Low Temperature Plasma Community

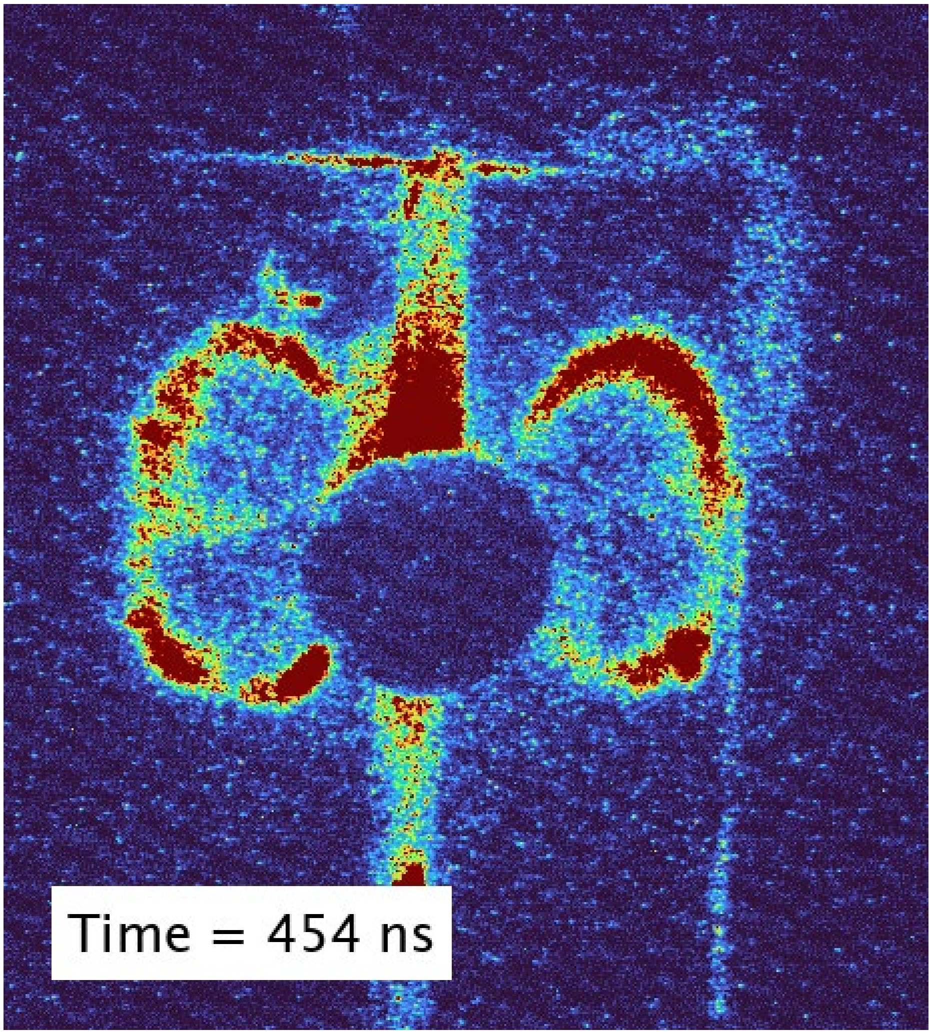
https://mipse.umich.edu/iltpc.php, iltpc-central@umich.edu

Newsletter 25

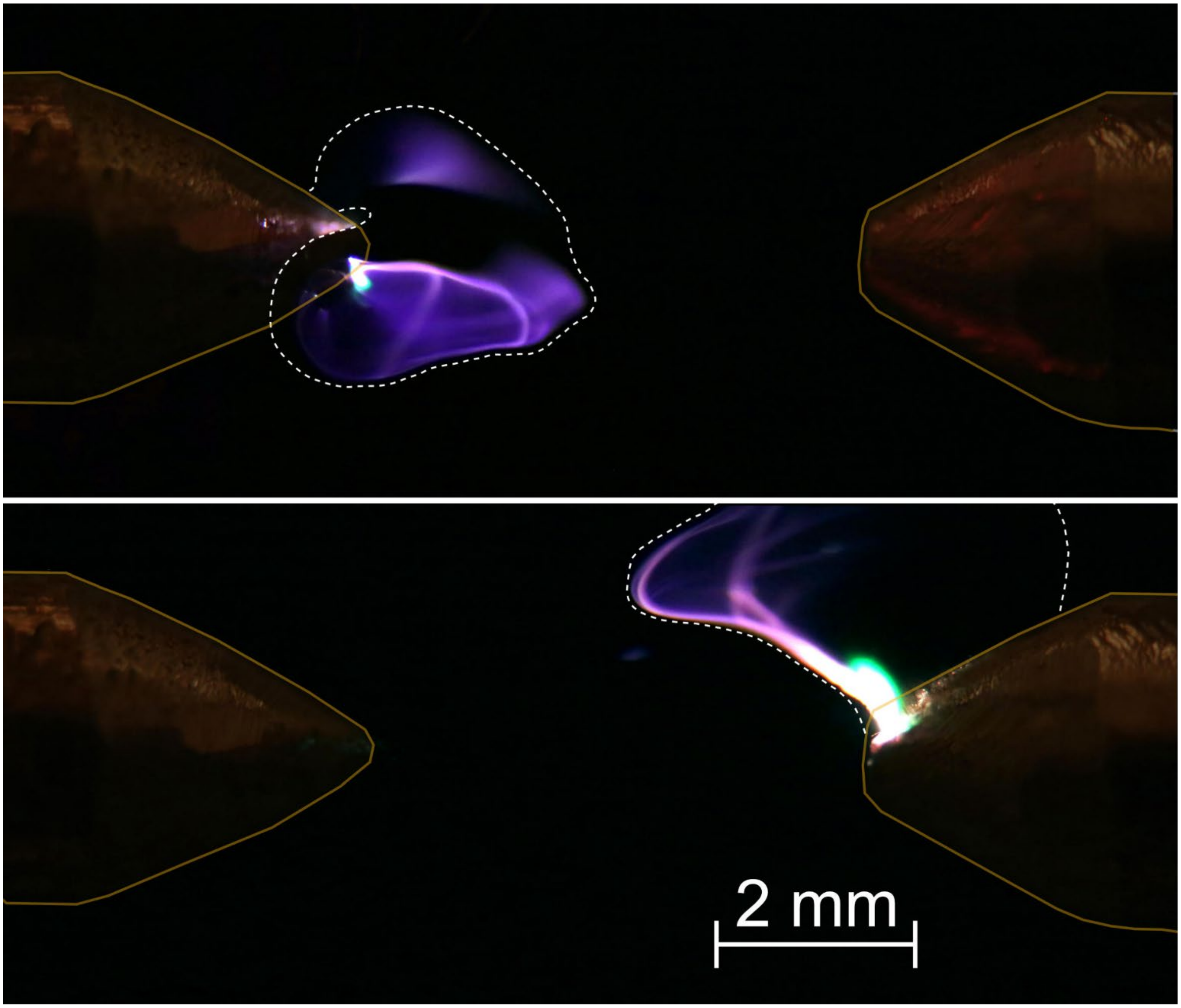
17 August 2022

Images to Excite and Inspire!

Please send your images (with a short description) to iltpc-central@umich.edu. The recommended image format is TIF, JPG, or PNG. The minimum file width is 800 px.



Surface ionization waves and plasma butterflies: An ionization wave from an atmospheric pressure plasma jet is incident onto a transparent dielectric target with a channel cut into it. The resulting surface ionization wave (SIW) is imaged from the bottom by a high speed ICCD camera. The angle that the SIW takes when escaping from the channel shows a dependence on discharge energy. The shape of this SIW is being referred to as a 'plasma butterfly'. The dark circle in the image is blocking glass to occlude the light emitted along the jet axis. **Joshua Morsell** (jkmorsel@ncsu.edu) and **Prof. Steven Shannon** (scshanno@ncsu.edu), North Carolina State University, USA.



Discharge in bubbles colliding with electrodes: The ignition of plasmas in liquids has applications ranging from medical instrumentation to manipulation of liquid chemistry. Formation of plasmas directly in a liquid often requires prohibitively large voltages to initiate breakdown. Producing plasma streamers in bubbles submerged in a liquid having a higher permittivity can significantly lower the voltage needed to initiate a discharge by reducing the electric field required to produce breakdown. The proximity of the bubble to electrodes and the shape of the bubbles play critical roles in the manner in which the plasma is produced in and propagates through the bubble. The images show rising bubbles in water, colliding with electrodes in a pin-to-pin configuration. A bright streamer outlines the edge of the colliding bubbles. Blurring in the top pane indicates a portion of bubble that is out of the field of depth along the z-axis. Dotted lines represent the inferred bubble interface. The image is part of the manuscript: "Plasma Breakdown in Bubbles Passing Between Two Pin Electrodes", Naveen Pillai et al., under review (Journal of Physics D: Applied Physics). **Nicholas Sponsel** (lsponse@ncsu.edu**)** and **Prof. Katharina Stapelmann** (kstapel@ncsu.edu), North Carolina State University, USA.

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Call for Contributions

Please submit content for the next issue of the Newsletter. Please send your contributions to iltpc-central@umich.edu by **September 23, 2022.** Please send contributions as MS-Word files if possible – and **avoid sending contributions as PDF files**.

In particular, please send **Research Highlights and Breakthroughs** using this ***template:*** https://mipse.umich.edu/iltpc/highlight_template_v05.docx. The highlight consists of an image and up to 200 words of text; please also send your image as a separate file (the recommended image format is JPG or PNG; the minimum file width is 800 px). The topic can be anything you want - a recently published work, a new unpublished result, a proposed new area of research, company successes, anything LTP-related. Please see the *Research Highlights and Breakthroughs* for examples.

LTP Perspectives: Policy, Opportunities, Challenges

An Appeal for Additional Emphasis on Applications of Low Temperature Plasma Science and Technology to Meeting Basic Human Needs

Plasma science and technology has long been at the forefront of addressing humanity's most basic needs. For more than a century, for example, plasma-based lamps have illuminated homes and public spaces worldwide, and germicidal lamps (185 nm, 254 nm) have provided a defense against bacterial and viral pathogens in hospitals and clinics. More recently, the advent of plasma medicine has shown considerable promise for effectively treating diseases that have resisted traditional approaches. The low temperature plasma community can justifiably be proud of the impact of our discipline on the advance of human welfare, but the gradual emergence of the world from the personal and economic suffering of millions during the COVID-19 pandemic is an opportune time to renew our commitment to devoting plasma technology to meeting several of the most basic needs of peoples worldwide.

Of greatest urgency is access to clean water and food. To this end, the National Academy of Engineering (USA) has identified the provision of clean water for all as one of the *Grand Challenges* for this century. Governments and nonprofits have been working feverishly for decades to provide clean water to off-grid communities in the developing world, in particular, but progress has been slow because chlorination is impractical and the digging of new wells, for example, is at best a partial solution. Over the past several years, the School of Public Health at the University of Illinois-Chicago, in partnership with the Safe Water and AIDs Project (SWAP) of Kenya and the Eden Park Foundation, has been pursuing a promising new approach to the disinfection of water that is available locally but is badly-infected (such as contaminated river water). As a result of this multiyear effort, solar-powered micro-plasma ozone generators are currently disinfecting 2000 liters of water per day in each of two systems located in western Kenya. These are small steps, but are nevertheless a reminder that large systems and national projects are not necessary to have an impact.

Many more opportunities exist for applying plasma technologies, one of which is to devise a compact, plasma-based heating source for food preparation. Over a substantial portion of the developing world, wood or other organic material is in short supply and dry animal dung serves as a fuel. Solar-powered plasma systems for dissociating water vapor to generate hydrogen would be of enormous value, even if the overall efficiency and H_2 production rates are modest. Waste management itself is a pressing matter in the developing world, and plasma treatment of bulk waste or the disinfection of wastewater are promising candidates for plasma processing.

Mosquito control, disinfection of the air in public spaces, and reducing the annual loss of grain due to spoilage are additional examples of large challenges to human welfare to which plasma technology could provide unique solutions. With regard to the latter, a significant fraction of agricultural production (fruit, vegetables, and grain) is lost each year to fungus, mold, and parasites, and groups of plasma scientists and engineers have already made impressive inroads into mitigating or eliminating these losses.

Solar-powered, water purification kiosk located in Kisumu, western Kenya. Driven by three compact microplasma generators producing 0.3 grams of O_3/hour from air, this kiosk disinfects 2000 liters of drinking water each day. Two such systems are in operation in Kisumu. (Photo courtesy of S.-J. Park)

Although considerable progress has been made to conquer these age-old threats to human health and the global economy, many challenges lie ahead but it is my conviction that plasma science and technology can make a major contribution to this effort. Now is the time to initiate coordinated international efforts to overcome the conditions that confine millions in poverty and subjected to disease or malnutrition.

Prof. J. Gary Eden
University of Illinois, USA
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Leaders of the LTP Community: Career Profiles

Dr. Vandana Miller – Bringing the Medicine into Plasma Medicine

Dr. Vandana Miller is the lead plasma medicine researcher at the Drexel University College of Medicine. As an immunologist looking to advance the field of plasma medicine, she has established numerous new collaborations to diversify and strengthen the field in a way that probably only Vandana can. She joined this research community at a time when most of us were still looking at the antimicrobial effects of plasmas. Some groups started to investigate human cell lines and reported apoptosis and necrosis after plasma treatment. Bringing her formal medical training to this field, Vandana instantly recognized a broader potential of plasma for use in medicine and was one of the first (if not the very first) to propose, investigate and ultimately verify immune-stimulatory effects of plasma. That was huge! It not only transformed how the community explained research observations, but it also opened new areas of research and was arguably one of the most important steps towards plasma oncology. Killing cells with plasma in a petri dish is easy – using plasma to stimulate the immune system to selectively kill cancer cells in primary and metastatic tumors was not imagined.

Vandana's research focus is plasma medicine. And we believe that this is the best description of her research. She is not easy to put in a drawer, neither scientifically nor personally. One of her exceptional strengths is to think outside the box and to create new connections between the "plasma" and the "medicine". It comes as no surprise then that her various research topics include plasma-assisted wound healing, plasma oncology, and even the use of plasma in treating viral infections, such as HSV and HIV. What her research areas have in common is to determine the response of cells to the plasma treatment, ranging from single cell responses to secondary and tertiary effects of recruiting immune cells and transporting the plasma effects further into tissue. She is using these studies to make progress toward understanding the mechanism of plasma-cell interaction and plasma dose for medical applications. She constantly expands the repertoire of medical models incorporating plasma treatment and maximizes their impact; from co-culture immunological studies to the "gold standard" of immunogenic cell death in animals. Vandana's contributions to the field have been truly extraordinary and every presentation she gives at a conference is eye-opening, naturally presenting novel ideas or novel connections between plasma and medicine. Even today, her infectious optimism and curiosity plant the seeds for potential applications.

Vandana is not only an exceptional researcher, she also is an awesome mentor to junior faculty, post-doctoral researchers and students. She is very perceptive, recognizing strengths (and weaknesses) and giving excellent advice accordingly. Just this year she launched Women in Plasma Medicine to establish an international network for mentoring the next generation of scientists. Her desire to advance the field is only surpassed by her overwhelming dedication to enhance the careers and personalities of her unofficial and official mentees, making her a highly valued collaborator and friend. And sometimes, you will even get a self-made, super-delicious bread when you meet with her or get invited to sit on her deck in Philadelphia.

Prof. Katharina Stapelmann, North Carolina State University, Raleigh, NC, USA, kstapel@ncsu.edu
Dr. Pietro Ranieri, Apyx Medical, Clearwater, FL, USA, pietro.ranieri@apyxmedical.com

- **Critical Aspects of Sustainability (CAS): Innovative Solutions to Sustainable Chemistry (CAS-SC) – US National Science Foundation**

The US National Science Foundation (NSF) announces the establishment of the Critical Aspects of Sustainability (CAS): Innovative Solutions to Sustainable Chemistry Program (CAS-SC), under the CAS metaprogram umbrella. The CAS-SC Program recognizes the importance of sustainable chemistry in addressing many societal challenges and aims to encourage the expansion of the Nation's research capacity in this topic area through submissions of research proposals. Proposals that emphasize a detailed and quantitative understanding of sustainable chemistry and include industrial partnerships are of particular interest.

NSF defines "sustainable chemistry" as efforts that seek to improve the efficiency with which resources are used to meet human needs for chemical products and materials while reducing use of hazardous substances and the generation of waste. This effort to minimize, reduce, and recycle includes the design of sustainable chemicals as well as sustainable materials, engineering process optimization, resource management (e.g., elimination or reduction of scarce and depletable resources such as rare earth elements, developing responsible, bio-based alternatives), and environmental remediation. Sustainable chemistry also addresses the design and discovery of safe products, while promoting safe process technology that reduces or eliminates the use and generation of hazardous substances.

International collaborations are encouraged in this and other NSF programs. Those researchers at non-US institutions should contact their colleagues at US institutions to explore such collaborations.

More information on this program can be found at:

https://beta.nsf.gov/funding/opportunities/critical-aspects-sustainability-cas-innovative-solutions-sustainable

The list of example suitable topics for investigation includes several that apply to the low temperature plasma science and engineering community. There are several NSF Divisions that participate in this program, including the Division of Physics in the Directorate for Mathematical and Physical Sciences; as well as the Divisions of Chemical Bioengineering, Environmental, and Transport Systems (CBET) and Civil, Mechanical, and Manufacturing Innovation (CMMI) in the Directorate for Engineering. These Divisions, in particular, also participate in the ECosystem for Leading Innovation in Plasma Science and Engineering (ECLIPSE https://beta.nsf.gov/funding/opportunities/ecosystem-leading-innovation-plasma-science-and-engineering-eclipse) meta-program. CAS-SC proposals to the Division of Physics should be submitted via the ECLIPSE meta-program, where proposal titles should include the prefix "ECLIPSE: CAS-SC:".

Prior to submission of a full proposal, potential research teams are required to submit a concept outline identifying the appropriate participating division where the primary research lies using the Program Suitability and Proposal Concept Tool (ProSPCT) webform at https://suitability.nsf.gov/s/.

Contacts:
Dr. Vyacheslav (Slava) Lukin, vlukin@nsf.gov
Dr. Jose Lopez, joslopez@nsf.gov
National Science Foundation, USA

- **US National Science Foundation Plasma Physics Program Semi-Annual Webinar**

  The Plasma Physics Program of the US National Science Foundation (NSF) will have its Semi-Annual webinar on Friday, September 23, 2022, 03:00 PM – 4:30 PM Eastern Time (US and Canada). The current status and future opportunities for funding of plasma physics related projects by the NSF, including international collaborations will be discussed. Register in advance for this webinar:
  https://nsf.zoomgov.com/webinar/register/WN_277t2suuQiON8js3M5xKSg
  After registering, you will receive a confirmation email containing information about joining the webinar.

  Contacts:
  Dr. Vyacheslav (Slava) Lukin, vlukin@nsf.gov
  Dr. Jose Lopez, joslopez@nsf.gov
  National Science Foundation, USA

Meetings and Online Seminars

- **Online Seminars – OLTP and IOPS**

  The *Online Low Temperature Plasma* (OLTP) seminar series and the *International Online Plasma Seminar* (IOPS) are continuing to provide the international community with regular opportunities to hear from leading researchers in the field.

  - The program of the OLTP (and links to past seminars) can be found at:
    https://theory.pppl.gov/news/seminars.php?scid=17&n=oltp-seminar-series

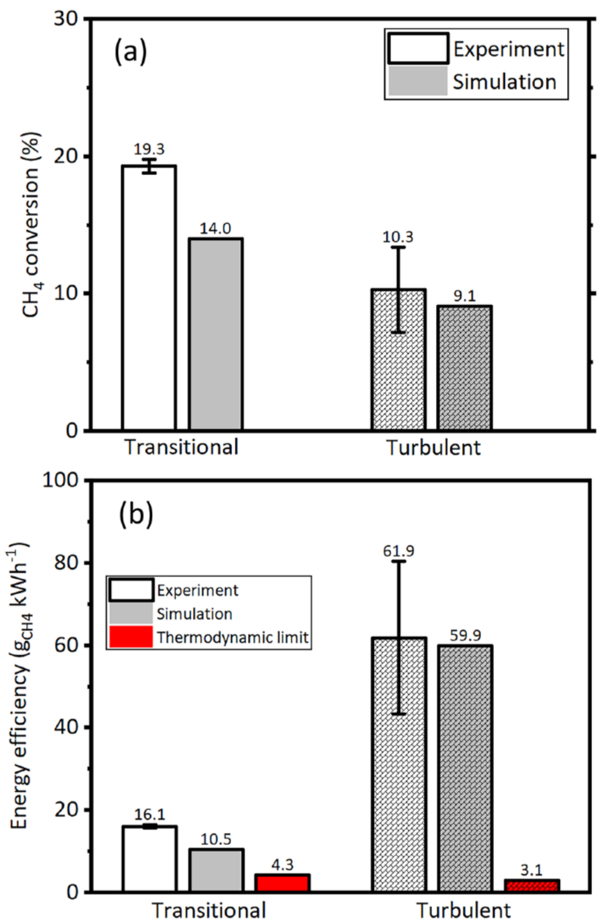
    Dr. Anne Bourdon and **Dr. Igor Kaganovich**, OLTP Co-Chairs
    anne.bourdon@lpp.polytechnique.fr, ikaganov@pppl.gov

  - The program of the IOPS (and links to past seminars) can be found at:
    http://www.apsgec.org/main/iops.php
    Dr. Kallol Bera, IOPS Chair, kallol_bera@amat.com

Community Initiatives and Special Issues

Please submit your announcement for Community Initiatives and Special Issues to iltpc-central@umich.edu.

Influence of Flow Regime on the Decomposition of Diluted Methane in a Nitrogen Rotating Gliding Arc



CH_4 conversion (a) percentage and (b) energy efficiency (b) for transitional and turbulent flow regimes estimated from experiment, simulation and thermodynamic equilibrium analysis. The gas mixture is 1% CH_4 in N_2.

This work reports on the operation of a rotating gliding arc (RGA) reactor at a high flow rate and the effect of flow regimes on its chemical performance. When the flow regime was changed from transitional to turbulent flow (5→50 SLPM), the operational mode transitioned from glow to spark type. The average electric field, gas temperature, and electron temperature increased (106→156 $V{\cdot}mm^{-1}$, 3681→3911 K, and 1.62→2.12 eV). The decomposition's energy efficiency for methane (η_E) increased by a factor of 3.9 (16.1→61.9 $g_{CH4}{\cdot}kWh^{-1}$). The first three dominant methane consumption reactions (MCR) for both the flow regimes were induced by H, CH, and CH_3 (key-species), yet differed by their contribution values. The MCR rate increased by 80–148% [induced by electron impact and singlet N_2], and decreased by 34–93% [CH, CH_3, triplet N_2], due to turbulence. The electron-impact processes generated at least 50% more of key-species and metastables for every 100 eV of input energy, explaining the increased η_E with turbulent flow. So, flow regime influences the plasma chemistry and characteristics through flow rate. The reported RGA reactor is promising to mitigate hydrocarbon emissions with high energy efficiency at a large scale while requiring some optimization to improve conversion.

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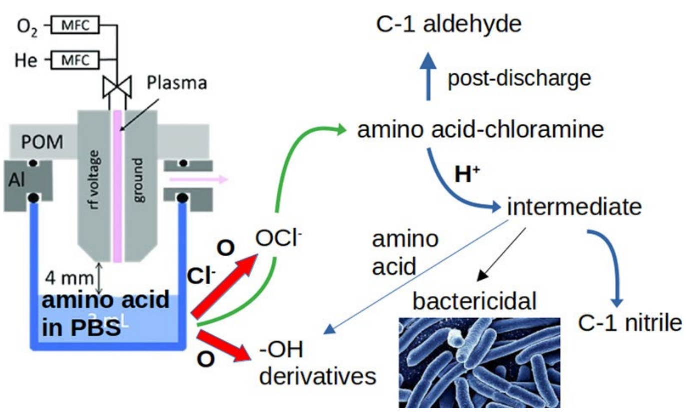
Source:

Ananthanarasimhan J., and L. Rao, Sci Rep **12**, 11700 (2022). https://doi.org/10.1038/s41598-022-14435-z

Culture Media Treated with Plasma O Atoms Forms Chloramines and Becomes Bactericidal



Scheme of the amino acide or media plasma treatment and the post-discharge events.

The principal chemical process in treated media or amino acids solution in PBS involved the formation of monochloramines and dichloramines depending on the O atoms dose. The plasma treated medium (PTM) treated with lower doses possessed post-discharge reactivity characterized by the decay of monochloramines to aldehydes during approximately 2h after the treatment. The head-space FTIR and TBA-assay confirmed the presence of aldehydes in samples (1 ml) treated for more than 10 min with a certain amount of malondialdehyde (< 2 uM). In the case of phenylalanine treatment, the presence of nitrile for higher treatment times was confirmed by HPLC. In the case of leucine, isovaleronitrile was detected by GC-MS. These findings are indirect evidence of dichloramine formation. It was further found that this dichloramine formation is connected with bactericidal properties of plasma treated amino acids towards E.coli bacteria. The bactericidal effect was also triggered even with shorter treatment times by artificial acidification of treated solution to pH 3. Such acidification promotes disproportionation of organic monochloramines to dichloramines which decay to unidentified toxic products.

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Source:
J. Phys. D **54**, 505206 (2021)
doi: 10.1088/1361-6463/ac252e;
Plasma Process. Polym. e2200079, 2022
doi: 10.1002/ppap.202200079.

Programmable Artificial Intelligence for Plasma Chemical Pathways

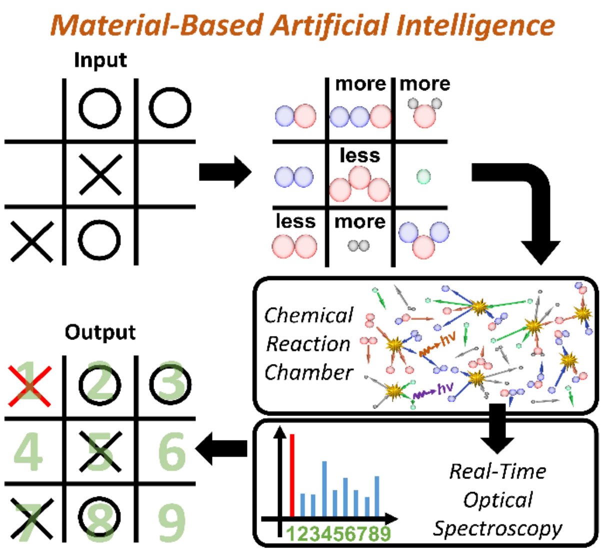

Figure 1. Material can be imbued with programmable artificial intelligence by training its chemical pathway network. As an example, plasma is trained to play a board game. The real-time board status is input by a mixture of 9 gases representing board positions. The real-time optical spectroscopy outputs the plasma's next move.

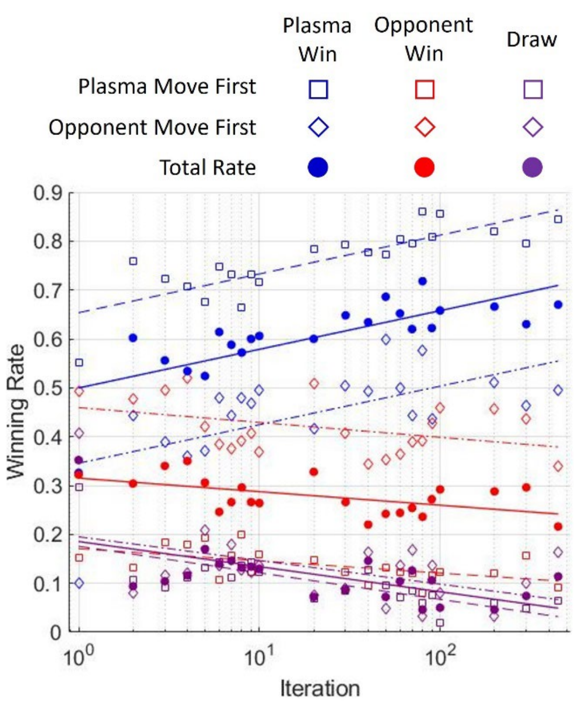

Figure 2. The winning rate of the intelligent plasma at a certain training iteration stage versus a random-move opponent in 500 games.

In a plasma chemical system, the chemical pathway network (CPN) is a map showing connections from reactants to their products. Such a network is similar to an artificial neural network (ANN) commonly used in modern machine learning technologies, where the species concentrations are the neurons and the chemical rate coefficients are the weights. The CPN can thus be trained to have intelligence like training as a ANN for artificial intelligence (AI).

A theoretical derivation of the mathematical similarity between CPN and ANN is introduced and followed by an example of training the CPN of a low-temperature plasma to play the board game Tic-Tac-Toe. In each plasma's turn, a combination of 9 gases is input to the plasma generator and each type of gas represents a position on the board. The gas mixture represents the board status by the mixing rate of each gas (Fig. 1). The plasma chemistry will thus behave accordingly and finally emit spectra indicating the plasma's next move. In Fig. 2, at the first iteration of training, the plasma has a winning rate of around 50% against its random-move opponent, meaning that the plasma plays randomly. At the 450th training iteration, the plasma's winning approached about 70%. This means that the plasma acquired an AI to play with logic and strategies. This work reveals that any matter, with substantial chemical complexity, can process information based on particle collisions, like a programmable analog computer at the molecular level.

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Source:
Adv. Intell. Syst. 2200157 (2022).
https://doi.org/10.1002/aisy.202200157

More information:
https://mpnl.seas.gwu.edu/

Coupled Antibacterial Effects of Plasma-Activated Water and Pulsed Electric Field

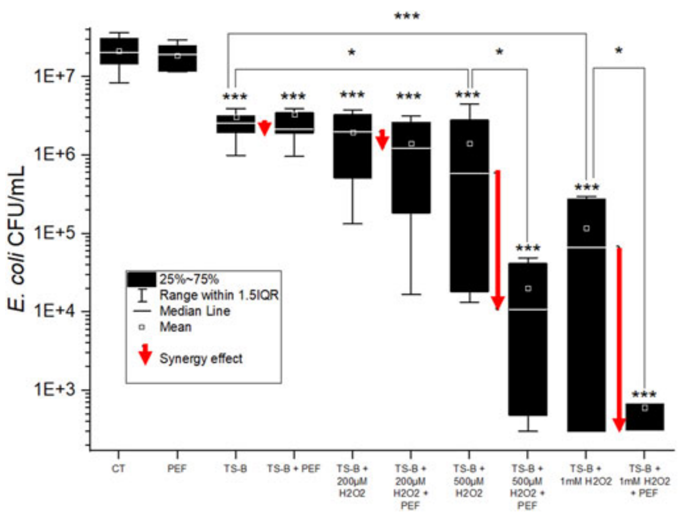

Figure 1. *E. coli* population (CFU/ml) for different treatments in PAW induced by transient spark discharge with water electrospray (TS-ES) in open air without and with adding different concentrations of H_2O_2, and without and with pulsed electric field (PEF) treatment. Boxes and whiskers show the median, mean value, interquartile range (IQR), and error bars corresponding to 1.5IQR. Red arrows indicate the bacterial population reduction due to synergy of PEF and PAW.

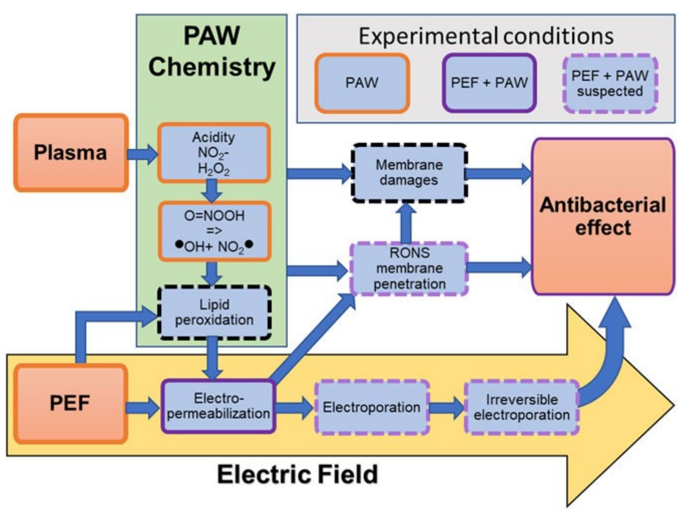

Figure 2. Summarizing schematics of the interaction between NO_2^- and H_2O_2 and bacterial incubation in PAW reinforced by the PEF treatment.

In the biomedical applications of cold plasma, the dominant biological effect is most typically attributed to the reactive oxygen and nitrogen species (RONS), while the physical effect of electric fields is sometimes overlooked. Here, we investigated the antibacterial effect of RONS in plasma-activated water (PAW) on the inactivation of *E. coli* bacteria, coupled with a mild 200-nanosecond pulsed electric field (PEF) treatment. By using transient spark discharge plasma in open atmospheric air and in closed air reactors, and by adding hydrogen peroxide (H_2O_2) into the PAW, different chemical compositions of RONS were obtained. We measured the time evolution of the concentrations of key species in the PAW post-discharge: nitrites (NO_2^-) and H_2O_2. PAW rich in both NO_2^- and H_2O_2 showed an antibacterial effect, which was enhanced by the PEF, whereas PAW rich in NO_2^- and poor in H_2O_2 showed an enhancement of the antibacterial effect by PEF only when H_2O_2 was externally added. The presence of sufficient concentrations of both NO_2^- and H_2O_2 optimized the formation of peroxynitrous acid (ONOOH), which caused a strong peroxidation of the cell membranes leading to the cell death, but it also made them more vulnerable to the PEF treatment.

The results suggest that the interaction with radicals during the bacteria exposure to PAW leads to an antibacterial effect reinforced by the PEF, hence showing a synergy of the chemical and physical plasma agents. This opens new perspectives for applications both plasma and PEF areas of research.

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Source:
Front. Phys. **10**, 895813 (2022)
https://doi.org/10.3389/fphy.2022.895813

New Resources

Please submit your announcement for New Resources to iltpc-central@umich.edu.

Career Opportunities

- **Plasma Physicist, Electric Propulsion, ThrustMe, France**

ThrustMe is a fast-growing industrial engineering startup in the space sector founded in 2017. The company made history in 2019 and 2020 with the world's first in-orbit demonstrations of iodine-fueled electric propulsion systems, technologies that will revolutionize the satellite mobility industry. As a Plasma Physicist at ThrustMe you will be a part of the research team and study new concepts, design and improve actual prototypes of the propulsion systems, leveraging these findings to deliver ground-breaking products.

Required skills and qualifications:

- PhD degree in physics or engineering (PhD students also eligible).
- Extensive knowledge of plasma physics, general coursework knowledge in other scientific or engineering disciplines.
- Hands-on experience with plasma-facing devices, including development or applied science.
- Knowledge/experience with electric propulsion systems is an asset.

Apply directly to careers@thrustme.fr submitting your CV and a motivation letter.

Contact:

Dr. Dmytro Rafalskyi
CTO, ThrustMe, France
dmytro.rafalskyi@thrustme.fr

- **Assistant Professor, Pontificia Universidad Católica de Chile, Chile**

The Institute of Physics at the Pontificia Universidad Católica de Chile (PUC) is seeking applicants for faculty positions at the Assistant Professor level. A PhD degree in Physics (or closely related areas) is required, and postdoctoral experience is highly desirable.

We are interested in outstanding candidates working on the following research areas: Condensed Matter Physics, High Energy Physics, Plasma Physics, Quantum Optics, and Mathematical Physics. Exceptional candidates working on other research areas will also be considered.

The selected candidates are expected to establish a leading research program as well as to teach at the undergraduate and graduate levels. Candidates do not need to be fluent in Spanish at the moment of applying, but need to teach in Spanish after a year of hiring.

Applicants should send the following documents to: concurso2022if@fis.uc.cl.

(1) Curriculum Vitae (with a complete list of publications)
(2) Statement of research interests and proposed research
(3) Statement of teaching interests
(4) Five representative publications
(5) At least two letters of recommendation sent directly by the recommenders to the email mentioned above.

Contact:

Prof. Felipe Veloso
Instituto de Física, Pontificia Universidad Católica de Chile, Chile
veloso.felipe@gmail.com

- **PhD Student, Plasma Physics and Chemistry, INP-Greifswald, Germany**

  The topic of this PhD project is the investigation of fundamentals of plasma-enhanced chemical vapor deposition with atmospheric-pressure plasmas at the INP-Greifswald. The central idea of our project is to make use of the special characteristics of dielectric barrier discharges with short gas-residence times to identify the main contributors to film formation. In particular, the evidences of an ionic deposition pathway will be studied in a single-filament arrangement. Your investigations will emphasize aspects of discharge physics, namely breakdown and development as well as determinations of key species densities. The project is part of a co-operation with the Technical University of Braunschweig and the department “Plasma Modeling” at our institute. The main responsibilities will be:

  - Construction of dielectric barrier discharge (DBD) reactors for surface deposition experiments.
  - Determination of argon metastable atoms by means of laser absorption spectroscopy.
  - Electrical characterization and optical emission spectroscopy of DBDs.

  Desired qualifications:

  - Master in physics, chemistry or similar subjects (at least master thesis should be submitted).
  - Fundamental knowledge of plasma physics and plasma diagnostics.
  - Experience in laser spectroscopy and/or atmospheric pressure plasma sources.
  - Enjoys working in an international team.
  - Ability to work independently, structured and meticulous with good communication skills.
  - Good English skills (spoken and written).
  - High degree of commitment, incentive, self-reliant working, ability to handle stress, team spirit, flexibility, reliability and problem-solving competence.

  Application information:
  https://inp-greifswald.dvinci-easy.com/en/jobs/20337/0485-phd-student-fmd-plasma-physics-and-chemistry

  Contact:
  Prof. Dr. Ronny Brandenburg
  Leibniz-Institute for Plasma Science and Technology (INP), Germany
  brandenburg@inp-greifswald.de

- **PhD Candidate, Atomic and Molecular Physics Group, University of Trento, Italy**

  The Atomic and Molecular Physics Group of the University of Trento (Trento, Italy) and ASML Research (Veldhoven, The Netherlands) are looking for a talented and motivated PhD candidate. The proposed PhD research project aims to understand the physical and chemical processes in a pulsed N_2-H_2 plasma generated inside EUV lithography systems. The PhD candidate is expected to design and develop optical diagnostic techniques capable of recording the time evolution of atomic radicals’ densities and temperatures. The research activity will be carried out at the University of Trento and ASML Research under the supervision of **Luca Matteo Martini** (University of Trento) and **Richard Engeln** (ASML Research).

  More information: https://molecular.physics.unitn.it/phd-position-available-2/

  Applications must be submitted through an online form at https://www.unitn.it/en/phd-nrrp-calls. **The deadline for application is August 23, 2022, 04:00 PM (Italian time, GMT +2)**.

  Contacts:
  Prof. Luca Matteo Martini, University of Trento, Italy, luca.martini.1@unitn.it
  Dr. Richard Engeln, ASML Research, The Netherlands, richard.engeln@asml.com

- **PhD Position, Electrodeless Plasma Thrusters, Universidad Carlos III de Madrid, Spain**

  Your research will consist of developing fluid/kinetic/wave models to simulate and understand the physics of electrodeless plasma thrusters and to help revolutionize their design. The contract will be funded by the recently awarded ERC Starting Grant project ZARATHUSTRA (Revolutionizing advanced electrodeless plasma thrusters for space transportation). The candidate will join the Space Propulsion and Plasmas Team (EP2, http://ep2.uc3m.es) at Universidad Carlos III de Madrid and collaborate closely with other researchers fully dedicated to the project under the supervision of **Dr. Mario Merino**.

  Minimum requirements:

  - MSc holder (or MSc student with 60 ECTS passed at contract's signature).
  - Strong background in the following disciplines: Aerospace Engineering, Plasma Physics, Fluid Dynamics, Applied Mathematics, and Scientific computing. Excellent candidates from other disciplines are also invited to apply.
  - Outstanding academic record; critical & creative thinking.
  - International experience; team-working and communications skills.
  - Good proficiency in English (oral & written).
  - Ability to deal independently and proactively with scientific and engineering challenges.

  Interested candidates must send their applications to cbackenk@pa.uc3m.es indicating in the e-mail subject the reference "ZARATHUSTRA-D5," and attaching in pdf format the following documents:

  - A motivation letter of experience, interests, and research goals (max. 1 page).
  - CV, including relevant education, experience and knowledge.
  - Sample of best works of the candidate.
  - The contact information of up to two references (will be contacted during the hiring process).

  More information: https://erc-zarathustra.uc3m.es/2022/07/08/we-are-hiring/

  Contact:
  Prof. Mario Merino
  Aerospace Engineering Department, Universidad Carlos III de Madrid, Spain
  mario.merino@uc3m.es

- **Post-doctoral Researcher, Electrodeless Plasma Thrusters and Magnetic Nozzles, Universidad Carlos III de Madrid, Spain**

  The selected candidate will study the instabilities that are present in the discharge of electrodeless plasma thrusters and magnetic nozzles, developing models and codes amenable to linear and nonlinear stability analysis techniques. The contract will be funded by the recently awarded ERC Starting Grant project ZARATHUSTRA (Revolutionizing advanced electrodeless plasma thrusters for space transportation). The candidate will join the Space Propulsion and Plasmas Team (EP2, http://ep2.uc3m.es/) at Universidad Carlos III de Madrid and collaborate closely with other researchers fully dedicated to the project under the supervision of **Dr. Mario Merino**.

  Minimum requirements:

  - PhD holder in Aerospace Engineering, Plasma Physics, Fluid Dynamics, or other relevant fields.
  - Demonstrable experience on modeling, code development, numerical analysis, postprocessing.
  - Outstanding academic record; critical and creative thinking.
  - International experience; team-working and communications skills.
  - Good proficiency in English (oral and written).
  - Ability to independently lead a research project and to deal proactively with scientific and engineering challenges.

Interested candidates must send their applications to cbackenk@pa.uc3m.es indicating in the e-mail subject the reference “ZARATHUSTRA-P1,” and attaching in pdf format the following documents:

- A motivation letter of experience, interests, and research goals (max. 1 page).
- CV, including relevant education, experience and knowledge.
- Sample of best works of the candidate
- The contact information of up to two references (will be contacted during the hiring process).

More information: https://erc-zarathustra.uc3m.es/2022/07/08/we-are-hiring/

Contact:
Prof. Mario Merino
Aerospace Engineering Department, Universidad Carlos III de Madrid, Spain
mario.merino@uc3m.es

- **Plasma Scientist/Engineer, Lam Research Corp., Tualatin, Oregon, USA**

Lam Research is seeking a plasma scientist/engineer to develop next-generation plasma reactors for plasma enhanced chemical vapor deposition (PECVD) and plasma enhanced atomic layer deposition (PEALD). The candidate will be responsible for conducting fundamental research and transferring scientific principles to industrial products.

Job responsibilities:

- Determines the direction of the next-generation plasma reactors and related technologies.
- Creates conceptual designs, builds the prototypes, characterizes the fundamental reactor properties, and proves the design concept in a timely fashion.
- Leads other engineers to convert the prototype reactors into the industry-scale production tools.
- Attends conferences and tradeshows to maintain a close relationship with experts in academia to learn the state-of-the-art technology.
- Understands requirements, roadmaps, cost, and business challenges our customers are facing and reflects those into the plasma reactor development roadmap.

Minimum qualifications:

- Ph.D. in Physics or Engineering (Chemical, Electrical, Mechanical or related fields) with 1-3 years of related work; or Master’s degree in those fields with +6 years of relevant work experience.
- Educational or work-related experiences in non-equilibrium low-temperature plasmas.

Preferred qualifications:

- Expertise in plasma source development.
- Proficiency in plasma diagnostics and automated data collection and analysis.
- Problem-solving and trouble-shooting skills.
- Ability to work independently in a highly dynamic and fast-paced environment.
- Ability to effectively communicate with colleagues in cross-functional team environment.

Contact:
Dr. Yuki Sakiyama
Lam Research Corporation, USA
yukinori.sakiyama@lamresearch.com

- **Post-doctoral Position, Physical Modeling and CFD Simulation of Turbulent Plasma Assisted Combustion, University of Minnesota, Minneapolis, USA**

  The University of Minnesota seeks outstanding candidates for a postdoctoral associate to carry out research in the Physical Modeling and CFD Simulation of Turbulent Plasma Assisted Combustion (PAC) for flare gas reforming to achieve near-zero methane emissions. Positions are generally **up to two years** but can be further renewed, depending on funding. The start date is **the earlier the better**, but applications will be reviewed until the positions are filled.

  Description of tasks and duties: Develop advanced physical models, numerical schemes, and CFD techniques for the DNS and LES of turbulent plasma assisted combustion. The postdocs will also have opportunities to participate in other exciting research conducted by both labs.

  Basic qualifications:
  - A Ph.D. in Mechanical Engineering, Aerospace Engineering, or other closely related discipline.
  - Strong publication record as a first author in peer-reviewed journal papers.
  - Ability and high self-motivation to work productively, both independently and as part of a diverse team.
  - Excellent verbal and written communication skills in English.

  Required qualifications:
  - Demonstrated experience in the modeling and simulation of turbulent combustion and/or 2D/3D PAC/nonequilibrium plasma (laminar is OK).
  - Demonstrated experience with object-oriented programming using C++, Fortran 90, and MPI.
  - Demonstrated coding experience with chemical kinetics using OpenSMOKE++, Cantera, ChemKin, or FlameMaster.

  Preferred qualifications:
  - Prior experience of coding in OpenFOAM and/or Pele for turbulent combustion CFD.
  - Prior experience of modeling and simulation of PAC or nonequilibrium plasma (0D/1D is OK if also has experience in turbulent combustion modeling and simulation): e.g., ZDPlasKin.
  - Prior experience using OpenMP and/or CUDA and/or OpenACC.

  Application materials (sent to the point-of-contact):
  - A detailed academic CV (including a list of publications).
  - A statement that highlights the research interests and skills (coding skills and experience must be described in detail with evidences).
  - One to three publications that you are most proud of.
  - Contact details of two/three references.

  Contact:
  Prof. Suo Yang
  Department of Mechanical Engineering, University of Minnesota, USA
  suo-yang@umn.edu

Collaborative Opportunities

Please submit your notices for Collaborative Opportunities to iltpc-central@umich.edu.

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Newsletter is supported by:

US National Science Foundation

US Department of Energy Office of Science

University of Michigan Institute for Plasma Science and Engineering