International Low Temperature Plasma Community

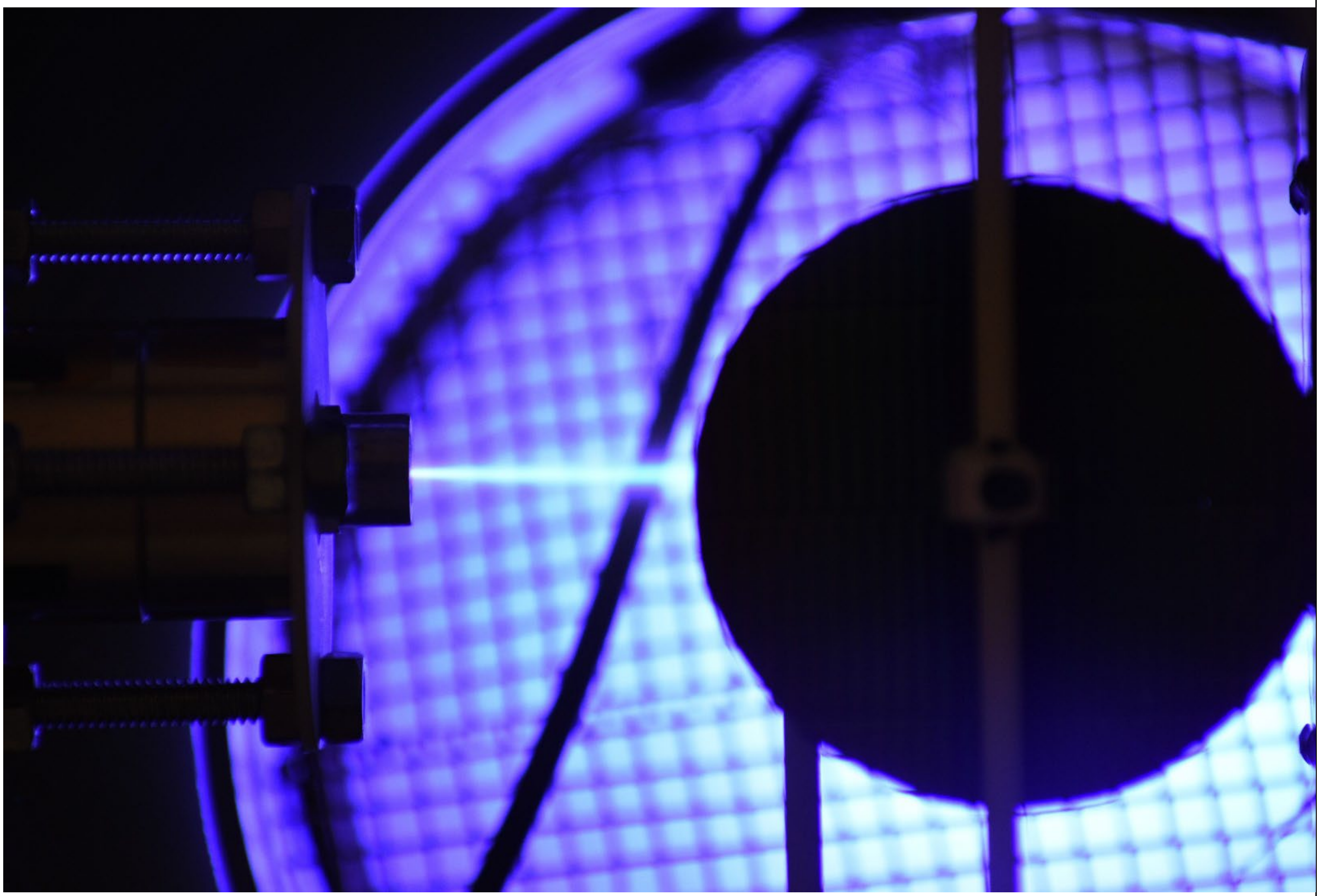
https://mipse.umich.edu/iltpc.php, iltpc-central@umich.edu

Newsletter 26

28 September 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.



Plasma Drag on Spacecraft: Plasma aerocapture is an orbit insertion method that leverages a magnetic dipole plasma to generate drag by ionizing, capturing, and deflecting atmospheric flow. A central challenge to the developing this technology is the inability of ground test facilities to simulate the high-speed (>10's of km/s) neutral particle flows experienced by the magnetized plasma. The image shows an experiment that aims to test mass and energy utilization in the plasma aerocapture flow regime. An RF plasma (background glow) recombines against a molybdenum plate, generating a flow of high-speed neutral particles towards the camera. The neutral flow interacts with a magnetized plasma (foreground glow) that is created using a hollow cathode and neodymium magnets. Drag due to the magnetized plasma is detected using a momentum flux sensor pendulum (circular surface in the foreground). Results from the experiment are at: Kelly, C. et. al, "Experimental investigation of high velocity neutral flow interaction with a magnetized plasma." Plasma Sources Sci. Tech. **31**, 065004 (2022). **Prof. Justin Little**, University of Washington, USA, littlej7@uw.edu.

In this issue:	
• Images	• Meetings and Online Seminars
• Call for Contributions	• Community Initiatives, Special Issues
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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 **November 4, 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.

Statement on Russian Invasion of Ukraine and Support of Individual Scientists

The ILTPC Newsletter is adhering to the American Physical Society (APS) policies on engagement with Russian institutions and support of individual scientists.

- The current APS Board Statement on the Russian Invasion of Ukraine: https://www.aps.org/policy/statements/russia-ukraine.cfm
- The APS Statement on the International Nature of Science and International Scientific Cooperation: https://www.aps.org/policy/statements/21_1.cfm

In following those guidelines and USA national policy, the ILTPC will at this time not publish announcements or articles promoting programs of collaboration, conferences or meetings sponsored by Russian institutions. We will accept scientific contributions from individual Russian researchers, scientists and engineers.

Defining Plasma

There is an ongoing debate among plasma physicists these days on how to make the word "plasma" familiar to the general public. Some of these discussions have recently been taking place online on an APS-DPP platform. The goal is that when a layperson reads an article where plasma (ionized gas) is mentioned he/she should know exactly what it is and does not confuse it with "blood plasma". This has been a big challenge and every time the word is mentioned it is followed by a mandatory brief description, so people would know which plasma the author is referring to. This situation does not arise for other complicated physical concepts, such as black holes or ozone layer, as examples. Most lay people understand clearly what an author or a speaker means when he/she mentions a black hole, without the need for a follow-up definition. The problem of defining plasma gets worse because each author/speaker has a different version of the definition. For example, some simply say "it is a gas that emits light", others say "if you heat a solid it becomes a liquid, then you heat the liquid it becomes a gas, then if you heat the gas it becomes plasma", and so on.

The problem with these definitions is that they may be incorrect under some conditions or confusing. For example, plasmas do not necessarily emit visible light. The second example, heating a solid, can be confusing to many non-scientists (especially children, middle schoolers, high schoolers). It gives them the impression that: 1) one has to pass through the well-known states of matter (solid, liquid, and gas) to achieve the state of plasma; 2) Plasma is "ranked" as the 4^{th} state because it comes as a 4^{th} step in matter creation. In this context and more realistically, plasma is probably the first state of matter (going back to the big bang) and gas, liquid, and solids only appeared when the universe cooled enough. Finally, why has plasma been assigned "the 4^{th} state"? Do people say first, second, or third state of matter when they talk about solid, liquid, and gas? I think not. So why assign plasma as a fourth state? In fact, there are more states of matter than just 4. In my opinion, it would be better to say that plasma is another state of matter (or one of the states of matter), different than the three more familiar states (solid, liquid, and gas).

The challenge gets even more difficult for the emerging field of plasma medicine. Most people would understandably think of blood plasma. I recently did a news search on Google by entering "plasma medicine". Most of the articles that showed up were about therapies that use blood plasma. So, I think the plasma physics community in general, and the plasma medicine community in particular, face an almost unsurmountable challenge when it comes to making "plasma" or "plasma medicine" widely known and understood terms. For now, it seems that it is imperative to include a brief description following the first mention of these words in a text or a talk. It would, however, be very helpful if a concise definition of plasma would be agreed upon and used consistently by all whenever we interact with non-scientists and especially the media. Maybe one day if fusion reactors become a reality for energy production or/and plasma becomes widely used in medical therapies, the public will certainly know plasma much better. When this happens the word plasma will be as common knowledge as the words "black hole" and "ozone layer", no follow-up definition necessary.

Prof. Mounir Laroussi
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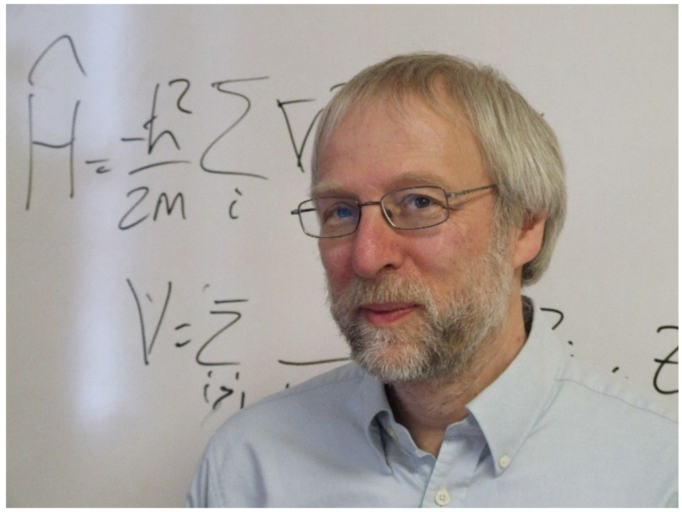
Professor Jonathan Tennyson: A Synergy of Chemistry and Physics



"So many worlds, so much to do, so little done,
such things to be". Alfred Lord Tennyson

I met Professor Jonathan Tennyson some 12 years ago, after starting my job at Quantemol. My first impressions were that Jonathan always rides his bike to University College London (around 6 miles [10 km] including a serious uphill section), has an infectious laughter and loves travelling to conferences as well as hosting a lot of visitors in his group. All of which were in contradiction to how I imagined a professor of physics to be.

His career path has been non-linear. However, that's to be expected for someone who ended up contributing to the plasma chemistry field!

Jonathan was an undergraduate at King's College, Cambridge where he gained a BA in Natural Sciences (part II Chemistry) in 1977 and a PhD in Theoretical Chemistry in 1980 at the University of Sussex. He spent two years (1980-82) as a Royal Society Western European Exchange Fellow at the University of Nijmegen in the Netherlands. In 1982 Jonathan joined the Theory Group at Daresbury Laboratory. He went on to join University College London (UCL) in Theoretical Atomic Physics in 1985.

He moved to UCL as a "New Blood" lecturer in 1985 where not only did he find out that he had become a physicist but he also discovered astronomy, which ended up being his long-term passion. Jonathan became a Professor of Physics in 1994. He was Head of the Department between 2004 and 2011 and was elected a Fellow of the Royal Society in 2009. He is currently the Massey Professor of Physics.

Jonathan's research is focused on R-matrix codes for electron/positron molecule scattering calculation (UKRMol and later UKRMol+) and astronomical spectroscopy, on which he has written a book "Astronomical Spectroscopy: An Introduction to the Atomic and Molecular Physics of Astronomical Spectra". He is currently the leader of the ERC (European Research Council) ExoMol project which provides molecular data for studies of exoplanets and other hot atmospheres.

In 2004 he founded Quantemol Ltd. Many visitors to his group wanted to use UKRMol to compute cross sections which the code calculates very well for low-energy electrons. However, they experienced a steep learning curve when trying to master working with UKRMol. Quantemol became the project which helps researchers from other academic fields and later industry to get electron molecule scattering data. As the company gained more traction among industrial users its expertise in plasma chemistry is expanding. Jonathan is still thinking of various research projects to serve the needs of the LTP community.

His entrepreneurial experience was so positive that he is co-founder and Chair of another company Blue Skies Space Ltd (BSSL). BSSL relates to his other passion, spectroscopy, and commercial astronomy spacecraft. Twinkle which will record spectra of exoplanet atmospheres is set for launch in 2025.

I believe Jonathan's career path can be an inspiration for young scientists, that your career can be a true adventure and you may never know in which field you will end up. While the most important is to remain true to yourself and follow your passion.

Anna Dzarasova
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General Interest Announcements

- **2nd United States Low Temperature Plasma Summer School (June 26-30, 2023), Ann Arbor, USA**

  The 2nd United States Low Temperature Plasma Summer School (USLTPSS) will be held June 26-30, 2023 on the campus of the University of Michigan, Ann Arbor, MI, USA. The USLTPSS is intended to provide an opportunity for graduate students and researchers new to the low temperature (LTP) field to be immersed in the fundamentals and applications of LTPs for one week and to learn from leading researchers in their field.

  The 1st USLTPSS addressed fundamentals in low and high pressure plasmas; magnetized plasmas; dusty plasmas; plasma-surface interactions; material processing; modeling and diagnostics; energy, environmental, agricultural and health applications; and electric propulsion, combustion and flow control. Hands-on sessions were held on modeling and diagnostics. Special Topics sessions addressed plasma-biofilm interactions and plasma interactions with complex surfaces. We expect the program for the 2nd USLTPSS will cover similar topics with a new set of Special Topics. An optional poster session will be held for attendees to discuss their own work. Accommodation will be provided.

  This is a "save the date" announcement. More information and registration information will be forthcoming. The ULSTPSS is sponsored by the US National Science Foundation.

  Please direct questions to **Prof. Mark J. Kushner**, mjkush@umich.edu.

  Organizers:
  Prof. Peter J. Bruggeman, University of Minnesota, USA, pbruggem@umn.edu
  Prof. Mark J. Kushner, University of Michigan, USA, mjkush@umich.edu

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

  Since the beginning of 2022, six tutorial/review seminars have been jointly organized by the OLTP and the GEC-IOPS. The next jointly organized seminars will be:

  - **Prof. Timo Gans**, October 27 (11:00 am US-EDT): "Reactive Species in Atmospheric Pressure Plasmas: Measurement and Control"

  - **Prof. Eray Aydil**, December 13 (10:00 am US-EDT): "The Role of Plasmas in the Electrification and Decarbonization of Chemical Manufacturing"

- **PLATHINIUM (Plasma Thin Film International Union Meeting), 11 – 15 September 2023, Antibes, French Riviera**

PLATHINIUM (Plasma Thin Film International Union Meeting) is now a recognized biennial meeting covering plasma physics, plasma processing and plasma applications. It emerged in 2019 from combining the former conferences CIP, ITFCP, and MIATEC.

Scientific topics:

- Plasma - deposited coatings for optical, electronical and other functionalities
- Plasmas for conversion and catalysis
- Thin films growth and modelling
- Plasmas for health, agriculture and life science
- Industrial applications of plasmas
- Plasma and liquids
- Nanomaterials and nanostructured thin films
- Process control (including plasma diagnostics, plasma modeling, new approaches in data science)
- Plasma sources and electrical discharges
- Plasma - surface interactions
- Plasma - deposited protective and tribological coatings

The call for papers opens in November 2022. Follow the conference: https://www.plathinium.com

Contacts:
Prof. Lenka Zajíčková
Conference Chair
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& Masaryk University, Brno, Czechia
lenkaz@physics.muni.cz

Prof. Corinne Champeaux
Chair of the Steering Committee
IRCER - University of Limoges, France
corinne.champeaux@unilim.fr

Community Initiatives and Special Issues

- **Special Issue of *Mathematics*: Quantum Dynamics of Strongly Coupled Systems of Particles**

  Mathematics (https://www.mdpi.com/journal/mathematics) is preparing a special issue "Quantum dynamics of strongly coupled systems of particles" that will present recent research on scientific computing in studies of strongly correlated systems of particles. From a theoretical point of view, the complex processes of interest which involve strong correlations and quantum and spin effects are difficult to treat with analytical methods. So in the last few decades, the role of scientific computing has been increasing, especially for the solution of real-world problems. The reason for success is the possibility of explicit configuration and phase space representations of the quantum many body propagator and of the density matrix for further calculations. Therefore, there has been considerable activity in the development of numerical treatment of quantum dynamics, quantum Monte Carlo methods and their combination. Papers on the application of the new and original methods of scientific computing to coulomb-plasma systems, as well as all physical systems of particles, analysis and computational performance are welcome. Manuscripts are due **January 30, 2023**.

  For more information and submission instructions, contact the Guest Editors.

  Guest Editors:
  Dr. Vladimir S. Filinov and Dr. Pavel Levashov
  vladimir_filinov@mail.ru

Micro-Vacuum Arc Thrusters

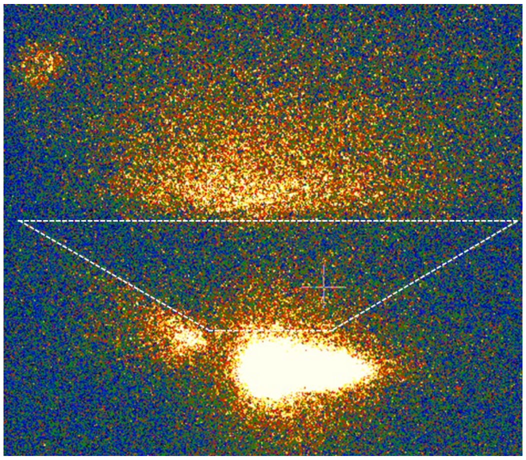

Figure 1. Plasma plume from a two-stage pulsed micro-cathode arc thruster with the second magnetoplasmadynamical (MPD) stage. A powerful discharge in the second stage creates a bright directed upwards plasma flow from the conical second-stage electrode thereby creating an average thrust of milli-newton level at thrust-to-power ratio of several tens of micro-newton per watt.

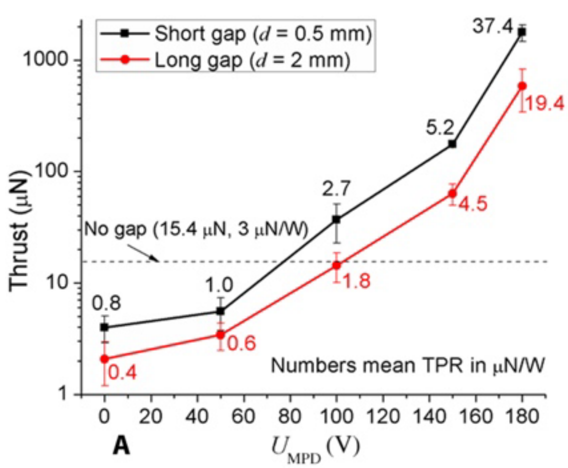

Figure 2. Results demonstrating thruster performance (thrust vs. second-stage voltage) and the change of the thruster performance.

A recently developed planar configuration of the micro-cathode vacuum art (μCAT) thruster achieves a superior combination of performance parameters: thrust (up to 1.7 mN) together with thrust to power (TPR) (up to 37 μN/W) at power below than 50 W and efficiency up to 57%. Such improvement is possible due to formation of the large-area cathode spots after applying a second-stage power to a region filled with the preliminary plasma produced during the first stage firing. This effect increases the thrust by increasing the flow rate and increasing the exhaust velocity.

The two-stage plasma thruster displays the anomalous direct (growing) "TPR vs. specific impulse Isp" trend at high Isp values in addition to "traditional" inverse behavior. Mechanism of ion acceleration is the Lorentz force while ion flow rate increases due to enhanced ion production by cathode spot in the second stage. The latter effect is due the nature of the cathodic arc that produces almost fully ionized plasma.

The presence of aforementioned trends of TPR vs. specific impulse allows multimodality at high efficiency. The combination of performance parameters achieved are superior for low-power electric propulsion devices.

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Source:

Sci. Adv. **8**, 1 (2022). https://www.science.org/doi/full/10.1126/sciadv.adc9850

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

Students from the Plasma Research Unit at the University of Pretoria Making a Difference for Africa

Students from the University of Pretoria (UP) Plasma Research Unit, *Team Tujenge*, were named the second-place winner in a competition during the *International Conference on Sustainable Development 2022*, a side-event of the United Nations (UN) General Assembly in New York City on 19 September 2022. The project developed a small-scale, solar-powered water purification system using plasma technology to provide safe drinking water to off-grid rural communities or disaster-affected areas. The "Universities for SDG 13 Award" competition is a joint venture between the UN Sustainable Development Solutions Network (SDSN) and Siemens Gamesa. The University of Pretoria hosts SDSN South Africa through its Albert Luthuli Leadership Institute.

The #universitiesforSDG13 competition started in 2022, with students from 5 global universities designing climate solutions. The UN Sustainable Development Goal (SDG) 13 addresses "Climate Action" through multiple targets. UP Team Tujenge – "Tujenge" means "Let's build" in Swahili – is made up of two PhD students (chemical engineering), and two MS students in chemical engineering and environmental management.

The winning project is one of several projects UP chemical engineers are working on that is aimed at providing easily operated, small-scale water purification systems that work without chemicals. Many villages in South Africa and on the continent do not have clean water, access to electricity. Therefore, the addition of a solar energy unit to the existing design is important to provide to rural, off-the-grid communities.

The competition was an opportunity to illustrate, once again, the role that LTP can play in bringing hope to people in Africa who struggle to access clean, drinkable water. The team's current laboratory prototype provides 120 litres of clean water every four hours in off-grid situations. There is an ongoing plan to improve the volume of water that can be treated.

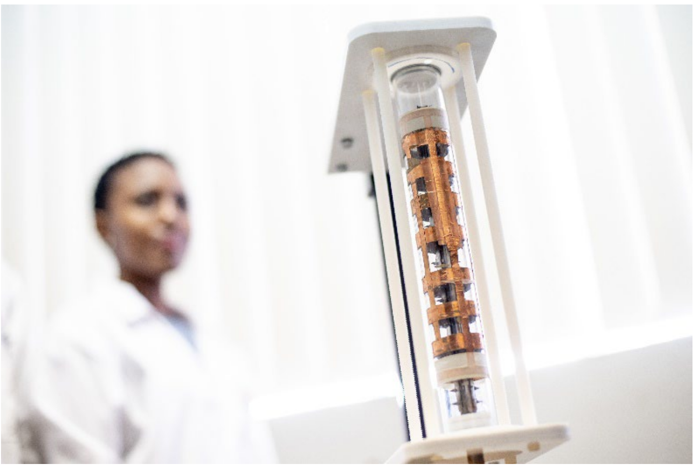

Image of the plasma unit for water purification.

Source:
https://www.youtube.com/watch?v=MeT48L99yIc

More information:
https://www.up.ac.za/usr/news/post_3102590-up-team-wins-second-place-in-international-climate-solutions-competition

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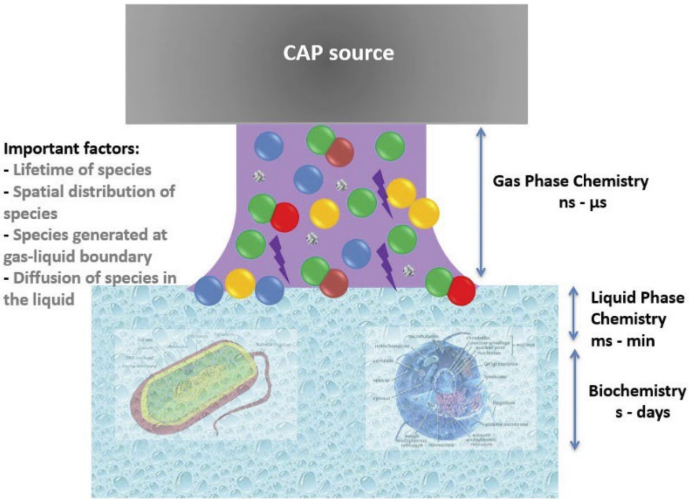
Foundations of Plasmas for Medical Applications



Schematic depiction of low temperature plasma (plasma jet) interacting with biological targets. Cells are typically covered by biological fluids, so the plasma first interacts with a liquid layer. Secondary and tertiary reaction by-products generated in the liquid then interacting with the biological cells.

Cold atmospheric plasma (CAP) entered the biomedical research field in the mid-1990s with promising results in decontamination and sterilization. Since then, the biomedical applications of plasma have expanded to plasma-assisted wound healing, cancer treatment, dentistry, cosmetics, etc.

This paper in the PSST Foundations series, presents background material and the scientific principles supporting the biomedical applications of low temperature plasma, i.e. Plasma Medicine. One of its main aims is to give introductory material and fundamental knowledge to graduate students who plan to conduct their research in the field.

Contact:

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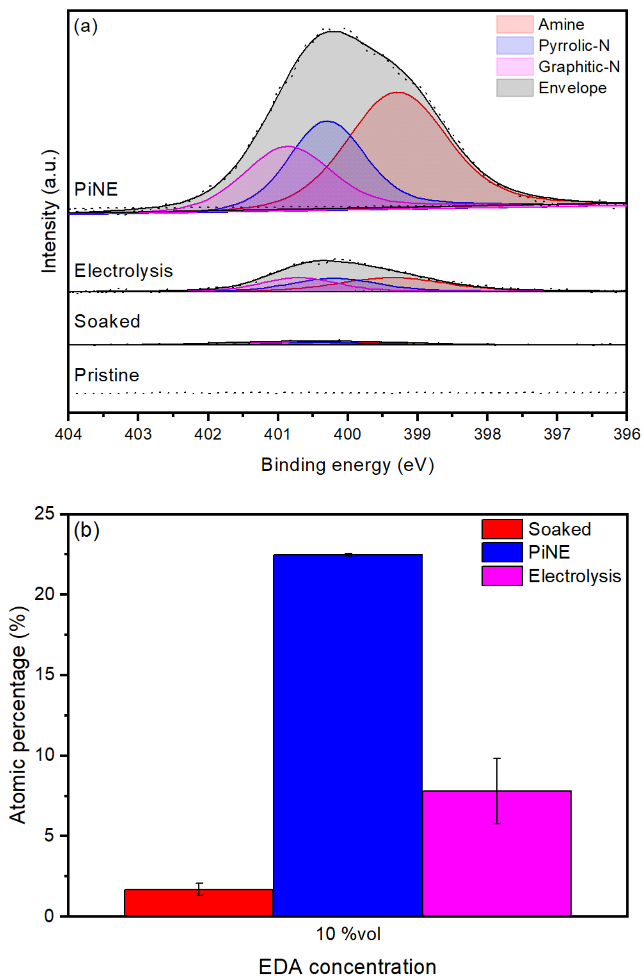
Source:

T. von Woedtke, M. Laroussi, and M. Gherardi, "Foundations of Plasma for Medical Applications", Plasma Sources Sci. Technol. **31**, 054002, (2022). https://doi.org/10.1088/1361-6595/ac604f

High Degree of N-functionalization in Macroscopically Assembled Carbon Nanotubes



X-ray photoelectron spectroscopy show that **(a)** rapid nitrogen functionalization of carbon nanotubes has been achieved by a Plasma-induced non-equilibrium electrochemistry system. **(b)** Ultra-high nitrogen contents of up to 22.5 at% are achieved in the optimised configuration, where the plasma-induced functionalization is demonstrable superior to a comparative electrolysis setup.

Nitrogen-doping of carbon nanomaterials has emerged as a method to develop novel material properties. Here we have leveraged novel and rapid plasma-induced chemical pathways to overcome the limitations of traditional functionalization such as protracted treatment times, harsh chemicals and stand limits on maximum nitrogen inclusion.

This system utilizes the direct-current plasma-generated species in an ethanol:water solution with ethylenediamine as a nitrogen precursor for the functionalization of a macroscopic ribbon-like assembly of carbon nanotubes.

These unique, plasma-generated species and pathways enable rapid and high levels of functionalization with the atomic concentration of nitrogen reaching 22.5%, the highest ever achieved. The value far surpasses a comparative electrolysis process, demonstrating the enhancement of nitrogen availability from the precursor and the resultant greater functionalization as a result of the plasma.

Contact:
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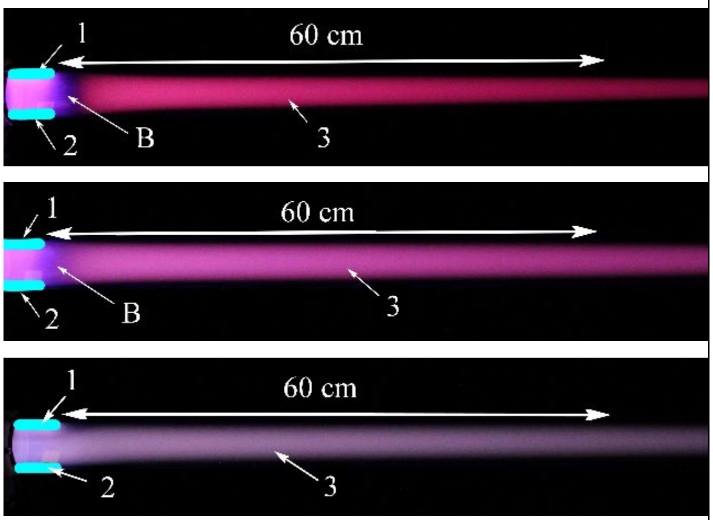
Ulster University, UK
r.mcglynn@ulster.ac.uk

Source:
J. Mater. Sci. **57**, 13314 (2022).
https://doi.org/10.1007/s10853-022-07463-7

Emission Spectra of Low-Pressure Air during a Diffuse Streamer Discharge



Images of the integral glow of the streamer discharge plasma at air pressures *p* = (top) 0.5 Torr, (middle) 0.2 Torr and (bottom) 0.04 Torr. Generator voltage amplitude is 7 kV. Images are for 1050 pulses for 0.5 Torr and 2100 pulses for the lower pressures.

Attention to the study of the radiation characteristics of streamer discharges in atmospheric air at pressures of a fraction of a Torr is primarily associated with obtaining new data on high-altitude discharges, including red sprites. Here we present results of studying the characteristics of the radiation of a streamer discharge in low-pressure air upon initiation of ionization waves (streamers) by a repetitively pulsed barrier discharge. It has been established that at air pressures of 0.08 – 3 Torr, the lines of the second positive, first negative, and first positive nitrogen systems have the highest intensities in the wavelength range of 280 – 900 nm, and their contribution to the spectral radiation energy density depends on the discharge region and pressure. The emission bands of the first positive nitrogen system give the red color of the ionization waves. However, the highest intensities under these conditions are recorded by the lines of the second positive and first negative nitrogen systems. It is shown that when the pressure decreases to 0.04 Torr or less, the spectrum and color of the streamer discharge, while maintaining the amplitude of the voltage pulses, changes significantly.

Contact:
Prof. Victor Tarasenko
Institute of High Current Electronics, Russia
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Source:
“Emission spectra of low-pressure air during a diffuse streamer discharge”, Tarasenko V.F., Baksht E.Kh., Vinogradov N.P., Sorokin D.A., under review in “Optics and Spectroscopy”.

New Resources

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

Career Opportunities

- **Process Engineer / Process Chemist, Levidian, Cambridge, UK**

  We at Levidian (https://www.levidian.com/) are looking for an expert in the field of process engineering to join our growing Research and Development section at Levidian. The role will specifically focus on parametric studies, optimizing and upscaling the current LOOP system that uses plasma technology to break down methane into hydrogen and carbon, which are then exported as hydrogen gas and high-quality graphene.

  Delivering production research and development projects: Supporting the delivery of all research projects associated with the development of Levidian patented plasma technology.

  Research strategy: Focusing on research and development activity to assist the scale up and optimisation of parameters in terms of yield and efficiency of the Levidian LOOP system.

  Thought leadership: Representing Levidian and keeping our technology market leading.

  Quality standards: Ensure that processes follow company ISO and HSEQ standards and contribute to their continuous improvement.

  Team values: Contribute to the Levidian Team:
  - Team cohesiveness, support, motivation, and confidence.
  - Contribution to broader Levidian team.

  Key relationships: The R&D Team works directly with the Engineering Team.

  This role is primarily based in our Cambridge, UK office. While you will need to be on site, we have a very flexible approach and understand that you might have responsibilities outside of work – let us know how we can accommodate your needs. Some travel is expected to customer and/or research partner locations, with limited international travel anticipated.

  The successful candidate will have a strong background in process engineering for plasma technology with a specific emphasis on plasma chemistry, stoichiometry, kinetics, and thermodynamics. Education is at the Master's level degree in Process Engineering.

  Contact:
  Dr. Adam Bennett
  Levidian Technology Centre, Cambridge, UK
  adam.bennett@levidian.com

- **Plasma Chemical Engineer / Plasma Chemist, Levidian, Cambridge, UK**

  We at Levidian (https://www.levidian.com/) are looking for an expert in the field of plasma chemical engineering to join our growing Research and Development section at Levidian. The role will specifically focus on optimising and upscaling the current LOOP production system, which uses plasma technology to break down gaseous methane into gaseous hydrogen and high-quality carbon products.

  Delivering production research and development projects: Supporting the delivery of all research projects associated with the development of Levidian patented plasma technology.

  Research strategy: Focusing on research and development activity to assist the scale up and optimisation of parameters in terms of yield and efficiency of the Levidian LOOP system.

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The successful candidate will have a strong background in plasma chemistry and chemical engineering. Specifically with emphasis on reaction stoichiometry and reaction kinetics of natural gas reforming and natural gas pyrolysis involving methane, acetylene, ethylene, ethane, propane, carbon oxides, etc.; plasma assisted pyrolysis or plasma assisted dry reformation; and optimization of reactions (ideally for graphene quality and quantity). We are looking for a person with both theoretical knowledge and experimental experience. This would ideally include working on some of the following: dusty plasma, methane plasma, non-equilibrium plasma and atmospheric plasma. They will have experience in a hands-on approach to running physical experimental iterations in a laboratory environment. Education at the Master's level degree in Chemical Engineering, Chemistry ideally related to Plasma processes.

Contact:
Dr. Adam Bennett
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adam.bennett@levidian.com

- **PhD Position, Experimental Plasma Physics, Ruhr University, Bochum, Germany**

A PhD position (m/f/d) is open in the group of Prof. Dr. Uwe Czarnetzki, Chair for Experimental Physics V, Ruhr University Bochum (RUB), https://www.ep5.ruhr-uni-bochum.de. The PhD thesis will be dedicated to electric field measurements by an Electric Field Induced Second Harmonic generation technique (EFISH) in nanosecond discharges as part of the CRC 1316 "Transient atmospheric pressure plasmas: from plasmas to liquids to solids" project (https://sfb1316.rub.de). Besides the temporally and spatially resolved EFISH measurements the PhD student will be expected to study the discharges by other experimental techniques, such as voltage/current measurements, Optical Emission Spectroscopy (OES), ICCD and Streak camera imaging, etc. The final goal of the work will be to gain fundamental understanding of transient atmospheric plasma discharges and Atmospheric Pressure Plasma Jets (APPJs), in particular.

RUB stands for diversity and equal opportunities. Therefore, we promote the cooperation of heterogeneous teams and the professional path of people who are underrepresented in the respective work areas. The RUB expressly encourages applications from women. In areas in which they are underrepresented, they will be given preferential consideration if they have the same qualifications. Applications from people with disabilities are also very welcome.

Contact:
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- **Post-Doctoral Research Fellow – Plasma for Micro-Combustion, Laboratory for Plasma Physics, Paris, France**

  The miniaturization of electromechanical engineering devices observed during the last decade requires high energy densities. These are made possible by micro-reactors based on combustion, as this process releases at least 100 times more energy than batteries. However, downscaling a reactor from macro to micro increases its area/volume ratio and, consequently, the heat and active species losses at the walls, thus reducing the stable operating range of the combustion. The project is to verify experimentally whether micro-plasma discharges in a catalytically coated micro-reactor intensify the combustion process.

  The postdoctoral fellow will be responsible for the design of the microreactor, the studies of the physics and chemistry of plasma and combustion, and the qualification of the micro-combustion regimes at atmospheric pressure of various fuels. The postdoctoral fellow will have the opportunity to use and improve several optical techniques to characterize the discharges and the combustion. Two laser systems, one nanosecond (7 ns) and the other picosecond (26 ps), will be available to develop TALIF, E-FiSH or other diagnostics.

  The postdoctoral fellow will conduct the experiments with plasma at the Laboratory for Plasma Physics (**Dr. Svetlana Starikovskaia**) and those in combustion at UCP ENSTA (**Prof. Laurent Catoire**) on the same campus. https://www.lpp.polytechnique.fr/?Plasmas-Froids&lang=en.

  Your profile:

  - You have experience in plasmas at atmospheric pressure and their characterization (laser diagnostics, fast imaging, electrical measurements).
  - You have a PhD in physics, laser diagnostics, combustion, plasma or a related discipline.
  - You have excellent theoretical and practical knowledge within one or more of the following areas: laser, plasma and combustion physics and diagnostics.
  - You have an outstanding scientific track record.
  - You have strong working skills, both autonomously and collectively, and good communication skills, in French and English, both written and oral.

  Citizenship: **EU**.

  Start date: **January 1st, 2023**.

  Duration: 1 year with possibility of prolongation for the duration of the Project **(3 years)**.

  Application: a cover letter describing your research interests, motivation and goals, (2 pages max.), your list of publications highlighting your most relevant peer reviewed works, your CV and 2 recommendation letters.

  Contact:
  Dr. Svetlana Starikovskaia
  Laboratoire de Physique des Plasmas, France
  svetlana.starikovskaia@lpp.polytechnique.fr

Collaborative Opportunities

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

Disclaimer

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