

The Newsletter of the International Low Temperature Plasma Community (ILTPC)

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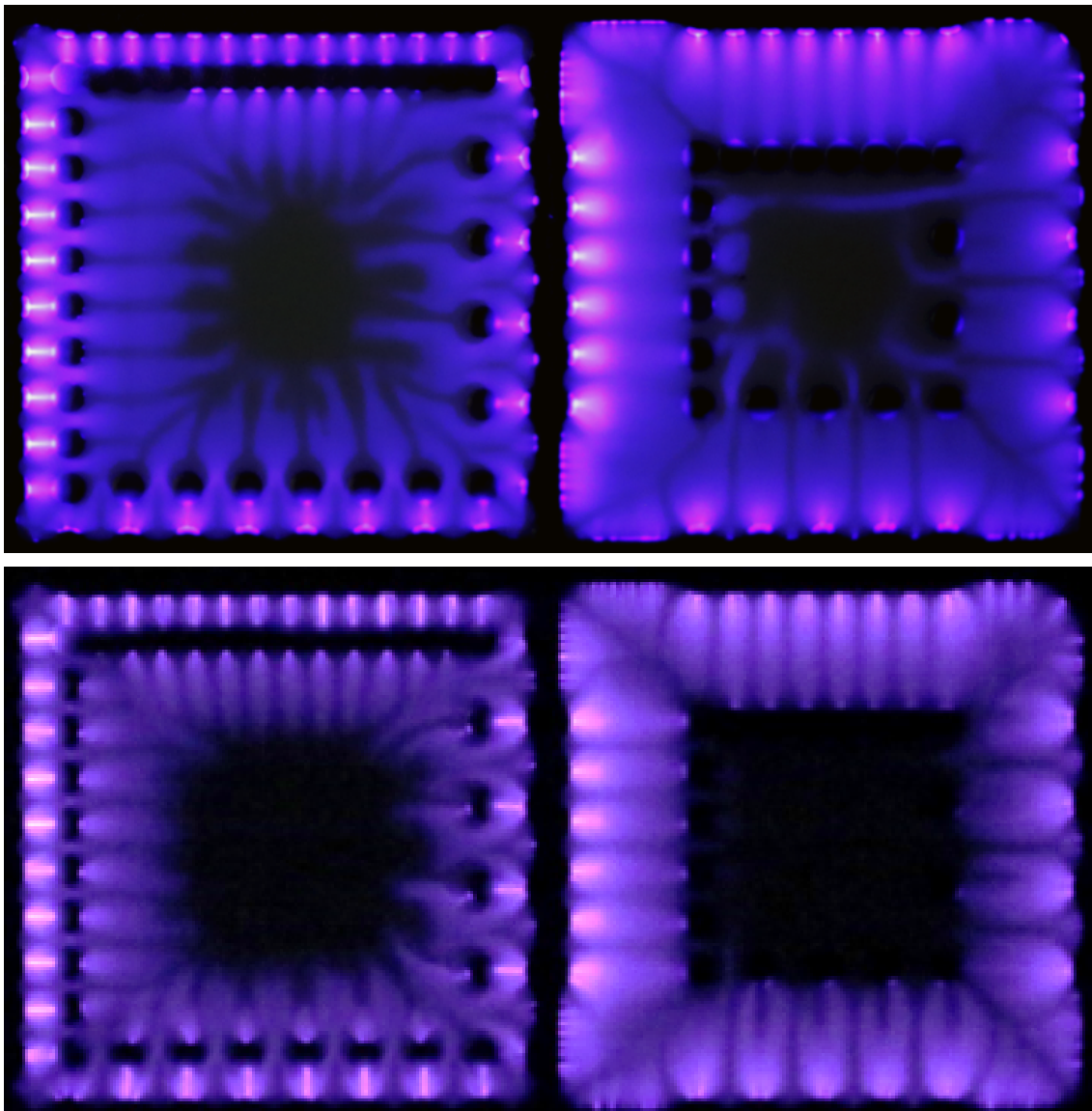
Call for Contributions

Please submit content for the next issue of the Newsletter. Please send your contributions to editor@iltpcnewsletter.org by September 20, 2024. Please send contributions as MS-Word files (*.docx) if possible. In particular, please send Research Highlights and Breakthroughs using [this template](#). You can also directly download the template in docx format [here](#). (Please do **not** send files in doc format.)

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 The topic can be anything you want - a recently published work, a new unpublished result, a proposed new area of research, company successes, anything LTP-related.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.

Images to Excite and Inspire

Please send your images (with a short description) to editor@iltpcnewsletter.org. The recommended image format is TIF, JPG, or PNG. The minimum file width is 800 px.



Photograph of the powered side of the Twin-SDBD electrode operated in synthetic air, driven by nanosecond voltage pulses (15 ns pulse width and 25 kV amplitude). The square cell area is $1 \times 1 \text{ cm}^2$. The cells contain conductive floating blocks positioned at various locations and distances from the powered grid line. The top row corresponds to 300 mbar, and the bottom row corresponds to 600 mbar.

Contact

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Chair of Applied Electrodynamics and Plasma Technology (AEPT)

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LTP Perspectives: Policy, Opportunities, Challenges

Please submit your notices for LTP Perspectives to editor@iltpcnewsletter.org.

A perspective on Bubbles

Bubbles are complicated. A lot of forces are acting on bubbles, resulting in a rising bubble changing shape and direction depending on many factors. Adding an electric field and a discharge with the respective forces does not make the system easier. A few lessons learned after spending years with the computational and experimental investigation of bubbles: Bubbles help to achieve efficient transport from the gas phase to the liquid, due to the high surface-to-volume ratio. For applications where reactive species need to be transferred into a liquid, bubbles are a good method. But does it have to be a bubble in which plasma is ignited? There are a few complications when it comes to igniting plasmas inside bubbles – the placement of the bubble with respect to the electrode, the thickness of the liquid layer between the bubble and the electrode, and the bubble shape at the position of the electrode are only a few of them. The properties of the liquid become very important up to the point where plasma cannot ignite inside a bubble if the conductivity of the liquid offers an easier path for the current. On what timescales is the voltage operating? In the nanosecond pulse regime, discharges tend to remain in a diffuse Townsend mode if the voltage pulse is short enough to prevent streamer formation. The plasma can ignite at electrode tips independent of the bubble, if conditions for cavitation are met. Moving to hundreds of nanoseconds, the conditions for cavitation are not met and the pulse is too short to facilitate Joule heating at the electrode. The bubbles have to come in close contact with the electrode, in particular when conductivity is present (i.e., every liquid but de-ionized water). In the microsecond regime and above, the time allows for Joule heating providing a gaseous zone enabling a discharge in the bubble by extending the electrode but discharges in bubbles show more variability, highlighting the intricate interplay between bubble dynamics, liquid conductivity, and voltage pulse duration.

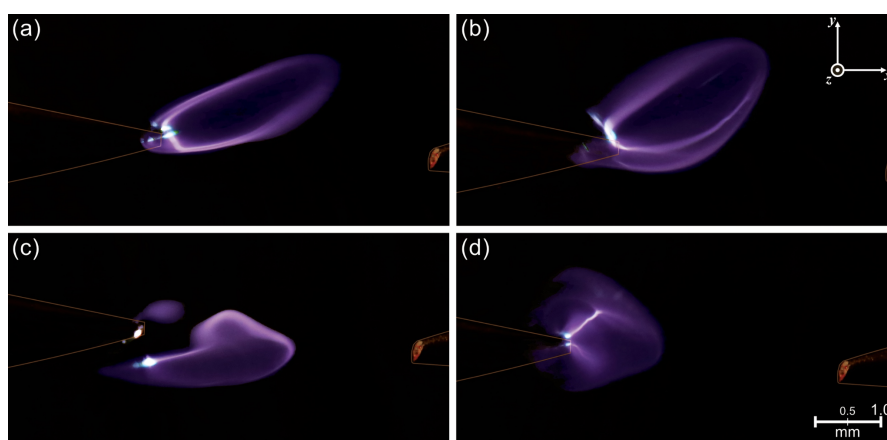


Figure: Long exposure (1s) images of propagation characteristics for multiple discharges and bubbles for an applied voltage pulse of width $\Delta t_{FWHM} \approx 10\text{ns}$. Surface-bound streamers propagate with a path that outlines the bubble boundary. If the interface is sufficiently perturbed (c) some light may be extinguished via lensing around the edge of the bubble, or (d) enough gas resides around the electrode tip to generate gas-propagating streamers. Image: Nicholas Sponsel, Dissertation, North Carolina State University 2024.

But do we actually need the plasma in the bubbles? While investigating the discharge inside bubbles is an exciting challenge, we can make our lives easier for applications. For nitrogen fixation from air, we are interested in the long-lived species nitrate and ammonium. If we just bubble “plasma-treated air” inside water, we still get the long-lived species of interest fixed into the water. In another example, bubbles can be used to move contaminants to the top of a water surface, where plasma is used in contact with the surface to degrade contaminants.

In conclusion, bubbles are exciting and fascinating. Discharges inside bubbles are either superficial or hard to investigate experimentally. For applications, it may not be necessary to use plasma inside bubbles, as the advantages of bubbles can be exploited in easier ways.

Prof. Dr. Katharina Stapelmann

North Carolina State University, Raleigh, USA

Leaders of the LTP Community: Career Profiles

Vasco Guerra Pioneering Plasma Science for Earth and Mars

Vasco Guerra is a Full Professor at the Physics Department of Instituto Superior Técnico (IST) and the Head of the Modelling and Simulation activities of the N-PRiME group at the Institute for Plasmas and Nuclear Fusion (IPFN) in Portugal. He received his MSc and PhD degrees in Physics from IST in 1994 and 1998, respectively. Early in his career, Vasco made significant contributions to the development of self-consistent models for non-equilibrium kinetics in low-temperature plasmas, including N_2 , O_2 , N_2O_2 , and ArO_2 systems, under both discharge and post-discharge conditions. His work advanced the fundamental understanding of the strong coupling between electron and vibrational kinetics, alongside chemical and ion kinetics. He led several projects on the modeling and simulation of non-equilibrium reactive plasmas, employing kinetic schemes with complex multi-species transport and radiation. Vasco has also contributed to the curation of elementary data and databases within the low-temperature plasma community while strongly involved in the development and distribution of many complete and consistent cross section sets. Interestingly, since 2004, he has also worked on the conceptualization of special relativity using simple geometrical methods, culminating in the publication of a book on the subject.



In 2016, Vasco was awarded the William Crookes Plasma Prize, co-sponsored by the European Physical Society and the Institute of Physics Publishing, "for the outstanding contribution to the modeling of molecular low-temperature plasmas." That same year, he began exploring the potential of combining non-thermal plasmas for in situ resource utilization (ISRU) on Mars, while contributing to the development of an open-source Monte Carlo code to describe electron kinetics. Accessible and open-minded, he has always been able to communicate his scientific and technical knowledge with enthusiasm and pedagogy, involving colleagues from all over the world. In 2016, he was an invited professor at Sorbonne Université, and in 2020, he held a visiting professor position from the Royal Netherlands Academy of Arts and Science. Vasco is the Director of the PhD training program APPLAuSE (Advanced Program in Plasma Science and Engineering) and he has served as Coordinator of the Integrated Master in Engineering Physics at IST, Vice-President of the Department of Physics at IST, and a member of the Governing Board of IPFN.

Although his academic pursuits could fill his entire life, Vasco carefully balances his professional and personal interests. He is an avid cyclist, often immersing himself in the stunning landscapes of France or Spain. Vasco also often promotes his group's involvement in enriching retreat-style gatherings, in which a wide range of topics are always covered. These topics can encompass everything: from the intricacies of plasma physics to the challenges of Mars colonization and the principles of special relativity, passing through the cultural delights of viniculture and olive tree cultivation in the valleys of Portugal. If not an exceptional plasma physicist, Vasco might have been a modern art critic or a gardener in the beautiful Gulbenkian Garden in Portugal. We are glad he chose the former.

Empathy is certainly the greatest quality of Vasco. He leads our group to excellence while genuinely caring about the well-being of each individual, both professionally and personally. We, his former students, current colleagues, and friends, are grateful to him for introducing us to this exciting field and for his continued support in our careers.

Tiago Silva

Universidade de Lisboa, Portugal

Tiago C. Dias

University of Michigan, US

General Interest Announcements

Please submit your notices for General Interest Announcements to editor@iltpcnewsletter.org.

UM Prize for Excellence in Plasma Science and Engineering 2024 Awarded to Prof. David Ruzic

The Michigan Institute for Plasma Science and Engineering (<https://mipse.umich.edu/>) and the University of Michigan (UM) College of Engineering (<https://www.engin.umich.edu/>) offer the UM Prize for Excellence in Plasma Science and Engineering to acknowledge

contributions to significant advances in plasma science and engineering that have or will lead to significant societal benefits. (https://mipse.umich.edu/plasma_prize.php). The Prize is international in scope and is awarded annually.

The 2024 UM Plasma Prize has been awarded to Prof. David Ruzic of the University of Illinois. Prof. Ruzic is honored “for contributions to the investigation of plasma-material interactions having significant impact on the fields of EUV (extreme ultraviolet) lithography, thin films manufacturing, and magnetic fusion.” Prof. Ruzic has a broad research portfolio addressing topics from pulsed magnetron sputtering to magnetically confined fusion. His research is supported by government agencies and industry, a blend of fundamental and applied research. As part of his industrial collaborations, Prof. Ruzic established the Illinois Plasma Institute (<https://ipi.illinois.edu/>) to enhance translational research and to provide professional development opportunities through the Master of Engineering in Plasma Engineering.

The press release for the 2024 UM Prize Awardee is at:
<https://ece.engin.umich.edu/stories/michigan-plasma-prize-honors-university-of-illinois-professor>

The call for nominations for the 2025 UM Prize will be released in January 2025.

Contact:

Michigan Institute for Plasma Science and Engineering
University of Michigan, USA
mipse-central@umich.edu

Meetings, Online Seminars, and Schools

Please submit your notices for Meetings and Online Seminars to editor@iltpcnewsletter.org.

2024 Gaseous Electronics Conference

The 77th Gaseous Electronics Conference (GEC) will be held from **September 30 – October 4, 2024**, in San Diego, California, USA.

The GEC is a leader in providing a venue for the exchange of ideas and reporting research in low-temperature plasma science and technology. The areas of emphasis are the science of plasma sources, diagnostics, modeling, plasma chemistry, basic phenomena, and atomic and molecular collision processes. GEC is often at the forefront of reporting on emergent areas of plasma-based technologies, including microelectronics, propulsion, biotechnology, plasma medicine, multiphase plasmas, environmental applications, and atmospheric-pressure plasma systems. Complete details about the 2024 GEC can be found on the conference website (<https://www.apsgec.org/gec2024/index.php>).

The 2024 GEC will feature the Will Allis Prize talk by Prof. Vincent Donnelly (University of Houston, USA), invited talks from leaders in plasma and collision science, and 5 workshops and tutorials.

Please note that the deadline for abstract submission, Student Award for Excellence nomination, and student travel grant application is June 3, 2024.

Contact:

Shahid Rauf, GEC Chair

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Venkatraman Ayyaswamy, GEC Secretary

vayyaswamy@ucmerced.edu

Online Low-Temperature Plasma (OLTP) Seminar Series

The schedule for OLTP seminars and more information on the program, including links to past seminars, can be found at the [OLTP website](#). The seminars are held on Tuesdays at 10:00 am EDT or EST via Zoom and are free to access.

Co-Chairs:

Dr. Ana Borrás

CSIC, University of Seville, Spain

anaisabel.borras@icmse.csic.es

Dr. Mohan Sankaran

University of Illinois, Urbana-Champaign, USA

rmohan@illinois.edu

IOPS Online Seminars

The International Online Plasma Seminar (IOPS) is continuing to provide the international community with regular opportunities to hear from leading researchers in the field. The program of the IOPS (and links to past seminars) can be found at: <http://www.apsgec.org/main/iops.php>. Nominations for future speakers scheduled for November 2024 to April 2025 can be submitted through this page until September 13, 2024.

Chair:

Prof. Quan-Zhi Zhang

Dalian University of Technology, China

qzzhang@dlut.edu.cn

Community Initiatives and Special Issues

Please submit your notices for Community Initiatives and Special Issues to editor@iltpcnewsletter.org.

Research Highlights and Breakthroughs

Please submit your notices for Research Highlight and Breakthroughs to editor@iltpcnewsletter.org.

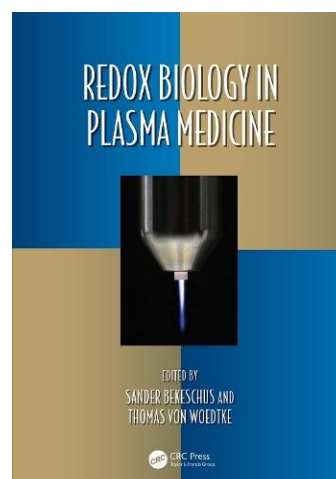
New Resources

Please submit your notices for New Resources to editor@iltpcnewsletter.org.

New Plasma Medicine Book published

On July 12, 2024, a new print and ebook edited by Sander Bekeschus and Thomas von Woedtke was published at CRC Press.

The book reviews the interrelation between plasma chemistry and biochemistry, complemented by discussion of the ways plasmas inactivate various pathogens. The focus is on the plasma effects on mammalian cells, subsequent consequences for cell-biological processes, and plasma applicability-specific medical therapies. Contributions illustrate the ways cold atmospheric-pressure plasma can be used as a controllable source of redox-active species and as a useful tool for research in redox biology.



https://www.routledge.com/Redox-Biology-in-Plasma-Medicine/Bekeschus-vonWoedtke/p/book/9781032356921?srsltid=AfmBOooao7gtWh5UH8W6w3Gfj257M74GfohGqldV_p39r4bAC4rOAuYE

Noteworthy Papers

This new section is intended to feature new noteworthy publications in the field of low-temperature plasma science that have appeared in **journals outside the standard reading repertoire of the ILTP community.**

Please submit your notices for Noteworthy Papers to editor@iltpcnewsletter.org.

Glows, arcs, ohmic discharges: An electrode-centered review on discharge modes and the transitions between them

André Anders

Applied Physics Reviews 11, 031310 (2024)

<https://doi.org/10.1063/5.0205274>

In this review, a rich field of various electrode-based discharges modes is surveyed. Discharges modes are defined by the electron emission mechanism rather than by their current and voltage levels. Beside thermionic and cathodic arcs, and glow discharges, ohmic discharges are defined as discharges where power dissipation and electron heating primarily occur in the plasma bulk, as opposed to by electrons accelerated in an electrode sheath.

Roadmap and review on plasma cancer treatment role of the immune system

Sander Bekeschus

Redox Biology 65, 102798 (2023)

<https://doi.org/10.1016/j.redox.2023.102798>

Plasma cancer treatment has been a topic of interest in plasma medicine for almost two decades. However, only in recent years have we begun to understand some of the mechanisms critical in mediating plasma anticancer effects. Importantly, an evergrowing body of experimental evidence suggests multifaceted roles of medical gas plasma-derived therapeutic ROS/RNS in targeting cancer alone or in combination with oncological treatment schemes such as ionizing radiation, chemotherapy, and immunotherapy. Intriguingly, gas plasma technology was recently unraveled to have an immunological dimension by inducing immunogenic cell death, which could ultimately promote existing cancer immunotherapies via in situ or autologous tumor vaccine schemes. Together with first clinical evidence reporting beneficial effects in cancer patients following gas plasma therapy, this work summarizes the main concepts along with the chances and limitations of medical gas plasma onco-therapy from a biological, immunological, clinical, and technological point of view.

Career Opportunities

Please submit your notices for Career Opportunities to editor@iltpcnewsletter.org.

Department of Physics Instituto Superior Técnico - University of Lisbon

Call for Expressions of Interest (2025) Professorship Positions

The Department of Physics at Instituto Superior Técnico (IST) invites Expressions of Interest (EOI) from researchers across all branches of physics (theoretical and experimental) who aspire to build international research careers and establish dynamic research groups. As a leading institution in Portugal and Europe, IST provides an exceptional research environment with outstanding students, making it an ideal setting for cutting-edge research.

This initiative seeks to identify areas of research with high growth potential for the Department of Physics. In 2025, we will launch international calls (Public Notice) to recruit primarily (not exclusively) tenure-track professors, at the Assistant Professor level.

In this call, the Department of Physics is preferentially interested in applications for three Assistant Professor positions in the following scientific areas: 'Astrophysics and Gravitation', 'Condensed Matter Physics and Nanotechnology', and 'Plasma Physics, Lasers, and Nuclear Fusion'. The Department has already committed to opening one Assistant Professor position in each of these areas.

We encourage applications from researchers with CVs demonstrating scientific achievements, exhibiting relevant publications, and proving ability to secure grants, especially from international funding organisations.

Learn more about the Department of Physics and its scientific areas on <https://fisica.tecnico.ulisboa.pt/>.

How to Express Interest:

Please send a single PDF document to eoil@fisica.tecnico.ulisboa.pt with the subject line "EOI: [Your Name]". The document should include the following items and must be addressed to Prof. Ilídio Lopes, President of the Department of Physics:

1. **Motivation letter (one page):** Clearly stating your preferred scientific area.
2. **Curriculum vitae:** Including a complete list of publications.
3. **Achievements and publications (maximum two pages):** Describe your three most significant achievements and up to five relevant publications from the past five years, detailing your specific contributions.
4. **Research and teaching statement (maximum two pages):** A concise overview of your future research plans and teaching interests.
5. **References:** Provide contact information (including email addresses) for two researchers or professors who will provide reference letters.

Reference letters should be sent directly by your referees to eoil@fisica.tecnico.ulisboa.pt

with the subject line "RL: [Your Name]". These letters should attest to your scientific, pedagogical, professional, and ethical qualities. Please ensure they are submitted before the deadline.

Additional information may be requested.

Deadline: Applications must be received by 30th September 2024 for full consideration.

IST Scientific Council Deadline: The IST Scientific Council will identify research areas of interest by the end of the first semester of 2025, with international calls expected to open by Public Notice around the Fall of 2025.

Disclaimer: This announcement does not guarantee the opening of calls for tenure-track or permanent positions.

For more details, visit <https://fisica.tecnico.ulisboa.pt/expression-of-interest>

Quantemol is seeking an experienced FORTRAN programmer with plasma modelling experience

Job Title: Computational Physicist

Job Type: Full time, Permanent

Location: UK (In-person meetings in London 2-4 times a month)

Salary: TBD

About us:

Quantemol is a leader in the plasma chemistry market for advanced software tools and consultancy services. Founded in 2004, we have established a global reputation for delivering cutting edge simulation software, comprehensive databases, and tailored consultancy services that empower researchers and industries to understand and optimise plasma processes.

Job Description:

We are seeking a highly skilled FORTRAN programmer with a strong background in plasma modelling to join our team. The successful candidate will play a crucial role in shaping the development of a new complex simulation code.

Responsibilities:

- Develop, maintain and optimise FORTRAN-based plasma codes
- Perform code validation and verification
- Work within a small team to ensure code modules successfully interface
- Document code development
- Analyse simulation outputs and provide insights

- Stay up-to-date with latest developments in low temperature plasma physics and computational modelling
- Construct plasma chemistry sets and perform plasma simulations
- Participate in customer meetings and presenting at international conferences

Requirements:

- Strong proficiency in FORTRAN programming (Modern FORTRAN preferred)
- Extensive experience in plasma physics and modelling (low temperature plasma physics a plus)
- In depth knowledge of relevant numerical methods and algorithms (FVM, FEM preferred)
- Experience in a Linux environment
- Ability to work independently and manage your own time effectively
- Strong communication skills
- PhD in plasma physics or closely related field

What We Offer:

- Competitive salary
- UK Visa sponsorship if necessary
- Opportunities for professional development
- Stimulating work environment with a focus on research and innovation
- The ability to make a large impact and help shape a small company

Quantemol is a scientific software and consultancy company with an international customer base and a small friendly team of experts based in the UK. We are providing plasma modelling solutions to the semiconductor industry and others. Our products are complicated but the results of your work have a real impact. We are facilitating innovation which can change the world. Join us on this journey!

To apply please send your CV outlining your experience and qualifications to recruitment@quantemol.com

Collaborative Opportunities

Please submit your notices for Collaborative Opportunities to editor@iltpcnewsletter.org.

Disclaimer

The content of this Newsletter comes from the contributions of members of the ILTPC. The Newsletter editors are attempting to provide as inclusive a newsletter as possible by publishing contributions from all members of the ILTPC. However, the editors may limit contributions of individual research groups to any single issue. The editors do reserve the right to not publish contributions that they deem as not being appropriate. The Newsletter

editors may do some light editing of the original submissions to maintain a consistent tone and style. The editors expect that submitting contributors have permission to share images. Inclusion of items in the Newsletter should not be interpreted as an endorsement by the editors nor as an advertisement for commercial purposes.

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