AstroPAH

A Newsletter on Astronomical PAHs

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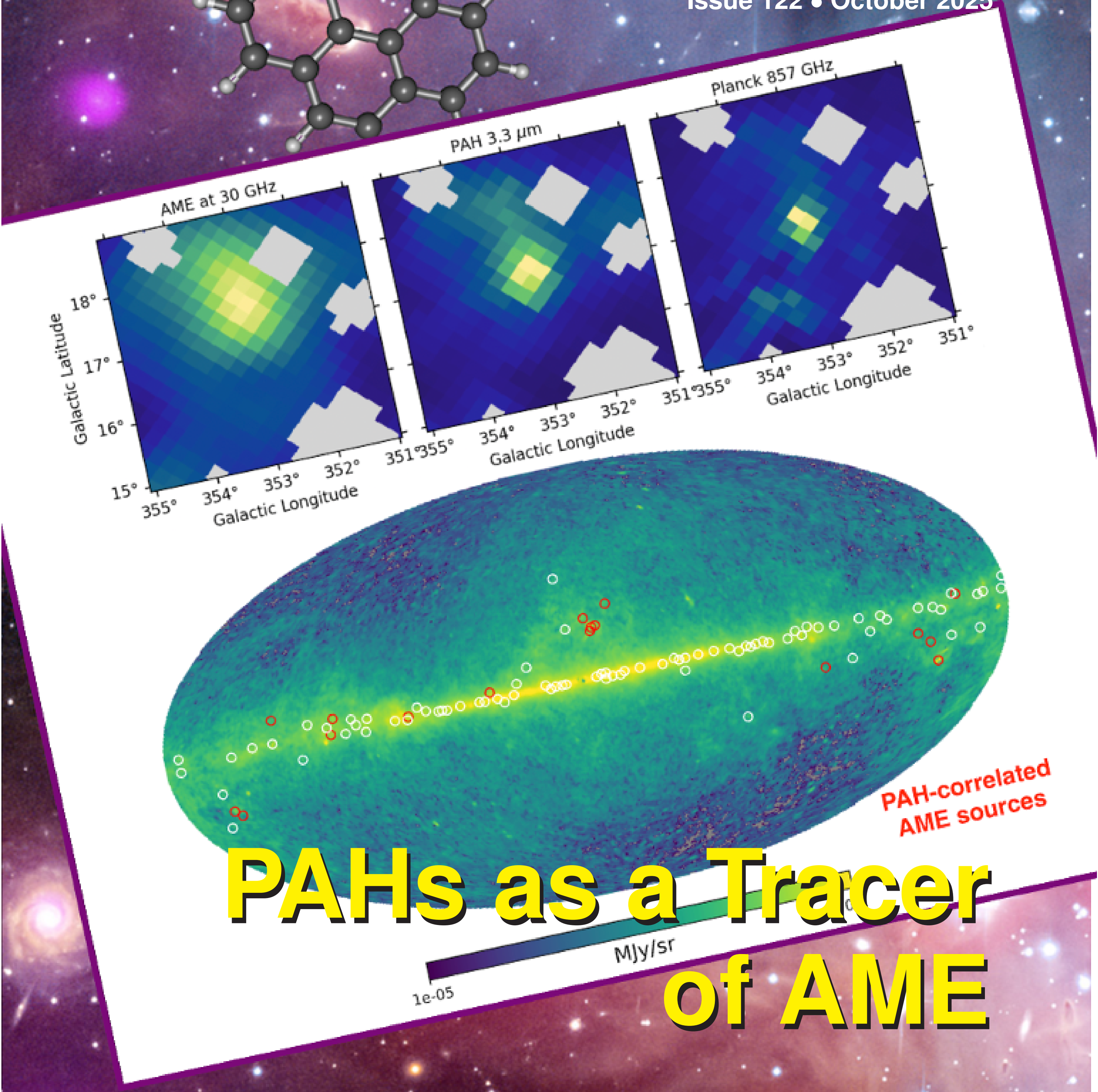

PAHs as a Tracer of AME

Editorial

Dear Colleagues,

Welcome to the 122nd issue of AstroPAH!

Our cover photo this month highlights an interesting correlation between the anomalous microwave emission (AME) mapped using data from the Planck Collaboration and PAH emission data collected by the Diffuse Infrared Background Experiment. Correlation between AME and PAH emission is observed for sources such as the Perseus Molecular Cloud and p-Ophiuchus. These data will allow the further deobfuscation of the sources of AME.

We have two In Focus sections this month. The first one presents a report on the workshop "Imagining Interstellar Ice: Across Art and Science" that was held in Rio de Janeiro, Brazil, in July to bridge the interstellar ice research and art. The second one is an interview with Dr. David Dubois, who has been an editor in AstroPAH for 7 years, as it is time for the AstroPAH editorial team to bid him farewell!

Abstracts in this issue range from the discovery of new interstellar molecules to JWST's latest glimpses of cosmic dust. Laboratory experiments, theoretical insights, and space observations together reveal how aromatic chemistry shapes our universe, from cold molecular clouds to blazing Wolf-Rayet systems. Featured in the abstracts is an article by Sponseller et al., who provided our Picture of the Month. Together, they represent the pinnacle of interdisciplinary collaboration that we strive to report on in AstroPAH.

Check out our Meetings section for two upcoming meetings: a symposium on "Exploring the Aromatic Universe in the JWST Era" in London Ontario, Canada in July 2026 and a COST Nanosphace Training School on Advanced Characterization of Carbon Materials in Benasque, Spain in January 2026.

Finally, you will find two postdoc positions in our Announcements section, one on high-resolution laser spectroscopy to work with Prof. Jinjun Liu in Louisville, KY, USA and one on observational studies of MIR evolved star with Domingo Aníbal García Hernández at Instituto de Astrofisica de Canarias, in Spain.

Thank you all for your contributions!

AstroPAH can help you promote your research. Send your contributions to our email.

The Editorial Team

Next issue: 20 November 2025.
Submission deadline: 07 November 2025.

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PAH Picture of the Month

Several foreground emission sources are observed to interfere with studies of the cosmic microwave background, the most puzzling of which is the aptly-termed anomalous microwave emission (AME). Recent work shows that, as has been hypothesized, small PAH emission can be used to help trace AME.

Credits: Background image: ESA/Webb, NASA & CSA, M. Matsuura, ALMA (ESO/NAOJ/NRAO), N. Hirano, M. Zamani (ESA/Webb), N. Bartmann (ESA/Webb). AME map images reproduced with authors' permission from Sponseller et al. (2025).

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In Focus

Imagining Interstellar Ice: Across Art and Science

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Motivation

Interstellar ice, as a phenomenon, forms hundreds of light-years away from Earth. To observe it, we rely not only on modern telescopes but also on experimental work along with computational calculations and astrochemical modeling — practices that inherently intersect with the act of imagination. On the one hand, such observations are scientifically translated into new insights into star and planet formation, as well as the possible prebiotic roots of life within their birthplaces. On the other hand, the very aesthetic and imaginative nature of these translations makes them particularly suitable for the creative speculation of artists. At what point do measuring and imagining interstellar ice intersect? Can artistic practices and scientific methodologies influence and contribute to one another?

Research, in general, requires imaginative insight and a sense of possibility. This sense of possibility allows for the exploration of imaginative possibilities in understanding interstellar ice that extend beyond what we know of water ice on Earth. We propose that imagination acts as a way to link scientific ideas and artistic practice. Therefore, we integrated our endeavor in the natural sciences with the arts and artistic research to stimulate the creative process by engaging with practice-based research through the arts and aesthetic-philosophical perspectives on the possible intersections between arts and sciences. A core motivation is to find out, in a broader sense, how the methods of research intersect between the two fields, and what forms of cooperation can be fostered from an inter- or transdisciplinary perspective, starting with imagining interstellar ice.

Presentations, interventions, and installations: how do art and science intersect around the theme of interstellar ice?

To bridge the work in the field of interstellar ice research to that of artists exploring themes of ice, astronomy, and or art-science entanglements, we organized a workshop and exhibition at Valongo Observatory in Rio de Janeiro (July 9–11, 2025) under the title: **"Imagining Interstellar Ice: Across Art and Science"** (https://ice2025.iq.ufrj.br/). Our event joined 25 participants with a program that interspersed natural scientific presentations with an artistic exhibition, lecture-performances, interventions, chemical workshops, and the pre-screening of a film.

The welcome talk was given by Karín Menéndez-Delmestre, a professor at Valongo Observatory, followed by Thanja Lamberts, an assistant professor at the Leiden Institute of Chemistry and Leiden Observatory at Leiden University, and Anke Haarmann, an artist, philosopher, professor, and coordinator of the PhDArts program at Leiden University. Throughout the workshop, we explored not only the physics and chemistry of ice formation in space but also the formation of transdisciplinary research practices across artistic and natural scientific domains. The program was designed to incorporate the plurality of perspectives and methods of research. Each participant contributed to the program with the intent of sharing an insight from their practice and research agenda in connection to the bounding theme, while attempting to bring each one's specificities into relation to one another.

The workshop therefore gave space to different formats of presentation. This very fact already highlights the commitment to bringing arts and sciences together, as the mode of presentation of insights was put into question. These ranged from an engaging scientific presentation by Diana Paula Andrade, an expert on meteorite research, who also enabled the observation of meteorites under the microscope, to the pre-screening of a new essay-film directed by Rodrigo Gontijo, with sound by Rael B. Gimenes, titled A pedra que caiu do céu. The film follows the recovery of the meteorite Bendegó that fell in the state of Bahia in Brazil and poetically intertwines its fall with ongoing political events and the emblematic fire at the National Museum in Rio de Janeiro in 2018. After each presentation, there were open spaces for questions and discussions, which proved to be quite fruitful and inspiring to the participants. For example, the dialogue following the essay-film's screening highlighted artistic research techniques such as extended documentary and sonification in contemporary music, which in turn can offer different methods and approaches to investigating scientific questions such as those pertaining to the imagination of interstellar ice.

Although each participant presented or showcased one particular aspect of their ongoing research processes, these proved to be quite fruitful in their attempt to communicate their practices to the general public. This concern is central, for example, to Eduardo Monfardini Penteado from the IAU Office for Astronomy Outreach, as well as to artist Felipe Carelli, who works mainly with video and virtual reality experiences. Through the years, they've formed a long-term collaboration in the field of science communication, culminating in projects with a shared artistic, social, and scientific agenda around the theme of astronomy from a pluriversal, cross-cultural perspective. Such discussions geared towards a broad perspective of outreach were at times counterbalanced by in-depth, highly field-specific discussions among our fields. For example, in a micro-workshop led by scientists on simulating chemical structures of interstellar ice, artists were introduced to a scientist's visual thought process, which in turn gave way to artists asking questions about kinetics and the time of said structures, evolving into a different way of looking at simulations and natural science questions.

Throughout the days, there was an ongoing concern with what turns a particular practice into research, and more importantly, how we could compose an epistemological framework where artists and scientists would collaborate together. This was the starting point for a lecture-performance and poetic intervention by artist and researcher Luiz Zanotello, which sought to shed light on the effort of translating methods between art and science by means of a performative exercise. Set outside, participants were invited to orbit the space while voicing out loud verses they would associate with their own practices of research in interaction with others. Another point of intense encounter among disciplines was during the mini-workshop on composing zines, organized by artist Maria Guadalupe Arriegue, where participants composed their own magazines and research by visually manipulating their questions as images.

These examples illustrate not only how artistic methods can uncover creativity across disciplines, but also how frequently artistic methods operate as means of knowledge production. Held in the main dome of the Valongo Observatory, an exhibition featuring the work of different artists operating in close collaboration with scientists was presented. The selected artists shared a long-term commitment to this endeavor, such as the artist Agnes Meyer-Brandis, who has dwelled in different research processes looking at things "below Earth" and things far beyond it, introducing within scientific endeavors questions, hypotheses, and interventions. Maria Guadalupe Arriegue intervened with the very telescope in the dome, co-creating with it an installation highlighting ontogenetic questions and a feminist perspective on the cosmos.

The computational approach for modeling interstellar ices via atomistic simulations was exposed in a talk by Breno R. L. Galvão, a Brazilian computational chemist. This talk illustrated how scientists try to imagine interstellar ices (periodic surfaces and cluster models) and how these models can be used to predict measurable properties of the ices, such as their catalytic effects in creating complex organic molecules. Results from his group were shown to exemplify what kind of information can be obtained by the calculations. This was later helpful on the hands-on micro-workshop, in which all participants explored and proposed ice models on computers, using simple tools such as the Avogadro software.

Franciele Kruczkiewicz, a scientist and amateur photographer, contributed with a dual approach that exemplified the workshop's commitment to bridging scientific practice and artistic inquiry. In her research, she simulates the formation of complex molecules in interstellar ices using ultra-high vacuum techniques and cryogenic temperatures, reproducing the extreme environments found in star-forming regions. As an extension of this meticulous experimental process, she developed a photographic project that documented the repetition and embodied precision of laboratory work — visually capturing the invisible temporalities of astrochemical experiments. The scientific talks that followed expanded on this trajectory.

Another talk about laboratory simulation of interstellar molecules was given by professor Wania Wolff focused on Mars atmosphere. Insights on ionization of fluorinated organic molecules and the impact on atmosphere composition was improved during the discussion.

Outcomes

The provided framework opened an interface between artistic and scientific methods of research and enlarged the doors for future transdisciplinary collaboration. We have widened our understanding of how artists and scientists in the field operate and the intersections and mismatches between artistic research and scientific methodologies. Throughout the days and in our closing discussion, it became apparent how a holistic image of research among the fields started to form beyond consolidated frameworks of action.

Open questions across art and science

The workshop itself has served as a research mechanism that generated insights through plural encounters, leading to further questions for future occasions. These research questions would be starting points for further iterations:

- Which interstellar ice mixtures can possibly exist?
- (Where and when) do measuring and imagining interstellar ice intersect?
- (How) can artists partake in scientific research, and (how) can scientists partake in artistic research?
- (When) can a tangible, factual exchange of methods take place between artistic and scientific research?
- (What) can transdisciplinary encounters between artists and scientists bring to knowledge production in the field?
- (When) do scientists use their creativity consciously?

While the project started as a means to foster collaboration between computational and laboratory astrochemistry with the arts and artistic research practice, its outcomes and questions have grown with and beyond it.

This very fact highlights the potential for fostering further encounters, both in a narrow sense (i.e. directed to interstellar ice) and in a broader sense (i.e. directed to other specific fields of inquiry). In a world and a time where much attention is given to the quantifiable measures of success and so-called “progress,” transdisciplinary actions such as this one foster an unmeasurable world rooted in collaboration, relation, and shared inspiration instead. To tackle increasingly complex problems and unimaginable phenomena, we opt for a plurality of perspectives and joint effort as a strategy of action. We therefore claim and hope for further opportunities and meeting occasions among disciplines, to widen our imaginations and research practices toward more desirable futures.

Selected images from the workshop (image credits: Luiz Zanotello).

Acknowledgements

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Prof. Thanja Lamberts is an assistant professor at the Leiden Institute of Chemistry and Leiden Observatory. Her group focuses on computational astrochemistry to unravel which molecules can be formed efficiently in the dense regions of the interstellar medium. She is particularly interested in the chemistry that takes place on the surface of ice-coated dust grains.

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Prof. Ricardo R. Oliveira is a Professor at Federal University of Rio de Janeiro working on simulations concerning surface science, chemical kinetics, spectroscopy and astrochemistry. He is currently working on project collaborations in the field of astrochemistry with the University of Leiden and also with the ”Institute of Fundamental Physics”in Madrid.

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Prof. Breno R. L. Galvão is a professor at CEFET-MG (Brazil) and Distinguished Professor at Qufu Normal University (China). His group researches the reactivity of molecules in space and models their abundances. They also work on science communication through videos on YouTube (youtube.com/JaPenso).

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Dr. Luiz G. F. Zanotello is an artist, researcher, and educator born in Brazil and living in Berlin. He is a PhD candidate in Artistic Research at the PhDArts program (Leiden University) with the University of the Arts Bremen, following six years as an Assistant Professor for New Media at UdK Berlin.

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An interview with

Dr. David Dubois

Dr. David Dubois is a research scientist at NASA Ames Research Center and is a member of the Laboratory Astrophysics and Astrochemistry group. He studies the chemistry of planetary atmospheres and cold environments in the solar system and interstellar medium, particularly how organic molecules form and what their composition is. He joined AstroPAH as an Editor in 2019.

What inspired you to become a scientist?

Initially my classes in Earth sciences, biology, and chemistry. In high school, those were the classes that got me interested the most. I took an Earth science and biology specialty, before specializing in Geology at university. The study of the Earth and all its incredibly complex features, from the biosphere and surface to its geological undergrounds was a great inspiration. All my professors who were passionate about science also inspired me. In parallel, I belonged to an astronomy club led by a Catholic priest in my hometown. That was the first exposure to space sciences and readings of historical pillars like Copernicus or Lemaître.

Can you tell us about your career path, the difficulties you have faced as a scientist to stay in the field and what has guided your current choice?

After studying Geology and Environmental Geochemistry for 4 years, I entered Planetary Science for my Masters and PhD. Then, I began a postdoc at the NASA Ames Research Center. Some difficulties have been the COVID period where many projects either had to be put on hold or changed. Adapting to these changes was at times difficult but led me to discover other research areas that I would not have necessarily thought of otherwise.

What are your current research goals?

Studying and understanding the formation of organic matter in the cold environments of the outer solar system like Saturn's moon Titan, the ice giants, as well as exoplanets and the primitive Earth. I am interested in characterizing the chemical inventory of these worlds and the low-temperature chemical reactivity of gas phase volatiles.

Which open question in Laboratory Astrophysics would you like to see answered in the near future? What are, in your opinion, the present forefronts of astrochemistry research?

Questions related to sulfur-based chemistry in the solar system and interstellar medium, as well as the role of negative ions on the growth of organic matter at low temperature. Another likely unanswerable question is whether life is contained only on earth or if it exists elsewhere. I think both answers are equally plausible, especially since the requirements for the emergence of life are so incredibly complex and no other similar environment has yet been found.

Astrochemistry is a very multidisciplinary field. Can you comment on how you collaborate and communicate with different experts and what you like about such interactions?

What I like is that I always learn from so many other specialists in the field of astrochemistry. You always find a person who is open to collaborate and can contribute to addressing the question you put forth. Be it a laser specialist, someone working at a synchrotron facility, or a computational chemist, everything is interconnected.

How do you balance your professional and personal life?

It's difficult but I try to set times at night and on the weekends where no work-related activity takes place.

What do you do outside of work?

I like to read, travel, and study philosophical and sociological topics from experts.

What advice would you give a grad student who wants a career in academia?

Although academia has been subject to recent hardships, it's really a fantastic world that gives you space and time to think and work about very unique questions, and gives you the possibility of doing so at your own rhythm. That is really a unique feature of academia, while also giving you the opportunity to meet many people who will be open to collaborate and work with you. It is a very social enterprise.

How was your experience as an editorial team member of AstroPAH?

It was a great experience of almost 7 years and the editorial team was always very pleasant to work with. AstroPAH gave me a broader exposure to the field of Astrochemistry as well as insights as to how a community editorial process works. Thank you!

Discovery of interstellar 1*H*-phenalene (*c*-$C_{13}H_{10}$): A new piece in the chemical puzzle of PAHs in space

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We present the discovery of the unsubstituted polycyclic aromatic hydrocarbon (PAH) 1H-phenalene, with molecular formula $C_{13}H_{10}$, in TMC-1 as part of the QUIJOTE line survey. This constitutes the second detection of a non-functionalized PAH in space after indene, which was discovered in the year 2021. In spite of the low dipole moment of this three-ring PAH, we managed to identify a total of 267 rotational transitions with quantum numbers J and K_a up to 34 and 14, respectively, corresponding to 71 independent frequencies. These transitions were assigned among the unknown features of the QUIJOTE survey using the same methodology employed to identify the rotational transitions of the cyano derivatives of acenaphthylene. The identification of 1H-phenalene in TMC-1 was based on the agreement between the rotational parameters derived from the analysis of the astronomical lines and those obtained by quantum chemical calculations. A subsequent chemical synthesis of this PAH in the laboratory allowed us to investigate its rotational spectrum in the 2–11 GHz frequency region using a broadband chirped pulse Fourier-transform microwave spectrometer. The rotational parameters derived from these experiments unequivocally support our identification of 1H-phenalene in TMC-1. We derived for this PAH a rotational temperature of 7.9 ± 1.2 K and a column density of $(2.8 \pm 1.6) \times 10^{13}$ cm^{-2}. The column density of 1H-phenalene in TMC-1 is similar to those found for other PAHs in the same source. The chemistry of PAHs in the ISM is still not understood, especially for medium-sized PAHs such as 1H-phenalene. Our preliminary results about the chemical formation for this molecule suggest that the ion-molecule chemistry could play a more significant role than previously expected.

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A Tale of Two Sightlines: Comparison of Hydrocarbon Dust Absorption Bands toward Cygnus OB2-12 and the Galactic Center

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Infrared spectra of hydrocarbon dust absorption bands toward the bright hypergiant Cygnus OB2-12 are compared to published spectra of the Quintuplet Cluster, a sightline to the Galactic center. The Cyg OB2-12 data include a new ground-based 2.86−3.70 µm spectrum and a previously published, but here further analyzed, spectrum of the 5.50–7.34 µm region. Higher spectral resolution data for the Cyg OB2-12 sightline in the 3 µm region allows a detailed comparison of the 3.4 µm aliphatic bands to those observed toward the Quintuplet. Despite differences in interstellar environments along each sightline, strong similarities are observed in the central wavelengths and relative strengths for bands at $\sim$ 3.3, 3.4, 5.85, 6.2, and 6.85 µm. Analysis of these bands, produced by aromatic, aliphatic, olefinic, hydrogenated, and oxygenated components, shows that carbonaceous dust is a significant component of the diffuse interstellar medium, second in abundance only to silicates, and is primarily aromatic in nature. The grains producing these bands likely consist of large aromatic carbon cores with thin aliphatic mantles composed of hydrogenated amorphous carbon (HAC). Laboratory analog spectra reproduce the observed aliphatic absorption bands well, supporting the presence of such mantles. We present evidence that the carriers of both the 3.4 µm aliphatic and the 3.3 µm aromatic bands reside exclusively in the diffuse ISM, and that the 3.3 µm bands observed in the diffuse ISM differ from those seen in dense clouds, implying chemically distinct carriers.

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Ultraviolet Spectra of Comets: Rejecting the Detection of Pentacene, Toluene and Fe^+

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A recent study announced the detection of three bands in the ultraviolet emission spectra of more than a dozen comets, assigning two of them to pentacene ($C_{22}H_{14}$) and the third one to toluene (C_7H_8). The comparison of the spectra with the results of exploitable laboratory measurements on rare-gas-matrix isolated pentacene and jet-cooled toluene does not reveal any elements that justify the assignment, which is therefore unsubstantiated. The study also claimed the detection of an Fe II line in the gas of all but one comet. Yet, spectroscopic data on Fe^+ do not corroborate the attribution. Because spectroscopic measurements on the ultraviolet emission of pentacene in the gas phase are not available, this work also presents a synthetic spectrum of the $S_5 \rightarrow S_0$ transition relevant to the wavelength range of the observations. Calculated using density functional theory and its time-dependent extension, the synthetic spectrum may facilitate the search for pentacene fluorescence in cometary spectra until laboratory measurements are accessible.

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Radical Isomerization upon Dissociative Electron Ionization of Anthracene and Phenanthrene

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Polycyclic aromatic hydrocarbons (PAHs) are abundantly present in space, as evidenced by their ubiquitous mid-IR emission bands. The grandPAH hypothesis states that small PAHs are photodissociated, while a subset of large symmetric PAHs survive the harsh environments in space. Moreover, it has been hypothesized that large aromatic molecules (C_nH_m with $n \geq 60$) can convert to buckminsterfullerene (C_{60}). In this work, we test these hypotheses by studying the products formed upon dissociative electron ionization of the two isomeric $C_{14}H_{10}$ PAHs anthracene and phenanthrene using 30 eV electrons. The fragment ions that are formed following H loss and H_2 loss are isolated in a cryogenically-cooled 22-pole ion trap and tagged with neon. Infrared predissociation spectra are recorded of the thus formed van der Waals bound complexes and the PAH dissociation fragments are identified based on a comparison with Density Functional Theory (DFT) calculated spectra. The ionized parent molecules undergo radical isomerization prior the loss of H or H_2 , resulting in the formation of a highly symmetric product ion that is identical for the two distinctly different parent PAH isomers. Moreover, the product ions are found to obey the isolated pentagon rule, which also curves fullerenes and contributes to their structural stability. We propose a mechanism for the radical isomerization based on existing molecular dynamics simulations from the literature augmented by DFT calculations. This study lends credit to the grandPAH hypothesis and shows that – even before a mere loss of one or two hydrogen atoms from a PAH – the species can isomerize drastically to form a new molecule that is highly symmetric and very stable. The latter suggests that the population of interstellar aromatic molecules may need to be reconsidered, and highly symmetric five-membered ring-bearing aromatic molecules may provide a thermochemical sink for the PAH population in photon dominated regions. Moreover, the formation of a daughter species that obeys the isolated pentagon rule suggests that there is a strong chemical link between interstellar PAHs and fullerenes.

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Resolving Emission from Small Dust Grains in the Blue Compact Dwarf II Zw 40 with JWST

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[2]Ritter Astrophysical Research Center, University of Toledo, Toledo, OH, USA
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[9]Department of Astronomy, School of Science, Graduate University for Advanced Studies (SOKENDAI), Tokyo, Japan
[10]Steward Observatory, University of Arizona, Tucson, AZ, USA
[11]Advanced Research Laboratories, Tokyo City University, Tokyo, Japan
[12]CCAPS, Cornell University, Ithaca, NY, USA
[13]Texas State University, San Marcos, TX, USA

We present James Webb Space Telescope (JWST) Near Infrared Spectrograph (NIRSpec) and Mid-infrared Instrument (MIRI) integral-field spectroscopy of the nearby blue compact dwarf II Zw 40, which has a low metallicity of 25% of solar. Leveraging the high spatial/spectral resolution and wavelength coverage of JWST/NIRSpec, we present robust detections of the 3.3 µm polycyclic aromatic hydrocarbon (PAH) emission on 20 pc scales. The strength of the Pfδ emission relative to the 3.3 PAH feature is significantly stronger than typical higher metallicity star-forming galaxies. We find that 3.3 µm PAH emission is concentrated near the northern super star cluster and is co-spatial with CO gas. A strong correlation exists between the 3.3/11.3 PAH ratio and radiation hardness probed by [NeIII]/[NeII], providing evidence of photodestruction of PAH molecules in intense radiation environments. Our analysis shows that while the overall PAH fraction is lower in II Zw 40 than in higher metallicity galaxies, the contribution of the 3.3 µm PAH feature to the total PAH emission is higher. We propose that the PAH size distribution is fundamentally shaped by two competing mechanisms in low-metallicity environments: photo-destruction and inhibited growth. Additionally, the high radiation field intensity in II Zw 40 suggests that multi-photon heating of PAHs may be an important effect. As one of the first spatially resolved studies of aromatic emission in a low-metallicity environment, our spectroscopic results offer practical guidance for future observations of the 3.3 µm PAH feature in low-metallicity galaxies using JWST.

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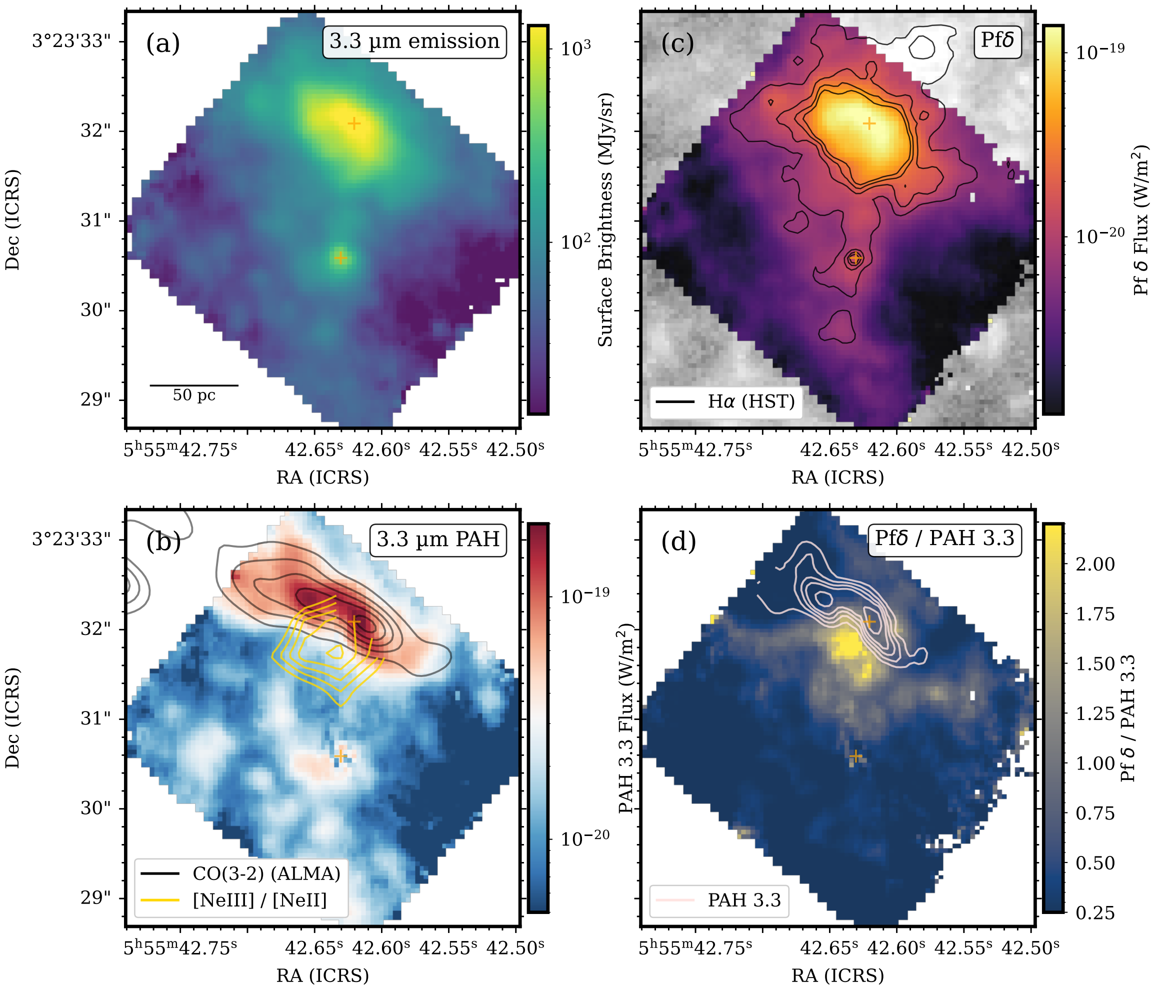
The Astrophysical Journal Letters **991**, L56 (2025)

https://arxiv.org/pdf/2509.04662



High spatial resolution maps of II Zw 40 obtained with JWST/NIRSpec IFU, showing the spatial distribution of key spectral features across the central starburst region.

Statistical Analysis of Polycyclic Aromatic Hydrocarbons as a Tracer of Anomalous Microwave Emission Using DIRBE Data

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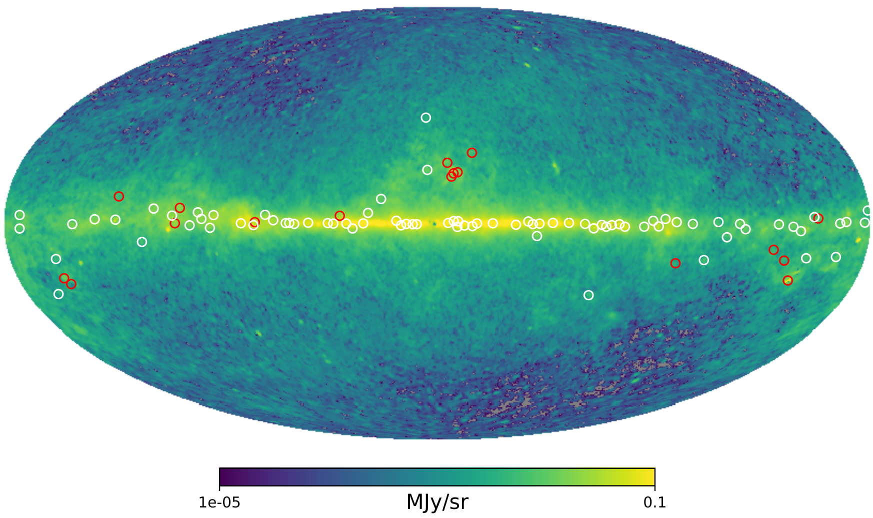
We use archival data from the Diffuse Infrared Background Experiment (DIRBE) to map the polycyclic aromatic hydrocarbon (PAH) 3.3 µm emission feature and analyze its correlation with anomalous microwave emission (AME) in 98 compact sources identified by the Planck collaboration. We find that while far-IR thermal dust emission continues to be a better tracer of AME in most of the considered regions, 17% of the AME sources are better correlated with emission from small PAHs as traced by DIRBE. Furthermore, of the 27 sources that were identified as highly significant AME detections in the Planck analysis, 37% prefer PAHs as an AME tracer. Further work is required to understand to what extent local interstellar conditions are affecting PAH emission mechanisms and to reveal the underlying carriers of AME.



Total AME at 30 GHz derived from Planck data. Circles indicate the 98 considered AME regions, with those in red being better correlated with PAHs than with thermal dust emission.

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Infrared Study of Electron-bombarded Phenanthrene ($C_{14}H_{10}$)/*Para*-H_2 Matrices: Isomers of Protonated Phenanthrene (1-, 3-, 4-, and 9-$H^+C_{14}H_{10}$)

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Protonated polycyclic aromatic hydrocarbons are potential carriers of the unidentified infrared (UIR) emission bands observed in interstellar space. Laboratory-generated infrared (IR) spectra of these protonated species can aid in identifying the molecular origins of these bands. In this study, a mixture of phenanthrene ($C_{14}H_{10}$) and *p*-H_2 was subjected to electron bombardment during deposition at 3.2 K, yielding new IR absorption features. These features decrease over time during maintenance of the matrix in darkness, consistent with the behavior of protonated species. Based on their photochemical responses to secondary laser irradiation at 619, 544, 524, and 463 nm, the features were categorized and assigned to four previously unreported isomers of protonated phenanthrene, 1-, 3-, 4-, and 9-$H^+C_{14}H_{10}$. Spectral assignments were supported by comparisons with scaled harmonic vibrational wavenumbers and IR intensities of possible candidates predicted with the B3LYP/6–311++G(d,p) method. The IR spectra of these isomers show prominent absorption in the 6–9 µm range but lack significant features near 11.3 µm, indicating that protonated phenanthrene is unlikely to be a major contributor to the UIR bands.

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The Journal of Physical Chemistry A **129**, 9260 (2025)

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The Aromatic Infrared Bands around the Wolf-Rayet Binary WR 140 Revealed by JWST

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We have analyzed the aromatic infrared bands (AIBs) in the $6-11.2$ µm, range around the Wolf-Rayet binary WR 140 ($d = 1.64$ kpc) obtained with the James Webb Space Telescope (JWST) Mid-Infrared Instrument (MIRI) Medium-Resolution Spectrometer (MRS). In WR 140's circumstellar environment, we have detected AIBs at 6 µm and 7.7 µm which are attributed to C-C stretching modes. These features have been detected in the innermost dust shell (Shell 1; ~ 2100 au from WR 140), the subsequent dust shell (Shell 2; ~ 5200 au), and "off-shell" regions in the MRS coverage. The 11.2 µm AIB, which is associated with the C-H out-of-plane bending mode, has been tentatively detected in Shell 2 and the surrounding off-shell positions around Shell 2. We compared the AIB features from WR140 to spectra of established AIB feature classes A, B, C, and D. The detected features around WR 140 do not agree with these established classes. The peak wavelengths and full width half maxima (FWHMs) of the 6 µm and 7.7 µm features are, however, consistent with those of R Coronae Borealis (RCB) stars with hydrogen-poor conditions. We discuss a possible structure of carbonaceous compounds and environments where they form around WR 140. It is proposed that hydrogen-poor carbonaceous compounds initially originate from the carbon-rich WR wind, and the hydrogen-rich stellar wind from the companion O star may provide hydrogen to these carbonaceous compounds.

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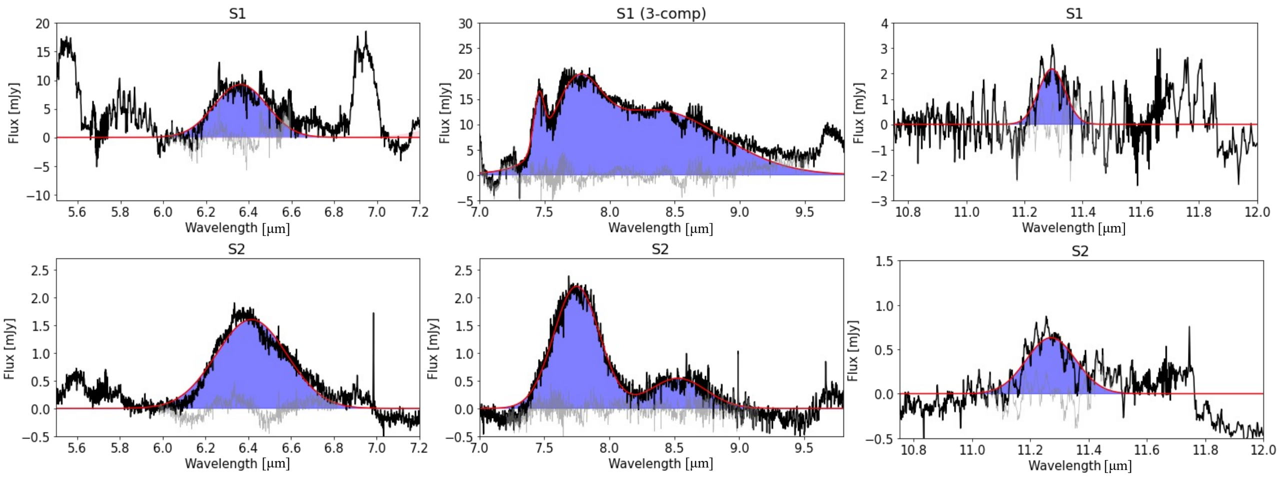
The Astrophysical Journal (Accepted)

https://arxiv.org/abs/2509.01026



Comparison of AIBs at S1 (on Shell 1) and S2 (on Shell 2). Black lines and the red curves indicate the observed spectra and the Gaussian fitting results, respectively. The filled regions highlight the Gaussian fitting results. The gray lines indicate residuals.

Experimental VUV Photoionization of C_{70} and Vibrationally Resolved Spectra of the Excited Electronic States of the C_{70}^+ Cation

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[3]CNRS, LISA UMR 7583, Universite Paris-Est Creteil and Université de Paris, Institut Pierre et Simon Laplace, Creteil, France

The nature of the photoionization of fullerenes is of significant interest to molecular astrophysics and astrochemistry. The C_{60}^+ cation has been identified as a carrier of five of the diffuse interstellar bands (DIBs), and recent correlations between C_{70}^+ electronic bands and a few weak DIBs have been presented. In this work, we present a high-resolution electronic spectrum of C_{70}^+ recorded with He-tagging messenger spectroscopy, as well as the first threshold photoelectron spectrum (TPES) of C_{70}. We comment on the He cage stability around C_{70}^+ and how it differs from that around other fullerenes, and we suggest some tentative vibrational assignments to the electronic spectrum based on a JahnTeller type formalism, which is expected from the C_{70}^+ system. We use a novel semiempirical method employing the high-resolution He-tagging spectrum and create band fits that we compare with the TPES to derive the adiabatic ionization energy of C_{70} (7.429 eV ± 0.015 meV). This methodology comes with some significant limitations but allows us to tentatively derive the energies of other excited states of the C_{70}^+ cation from the TPES.

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ACS Earth and Space Chemistry (Accepted)

https://doi.org/10.1021/acsearthspacechem.5c00217

Symposium on Exploring the Aromatic Universe in the JWST Era

London, ON, Canada
6–10 July, 2026

https://www.aromaticuniverse.space

Polycyclic Aromatic Hydrocarbons (PAHs) are a cornerstone of interstellar physics and chemistry. They play a fundamental role in heating the interstellar medium (ISM) through the photoelectric effect, regulating its ionization balance, and contributing to its molecular complexity. Identified as the carriers of the aromatic infrared bands (AIBs), PAHs are detected across a vast range of astrophysical environments–from the ISM of our own Galaxy to the early universe. In addition to their role in the ISM, PAHs serve as critical tracers of star formation in galaxies across cosmic time and as sensitive probes of physical conditions in planet-forming disks. Their detection in a variety of solar system objects has also made them central to discussions of astrobiology and the origin of prebiotic organics.

With JWST's unprecedented combination of spectral resolution, spatial detail, and sensitivity, the study of aromatics has entered a transformative era. JWST enables resolved studies of the evolution of aromatic species in nearby interstellar environments while simultaneously detecting AIBs and the UV attenuation bump at high redshifts, fueling an explosion of extragalactic research using PAHs as tracers of star formation, dust processing, and galaxy evolution.

Yet, many fundamental questions about the life cycle of PAHs and fullerenes remain unanswered: How do these molecules form and survive under the extreme conditions of space? How do their physical and chemical properties transform over cosmic time? What roles do they play in shaping the lifecycle of interstellar matter? Laboratory experiments and quantum chemical calculations are essential to address these questions, enabling robust interpretation of observations and identification of molecular structures and processes. A comprehensive understanding of interstellar aromatics also requires connecting them to other spectral signatures, including the diffuse interstellar bands in the optical and the radio detections of small PAHs in cold molecular clouds.

This symposium will bring together experts from observational astronomy, laboratory astrophysics, theoretical modeling, and quantum chemistry to explore the latest discoveries and future frontiers in PAH and fullerene research. With a special emphasis on extragalactic PAH studies, we will discuss how new observational capabilities (e.g., JWST, SPHEREx) and cutting-edge theoretical and experimental approaches can expand our understanding of these key interstellar species.

The meeting is the fourth installment in a series of international symposia on interstellar PAHs, following previous editions in Toulouse (2010), Noordwijk (2016), and Aarhus (2022).

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NanoSpace Training School on Advanced Characterization of Carbon Materials

A COST NanoSpace Winter School on advanced characterization techniques of carbon materials and their potential applications in astrochemistry

Benasque (Pyrenees, Aragon), Spain
20–22 January, 2026

https://benasque.org/2026nanospace/

We are very happy to announce the **NanoSpace Training School on Advanced Characterization of Carbon Materials**; a COST NanoSpace Winter School on advanced characterization techniques of carbon materials and their potential applications in astrochemistry. The School will be held 20-22 January 2026 in Benasque (Pyrenees, Aragon), Spain.

The list of confirmed topics and lecturers/trainers is the following:

- Introduction to Carbon Nanomaterials – Chris Ewels, CNRS-IMN, France
- Kicking Out Electrons: What Photoemission Tells Us About Carbon Materials – Paola Ayala, Vienna Univ., Austria
- Transmission Electron Microscopy (TEM) - Imaging and Spectroscopy on Carbon Nanomaterials – RaÃºl Arenal, INMA-CSIC-Universida de Zaragoza, Spain
- Modelling for Experimentalists: The Case of Carbon Defects – Chris Ewels, CNRS-IMN, France
- Probing the Matter with infrared and Raman Spectroscopies: from Molecules to Solids – Cedric Pardanaud, CNRS-PIIM, France
- Scanning Probe Microscopy/Spectroscopy (AFM, STM-STS, KPM...) Studies on Carbon Materials – José Angel Martín-Gago, ICMM-CSIC, Spain
- First principles modelling of electronic, structural, and vibrational properties of carbon materials – Vincent Meunier, Pennsylvania State Univ., USA
- Spectral features and Photophysics of Laboratory Analogues of Carbonaceous Nanograins – Thomas Pino, CNRS-ISMO, France

- Laboratory IR Spectroscopy of Astrophysically Relevant Molecules and Ions using Fancy Lasers – Jos Oomens, HFML-FELIX, The Netherlands

This NanoSpace Training School on Advanced Characterization of Carbon Materials is organized by the COST Action NanoSpace (CA21126) (https://research.iac.es/proyecto/nanospace/). The main goal of the Advanced Characterization of Carbon Materials Training School is to provide specialized knowledge to PhD students and young researchers, systematically addressing the description of (nano)materials and the principal and advanced methods and techniques for their characterization and study, with a special emphasis on their potential applications in astrochemistry.

The School will be in person with attendance limited to 33 trainees and with priority given to PhD students and Young Researchers, who are strongly encouraged to participate. There is no registration fee and the NanoSpace COST Action will provide financial support (i.e. reimbursement after the event, covering full or partial travel, accommodation, and subsistence costs) for a significant number of participants (at least 15-20), with high priority to those with a primary affiliation in an institution located in an Inclusiveness Target Country (ITC) / Near Neighbour Country (NNC) participating in the Action. The information requested in the registration form will be used to select the final list of registered participants as well as those eligible for financial support, which will be notified in advance of the Training School (i.e., by 5th December 2025). The attendees are expected to arrange their own travel and accommodation.

Deadline for Registration: 30th November 2025

Domingo Aníbal García-Hernández, NanoSpace Action Chair on behalf of the Organizing Committee

Final note: Please check the Training School website for news and updates. The list of lecturers/trainers and topics is already confirmed.

E-mail for contact: arenal@unizar.es, agarcia@iac.es

Postdoctoral Position
in High-Resolution Laser Spectroscopy
University of Louisville, Louisville, Kentucky, USA

Advertised by Jinjun Liu

A postdoctoral position is available in the research group of Prof. Jinjun Liu in the Department of Chemistry and the Department of Physics & Astronomy at the University of Louisville, Louisville, Kentucky, USA. The project is supported by the Division of Astronomical Sciences of the National Science Foundation (NSF-AST) and focuses on the laser spectroscopy of metal-containing free radicals of astronomical interest under jet-cooled conditions. More information about the NSF-AST award can be found here: https://www.nsf.gov/awardsearch/showAward?AWD_ID=2511077&HistoricalAwards=false.

The University of Louisville offers a market-competitive salary and benefits. Grade EE Salary Minimum is $47,476.

The initial appointment is for one year, with renewal contingent upon performance and mutual agreement.

Interested applicants should submit a cover letter, their CV (including a list of publications), and the names of two or three references to the email provided below.

Responsibilities

- Design and construct high-resolution laser spectroscopy apparatuses using continuous-wave (cw) lasers and optical parametric oscillators (OPOs).
- Perform data acquisition, analysis, and interpretation.
- Prepare manuscripts for publication and present results at scientific conferences.
- Supervise and mentor graduate and undergraduate students.
- Collaborate closely with computational chemists and theoretical molecular spectroscopists.

Expected Qualifications

- Ph.D. in Chemistry, Physics, or a related field with a strong background in experimental laser spectroscopy.

- Hands-on experience with research lasers, optics, optoelectronics, vacuum systems, and spectroscopy techniques.
- Proficiency in instrumental programming (LabVIEW).
- Strong scientific judgment, initiative, and ability to work both independently and collaboratively.
- Excellent oral and written communication skills in English.

Preferred Experience

- Single-mode cw laser systems (dye or Ti:Sapphire ring lasers or OPOs).
- Laser-induced fluorescence (LIF), cavity-enhanced spectroscopy (including cw cavity ring-down spectroscopy), or photoelectron/photoionization spectroscopy techniques.

University of Louisville Laser Labs (UL^3, https://www.theul3.com)

Details of research lasers and instruments in Prof. Liu's research lab:
https://www.theul3.com/equipment/laser-sources

Lab photos: https://www.theul3.com/equipment/lab-photos

The City of Louisville

Louisville is the largest city in Kentucky, with a rich history and vibrant culture. Originally a French settlement, the city retains strong European architectural influences and is home to many fine French and Italian restaurants. Louisville is world-renowned for the Kentucky Derby, the largest horse race in the world, while Kentucky is also famous for Bourbon whiskey and bluegrass music. With its affordable housing, low cost of living, light traffic, accessible public transportation, and pleasant climate, Louisville offers an excellent quality of life and is an ideal place to raise a family.

Contact Information

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Professor of Chemistry
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University of Louisville
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Web: https://profiles.louisville.edu/j.liu
The University of Louisville Laser Labs (UL^3): https://www.theul3.com

Deadline: 31 December 2025

E-mail for contact: j.liu@louisville.edu

Postdoctoral Contract
Mid-IR Evolved Stars at the Instituto de Astrofisica de Canarias (IAC)

Advertised by Domingo Aníbal García Hernández

The IAC (Tenerife) announces ONE postdoctoral contract to work on the project linked to the line of research "Nucleosynthesis and molecular processes in the late stages of stellar evolution." The contract is funded by the project "The formation of fullerene molecular nanostructures in space" (NanoFullerenes; PID2023-147325NB-I00), led by Dr. Domingo Aníbal García Hernández.

Research topics at the IAC include most areas of astrophysics: Solar Physics (FS), Exoplanetary System and Solar System (SEYSS), Stellar and Interstellar Physics (FEEI), The Milky Way and The Local Group (MWLG), Formation and Evolution of Galaxies (FYEG), and Cosmology and Astroparticles (CYA-CTA). All of these are supported by an ambitious instrumentation programme. Further information about the IAC's research programme, its Observatories and the 10.4-meter GTC is available at the IAC's web page: https://www.iac.es/en

Tasks:
The successful candidate will pursue research in the following fields:

- Analysis of mid-infrared (IR) spectroscopic observations (Spitzer and James Webb space telescopes) of evolved stars.
- Comparison of laboratory and/or theoretical spectra with astronomical observations for molecular identifications.
- Scientific exploitation of the data provided by the James Webb Space Telescope (JWST) and preparation for data collection in Cycles 6 and 7.
- Preparation for obtaining (and subsequent analysis) of additional IR data on evolved stars.

Particular attention will be given to applicants with experience in the field of mid-IR spectroscopic data with space telescopes (Spitzer and JWST) and IR molecular identifications.
Complete information about this postdoc position and how to apply can be found at the link below.

Deadline: 16 November 2025

E-mail for contact: agarcia@iac.es

Webpage: https://www.iac.es/en/employment/one-postdoctoral-contract-mid-ir-evolved-stars-2025-ps-2025-075
Webpage: https://www.iac.es/en/employment

AstroPAH Newsletter

http://astropah-news.strw.leidenuniv.nl
astropah@strw.leidenuniv.nl

Next issue: 20 November 2025
Submission deadline: 07 November 2025