AstroPAH

A Newsletter on Astronomical PAHs

Issue 131 • October 2026



JWST Detects PAHs in a Metal-Poor Galaxy

Editorial

Dear Colleagues,

Welcome to the 131st issue of the AstroPAH newsletter!

Our **Picture of the Month** shows an image of the dwarf galaxy Sextans A taken by JWST. The observations shows that aromatic hydrocarbon dust particles persist and grow in this extremely metal-poor galaxy, providing new insight into how complex carbon-rich dust formed in the pristine early Universe.

For our **In Focus** this month, we have an interesting interview with our newest editor, Corentin Rossi who takes us through his experience of performing electronic spectroscopy of interstellar molecules and ions; and shares his flair for wildlife photography. Welcome Corentin!

Our **Abstracts** section this month highlights two papers from the JWST ProtoPAH project, a paper providing theoretical anharmonic PAH spectra, and the paper presenting the JWST detection of PAHs in a metal-poor galaxy featured on our cover.

In the **Announcements** section you will find information on a James Webbinar dedicated to the Optical Constants database and its use to analyze JWST observations of dwarf planets and exoplanets. The registration window has closed but the webinar will be recorded if you want to check it out later!

AstroPAH can help you promote your research! Please send your contributions to our email address.

Thank you all for your contributions!

The Editorial Team

Next issue: 28 November 2026.
Submission deadline: 16 November 2026.

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PAH Picture of the Month

JWST observations of the metal-poor galaxy Sextans A reveal compact (3-10 pc) clumps of PAH emission (in green), representing the lowest metallicity detection of PAHs to date (Tarantino et al. 2026).

Credits: Image: NASA, ESA, CSA, Elizabeth Tarantino (STScI), Martha Boyer (STScI), Julia Roman-Duval (STScI). Image Processing: Alyssa Pagan (STScI).

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An interview with Corentin Rossi

Corentin Rossi has recently completed his Ph.D. at the Institut des Sciences Moléculaires d'Orsay, Université Paris-Saclay, France, under the supervision of Dr. Ugo Jacovella and Dr. Bérenger Gans. His work focuses on the electronic spectroscopy of ions of interstellar relevance, as well as ion-molecule reactions, using ion mobility and mass spectrometry, and ion traps. One of his main research goals is to provide astrochemical models with reliable laboratory data to describe as accurately as possible the formation of PAHs in dense molecular clouds. He is now working as a postdoc at the University of Basel, in the group of Prof. Dr. Stefan Willitsch.



What inspired you to become a scientist?

I remember wanting to do research in a laboratory since middle school. Back then, I was picturing myself working all day long in a lab coat, and my favorite subjects were chemistry and physics. I was fascinated by space in general. This is something I have pursued through high school and beyond. During my undergraduate projects, I realized how chemistry, physics, and astronomy come together, and I decided to dedicate myself to this field. In a way, I ended up doing what I imagined as a kid, though with far fewer lab coats and many more vacuum chambers and lasers!

How did you get into PAH related and astrochemistry research?

As an undergraduate student, I had the opportunity to join a one-week synchrotron shift on the DESIRS beamline at the SOLEIL synchrotron, with Dr. Roland Thissen and Dr. Ugo Jacovella, who would later become my Ph.D. supervisor. The project involved ion-molecule reactivity of cationic PAHs and their role in the chemical network of interstellar clouds, and later evolved into a lasting collaboration. We now focus on the ionic pathways leading to the formation of the first aromatic rings (benzene, cyclopentadiene), which are cornerstone species in the formation of PAHs. We use a guided ion beam setup to obtain reaction

cross sections and rate coefficients of reaction between ions generated by VUV dissociative photoionization of hydrocarbons, and various neutral partners. These results can then be used to refine astrochemical models.[1]

Which open question in Laboratory Astrophysics would you like to see answered in the near future?

One of the most puzzling open questions is certainly the nature of the carriers of the Diffuse Interstellar Bands. Only four bands have been unambiguously attributed so far – out of more than 600! – more than a century after the first band was observed. Exploring the spectroscopy of other candidates was the topic of my Ph.D. work, and I would be excited to see any significant progress in the near future.

What was the most important advice somebody gave you?

The very first piece of advice that my Ph.D. advisor gave me when I joined his group was: ”Always have a multimeter in your pocket”, and this proved to be invaluable in the lab.



What do you do outside of work?

Outside of work, I enjoy wildlife – especially bird – photography. I used to wander with my telephoto lens in the forest in Orsay, where I did my Ph.D. The setting is beautiful, and I find walking through the forest, chasing birds and listening to them sing, very relaxing.

How excited are you to become an editor of AstroPAH?

On a personal level, I think being part of the editorial team of AstroPAH will be a truly enriching experience. I also believe it is an important tool for the community, and I am both excited and honored to be part of it.

[1] See Rossi *et al.*, *ACS Earth Space Chem.* 9(2):349–355 (2025), or Loison *et al.*, *Astron. Atrophys.*, 709, A255 (2026)



Abstracts

The JWST Proto-PAH project: Aromatic backbones with extensive aliphatic substitution account for both the aromatic and aliphatic emission

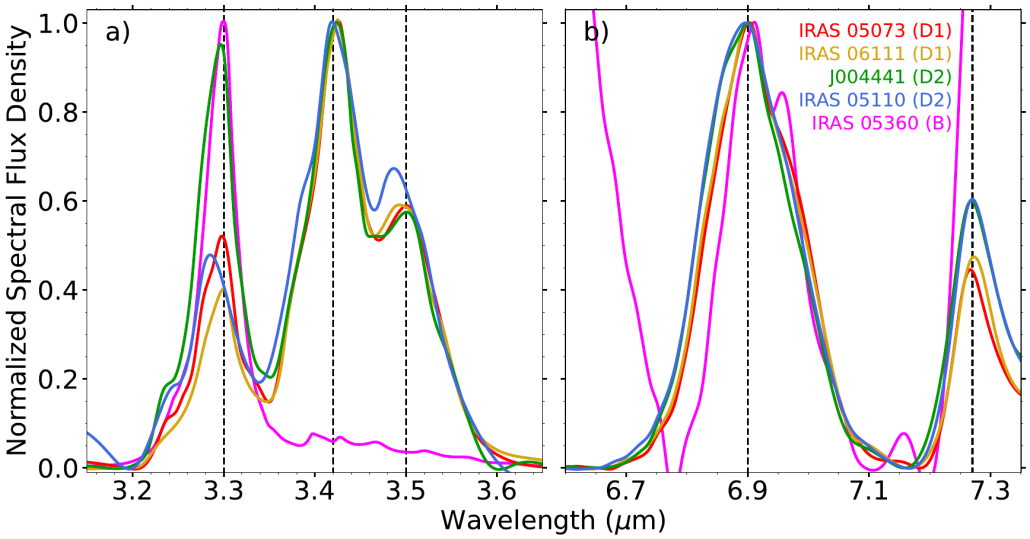
N. Clark[1,2], E. Peeters[1,2], J. Cami[1,2], G. C. Sloan[3,4], K. Volk[3], K. E. Kraemer[5], H. L. Dinerstein[6], M. A. Gómez-Muñoz[7,8,9], G. M. Wahlgren[3], N. C. Sterling[10], A. Ricca[11,12], A. A. Zijlstra[13], J. Li[14,15], M. Matsuura[16], D. A. García-Hernández[14,15], R. Sahai[17], B. Aringer[18,19], C. Bhatt[1,2], J. Bernard-Salas[20,21], D. Das[1], A. Manchado[14,15,22]

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We find that the aromatic and aliphatic emission bands in four carbon-rich post-asymptotic giant branch stars with class D emission arise from a single carrier population: extensive aliphatic decoration of an aromatic skeleton, i.e. molecules with a coherent aromatic backbone and an unusually high aliphatic content. This conclusion is based on JWST NIRSpec and MIRI/MRS spectroscopy, covering 2.88–28.7 µm.

The aliphatic 3.4 µm feature is stronger than the aromatic 3.3 µm feature, reversing the ratio seen in sources with typical polycyclic aromatic hydrocarbon (PAH) emission. If the aromatic emission arose from nominal PAHs, the 3.3 µm feature – unavailable in previous observations – together with the mid-infrared aromatic features, would constrain them to be large ($\gtrsim$200 carbon atoms), compact, and at least partially ionized. These properties predict a strong 8.6 µm feature. However, the 8.6 µm feature is weak or absent in all four sources,

ruling out PAHs as the source of the aromatic emission. Instead, the emission must arise from the same carriers as the aliphatic emission. The position of the 6.9 μm feature and the broadened 11–14 µm out-of-plane emission independently support this. The CH_2 and CH_3 feature strengths vary across the sample, with the class D2 sources showing higher CH_3 content. These carriers are far more aliphatic than the PAHs of planetary nebulae and the interstellar medium. However, they retain the aromatic skeleton that produces their aromatic features.



Normalized, continuum-subtracted emission features. IRAS 05360 is included as a reference. Its aliphatic emission is much smaller than its aromatic emission. Panel a): Emission from the C–H stretching modes over the 3.1–3.7 µm range. This is normalized to the peak emission at 3.42 µm, except for IRAS 05360, which is normalized to the peak emission at 3.30 µm. The vertical dashed lines indicate the locations of the 3.3 µm feature peak at 3.30 µm and the main 3.4 µm feature peaks at 3.42 and 3.50 µm. Panel b): Emission primarily from the C–H aliphatic bending modes over the 6.6–7.4 µm range. This is normalized to the peak emission at 6.90 µm. The aromatic 7.7 µm feature is also partially included, blending with the red wing of the 7.25 µm feature and dominating it in the case of IRAS 05360. This spectrum also includes the end of a feature at 6.7 µm. The vertical dashed lines indicate the locations of the 6.9 and 7.25 µm feature peaks at 6.90 and 7.27 µm.

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Astronomy & Astrophysics, accepted (2026)

https://arxiv.org/pdf/2609.30598
https://www.aanda.org/articles/aa/pdf/forth/aa62644-26.pdf

The JWST Proto-PAH Project: Detection of the methyl radical CH_3 in the highly evolved C-rich object SMP LMC 011

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We report the first detection of the neutral methyl radical CH_3 in a highly evolved C-rich object, SMP LMC 011, using JWST MIRI/MRS. CH_3 is well fitted by an excitation temperature of $T_{\rm ex} \simeq 190$ K and a column density of $N_{\rm tot}({\rm CH_3}) \simeq 5.6 \times 10^{17}$ cm^{-2}. We also report the non-detection of ethane (C_2H_6), consistent with CH_3 reacting preferentially with unsaturated radicals rather than self-recombination, which may be inefficient in SMP LMC 011. Combined with the exceptionally large benzene column density of SMP LMC 011, this supports a methyl-addition route from benzene towards alkyl-substituted aromatics. We propose that the high CH_3 abundance is driven by the erosion of hydrogenated amorphous carbon (HAC) dust grains in the dense warm torus by UV photons from the central star and/or by shocks, which release CH_3 directly into the gas phase. These results establish CH_3 as a key reactive intermediate in the formation of complex hydrocarbons in C-rich circumstellar environments. Chemical models that incorporate methyl-addition reactions are needed for a better understanding of PAH formation pathways in evolved stars. The potential detection of alkyl-substituted aromatics such as toluene (C_7H_8) and ethylbenzene (C_8H_{10}) in C-rich evolved stars would provide direct confirmation of CH_3-driven aromatic growth in circumstellar environments.

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The Astrophysical Journal Letters, **1009**, L47 (2026)

https://iopscience.iop.org/article/10.3847/2041-8213/aea794

Growth of aromatic hydrocarbon dust particles in the extremely metal-poor galaxy Sextans A

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The mid-infrared spectrum of star-forming, high-metallicity galaxies is dominated by emission features from aromatic and aliphatic bonds in small carbonaceous dust grains, often referred to as polycyclic aromatic hydrocarbons (PAHs). In metal-poor galaxies, the abundance of PAHs relative to the total dust sharply declines, but the origin of this deficit is unknown. Here we present observations by the James Webb Space Telescope that detect and resolve emission from PAHs in the 7% solar metallicity galaxy Sextans A, representing, to our knowledge, the lowest metallicity detections of PAH emission known so far. In contrast to higher metallicity galaxies, the clumps of PAH emission are compact (0.5–1.5”or 3–10 pc), which explains why PAH emission has evaded detection by lower resolution instruments. Ratios of the 3.3-µm, 7.7-µm and 11.3-µm PAH features indicate that the PAH grains in Sextans A are small and neutral, with no evidence of substantial processing from radiation fields. These results favour inhibited grain growth over enhanced destruction as the origin of the low PAH abundance in Sextans A. The compact clumps of PAH emission are likely active sites of in situ PAH growth within a dense, well-shielded phase of the interstellar medium. Our results show that PAHs can form and survive in the extremely metal-poor environments common early in the evolution of the Universe.

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Nature Astronomy (2026)

https://doi.org/10.1038/s41550-026-02969-5

Fully Anharmonic IR Spectra of Neutral Polycyclic Aromatic Hydrocarbons With Up to 38 Carbons

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Interstellar aromatic infrared band (AIB) spectra show agreement with presently-computed, anharmonic spectra for various types of polycyclic aromatic hydrocarbons (PAH) determined using a novel semi-empirical quantum chemical method. Since the AIB spectrum is a blend of emission spectra from a vast number of different PAHs, likely with an array of different molecular structures, the spectra for a sample set of 31 PAHs ranging in size from naphthalene ($C_{10}H_8$) up to circumbiphenyl ($C_{38}H_{16}$) are combined giving consideration to almost all PAH structural motifs. The computed, numerical quartic force fields coupled to second-order vibrational perturbation theory support the claim that PAH C-H stretches are responsible for the features close to 3000 cm^{-1} (3.3 µm). The shoulder at 3080 cm^{-1} (3.24 µm) of this feature likely also arises from similar motions, notably in small PAHs. Additionally, the present work highlights that the mid-IR features of neutral PAH combination bands could be responsible for the bulk of the plateaus underlying the strong AIBs in the 2000-1000 and the 980-590 cm^{-1} (5-10 and 11-15 µm) ranges. Finally, low-frequency combination bands are also computed in the vicinity of the 5.25 µm feature and are consistent with the provenance of this feature hypothesized nearly 40 years ago. PAHs of all classes are likely to contribute to different portions of interstellar spectra, but more anharmonic PAH spectra are needed to delineate such fully.

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The Astrophysical Journal, **1009**, 113 (2026)

https://iopscience.iop.org/article/10.3847/1538-4357/ae9fed

Announcements

JWebbinar 53

Introduction to the Optical Constants Database and Applications for JWST

Advertised by

Ella Sciamma-O'Brien, Sarah Moran, James Mang, and Lora Jovanovic

Check out the James Webb Space Telescope (JWST) webinar (JWebbinar) dedicated to the Optical Constants database (OCdb) and its use in the PICASO and VIRGA models to analyze and interpret JWST observations of brown dwarfs and exoplanets.

The JWebbinar is scheduled for Wednesday November 4, 8-10 a.m. (PST) and is organized by the Space Telescope Science Institute (STScI).

Registration has passed but you will be able to watch the webinar afterwards!



The Optical Constants database (OCdb), developed at NASA Ames, centralizes published optical constants of materials relevant to (exo)planetary and astrophysical environments, making them more accessible to the community for use in the analysis of observational data. This JWebbinar will provide: 1) a demo of the OCdb website: how to search the database content, utilize its online tools for simple analyses, and download data; and 2) how to use OCdb data in the **PICASO** and **VIRGA** models to analyze and interpret JWST observations of brown dwarfs and exoplanets.

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Next issue: 28 November 2026
Submission deadline: 16 November 2026