

CV date

17/11/2022

A. PERSONAL INFORMATION

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A.1. Current position

Institution	Centro de Astrobiología, CSIC-INTA		
Department	Astrophysics		
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Current position	Investigador Ramón y Cajal	From	01/05/2022
Key words	Astronomy & Astrophysics, Astrochemistry, Prebiotic Chemistry, Molecules, Star formation, Interstellar Medium, Origin of Life		

A.2. Education

Title	University	Year
PhD thesis	Universidad Autónoma de Madrid	2014
Master in Astrophysics	Univ. Autónoma de Madrid / Univ. Complutense of Madrid	2008-2010
Physics Degree	Universidad Autónoma de Madrid	2003-2008

B. BRIEF SUMMARY OF THE CV

My scientific research aims at elucidating up to what extent the chemistry that takes place in the molecular clouds of the interstellar medium is able to synthesize molecules that are important for driving the prebiotic chemistry that might have allowed the emergence of Life on Earth. To achieve this goal, I have adopted a multidisciplinary approach that combines: **i)** the discovery and characterization of astronomical sources with astrobiological potential; **ii)** ultra-high sensitivity radio astronomical observations; **iii)** the development of new chemical models and data analysis tools; and **iv)** a strong involvement in pushing spectroscopic characterization of key prebiotic molecules in the laboratory. My research has reported the first detections in the interstellar medium and in comets of several key prebiotic species relevant for supporting the RNA world hypothesis for the origin of life. Among them, we can highlight ethanalamine (precursor of phospholipids), hydroxylamine or 1,2-ethenediol (precursors of RNA nucleotides), cyanomethanimine (precursor of adenine), or phosphorus oxide. The combination of my observations with the chemical models have shed important clues about the formation of these molecules in the interstellar medium (ISM) related to the origin of Life. I have also proposed to different spectroscopic laboratories to produce and characterize a number of key molecules in the context of the RNA World to be searched in the ISM.

I am author of **87 peer-reviewed scientific articles** (**19 as first author**, see [this link](#)) published in several of the most important journals in science such as *Proceedings of the National Academy of Sciences of the United States of America* (impact factor 11.2), in astrophysics, such as *The Astrophysical Journal*, *Astronomy and Astrophysics* and *Monthly Notices of the Royal Astronomical Society* (impact factors > 5), and also in *Astrobiology*, *Frontiers in Astronomy and Space Science*, and *Molecules* (impact factors >4).

My publications have received so far more than **1888 citations** and my current **h-index is 26** (source: Google Scholar).

Since 2017 I have fully funded my research and also of my own group (graduate and PhD students and a postdoc). I have raised more than 640.000 € from highly-competitive grants.

I have also published 6 conference proceedings, 2 book chapters of the Next Generation Very Large Array (ngVLA) White Book, and delivered **28 invited talks and seminars at international conferences and research institutions**. I have been also very active in dissemination and outreach activities, giving public talks, Youtube talks/discussions and published outreach articles in scientific magazines, such as [Investigación y Ciencia](#) (Spanish version of *Scientific American*), the [Boletín of the Spanish Astronomical Society](#), or the [Colle di Galileo](#) journal, and several [chapter books](#) and [scientific blogs](#) for a general audience. More than 25 press releases based on my work have been selected by world-leading research institutions and scientific journals.

I have chaired or co-chaired three Scientific Organising Committees of international conferences and participated in the organization of another three. I have served in several international advisory panels of world leading facilities in Astronomy and actively participate in several international networks.

C. CAREER SUMMARY

I received my 5-year Physics degree (Univ. Autónoma de Madrid) in 2008, and my Master Degree (Univ. Autónoma de Madrid/ Univ. Complutense) in 2010, with excellent grades (30 “Sobresaliente” and 15 special mentions of “Matricula de honor”), which were recognised by several Grants of Excellence awarded by the Comunidad de Madrid (2003/2004, 2004/2005 and 2005/2006), and allowed me to obtain the Junta de Ampliación de Estudios (JAE/CSIC) grant for the completion of a doctoral thesis. From 2010 to 2014 I worked on my PhD thesis in the Center of Astrobiology of Madrid (INTA-CSIC). My thesis, entitled “*The role of low-mass star clusters in the formation of massive stars*”, presented on July 24 2014 with the maximum grade of “Sobresaliente cum laude” and the special mention of “Doctor Internacional”, was selected as finalist for the “Best PhD thesis award” of the Astronomical Spanish Society. During my PhD I spent more than 8 months abroad visiting several research institutions such as the National Radioastronomy Observatory, the Arcetri Astrophysical Observatory and the Harvard-Smithsonian Center for Astrophysics. After my PhD I moved to the Arcetri Astrophysical Observatory (Italy) for a first postdoc (2015-2017). In 2017 I obtained a Marie Skłodowska Curie grant with my project BIOSFERA (Birth Of Stars and liFe: Edge Research at inAf), to be developed in the Arcetri Astrophysical Observatory. This project also received the “Seal of excellence” (2017), quality label awarded by the European Commission. In 2020, I move back to the Center of Astrobiology (Madrid), after obtaining an “Atracción de Talento para doctores con experiencia” grant, funded by the Comunidad de Madrid, with my project COOL (Cosmic Origins Of Life), which also received the “Seal of excellence” (2020) by the European Commission. More recently, I have obtained the highly-competitive Ramón y Cajal 2020 grant, and also additional funding from the “Ayudas de Atracción de Talento RyC 2020” program funded by CSIC for the highest ranked researchers in the Ramón y Cajal selection process. This year I will be able to apply for funding to the Spanish National program calls.

D. RELEVANT MERITS

D.1. Research projects and grants

From 2017 I have fully funded my research and that of my group (graduate and PhD students and a postdoc) thanks to funds (> 640.000 €) from highly-competitive grants:

1. Ayudas de Atracción de Talento RyC 2020 – Title: COOL – Cosmic Origins Of Life – Proyectos intramurales especiales del CSIC – Project ID: 20225AT015 – Funding institution: CSIC and Centro de Astrobiología (CSIC-INTA) – Host institution: Centro de Astrobiología (CSIC-INTA) – Dates: 01/01/2023 - 31/12/2025 – Role: principal investigator – Funds awarded: 150.000 €

2. Ramon y Cajal 2020 contract – Title: COOL – Cosmic Origins Of Life CSIC – Project ID: RYC2020-029387-I – Funding institution: Agencia Estatal de Investigación – Host institution: Centro de Astrobiología (CSIC-INTA) – Dates: 01/05/2022 – 30/04/2027– Role: principal investigator – Funds awarded: 42.000 €

3. Atracción de Talento Modalidad 1 (Doctores con experiencia) fellowship – Title: COOL – Cosmic Origins Of Life CSIC – Project ID: 2019-T1/TIC-15379 – Funding institution: Comunidad de Madrid – Host institution: Centro de Astrobiología (CSIC-INTA) – Dates: 01/08/2020 - 31/07/2024 (renuncia) – Role: principal investigator – Funds awarded: 301.000 € (including salary of the PI).

4. Marie Skłodowska Curie fellowship – Title Project BIOSFERA (Birth Of Stars and liFe: Edge Research at INAF) – Project ID: Marie Skłodowska-Curie grant agreement No. 664931, ASTROFIT-COFUND – Funding institution: European Commission (European Union’s Horizon 2020 research and innovation

programme) – Host institution: INAF-Osservatorio Astrofisico di Arcetri – Dates: 01/08/2017 hasta 31/07/2020 – Role: principal investigator – Funds awarded: 150.000 € (including salary of the PI).

D.2. Invited seminars and talks: I have been invited to give more than **28 invited talks and seminars** at international conferences and research centres. I list here some examples:

- 1. Molecular precursors of the RNA-world in the interstellar medium: the astrochemical mine found towards the G+0.693-0.027 molecular cloud**, Dust Ice and Gas (DIG) online conference, 17th-18th November 2022.
- 2. Molecular precursors of the RNA-world in the interstellar medium**, University of Cologne, October 17th 2022.
- 3. Molecular precursors of the RNA-world in the interstellar medium**, July 17 2022, COSPAR 2022 44th Scientific Assembly, Athens, Greece.
- 4. Phosphorus-bearing molecules in space**, July 21 2022, COSPAR 2022 44th Scientific Assembly, Athens, Greece.
- 5. The Pathway to Prebiotic Chemistry: molecular precursors from space**, European Astrobiology Academy 2021-2022, January 26 2022, online seminar.
- 6. Precursores moleculares de la vida en el medio interestelar**, II Congreso Nacional de Estudiantes de Biociencias, October 15 2021, Cáceres, Universidad de Extremadura, Spain.
- 7. Molecular precursors of the RNA-world in the interstellar medium**, October 5 2021, Osservatorio Astrofisico di Arcetri, Florence, Italy.
- 8. The interstellar journey of phosphorus**, February 24 2021, Astrochemical discussion online seminars.
- 9. Phosphorus in the interstellar medium**. Round Table about biomarkers organised by the María de Maeztu Academy (Center of Astrobiology, Madrid), September 30 2020
- 10. New Frontiers in the Physics and Chemistry of Star- and Planet-Forming Regions**, Radio/Millimeter Astrophysical Frontiers in the Next Decade Conference, Charlottesville, VA, USA, June 26 2019
- 11. PASTA: Phosphorus interstellAr Search aT Arcetri**. Chalmers Jubilee Professor Workshop on Fractionation, Astrochemistry and Star/Planet formation Chalmers University, Gothenburg, Sweden, September 20 2018
- 12. Phosphorus and complex organic molecules in star-forming regions: links with comets**. Center for Space and Habitability (CSH), Bern, Switzerland, May 29 2017
- 13. Why should I care about chemical complexity in space?** European Southern Observatory (ESO), Garching, Germany, May 29 2017
- 14. The formation of prebiotic molecules in star-forming regions**. ASTROWIN workshop. University of Florida, Gainesville, USA, March 14 2017
- 15. Understanding the formation of prebiotic molecules in star-forming regions**. Istituto di Radioastronomia (IRA), Bologna, Italy, November 14 2016
- 16. The path to pre-biotic molecules**. Origins of Habitable Planets Programme. Gothenburg Centre for Advanced Studies in Science and Technology, Chalmers University, Gothenburg, Sweden, May 13 2016
- 17. Understanding the formation of astrobiological molecules in star-forming regions**, Arcetri Astrophysical Observatory, Florence, Italy, May 24 2015

D.3. Contributed talks: I have presented my work in **28 contributed talks** at international conferences. I list here some recent examples:

- 1. Molecular precursors of the RNA-world in the interstellar medium: the astrochemical mine found towards the G+0.693-0.027 molecular cloud**, conference “From Clouds to Planets II: The Astrochemical Link”, 3–7 October 2022, Berlin, Germany
- 2. Molecular precursors of the RNA-world in the interstellar medium**, Workshop on Interstellar Matter, 17-19 November 2021, Japan (online)
- 3. Prebiotic precursors of the RNA-world in the interstellar medium**, Pacificchem 2021, Misconceptions in Astrochemistry, 16-21 December 2021, online & Honolulu, Hawaii, USA
- 4. Prebiotic precursors of nucleic acids, proteins and sugars in Solar-like protostars**, Chemical processes in Solar-type star-forming regions, 13-17 September 2021, Turin, Italy

5. **Discovery in space of ethanolamine, the simplest phospholipid head group**, Astrochemical Frontiers Astrochemical Frontiers Conference - Quarantine Edition 2, July 5-9 2021 (online)
6. **ALMA and ROSINA detections of phosphorus-bearing molecules**, EAS 2020 (online conference) Session SS11a - The molecular journey from stars to disks (Astrochemistry), June 29 2020.
7. **Abundant Z-cyanomethanimine in the interstellar medium: paving the way to the synthesis of adenine**, From Stars to Planets II - Connecting our understanding of star and planet formation, Gothenburg, Sweden, June 17-20 2019
8. **ALMA maps of HCO, the basic precursor of complex organic molecules, towards the solar-like protostellar binary IRAS16293-2422**, The Olympian Symposium, Gas and stars from milli- to megaparsecs, Paralia, Greece, May 28 - 1 June 2018
9. **Phosphorus: the missing prebiotic element found in star-forming regions and comets**, Prebiotic Molecules in Space and Origins of Life on Earth, 664 Wilhelm und Else Heraeus-Seminar, Bad Honnef, Germany, March 19-23 2018
10. **Complex organic molecules in star-forming regions: hot cores and hot corinos**, Molecules in space - Linking the interstellar medium to exoplanets, Washington DC, USA, August 20-24 2017
11. **Phosphorus, the missing prebiotic element. How to detect and model it**, Current and future perspectives of Chemical modelling in Astrophysics, Hamburg, Germany, July 17-19 2017
12. **The formation of prebiotic molecules in star-forming regions**, Francesco Palla's Legacy: Star formation in space and time, Florence, Italy, June 5-9 2017

D.4. Mentoring: I have supervised 13 postdoc, PhD, graduate and undergraduate students, which are listed below:

- *Postdoctoral Scholars:*
 - **Miguel Sanz-Novo** (Centro de Astrobiología, Spain, starting in December 2022)
 - **Laura Colzi** (Centro de Astrobiología, Spain, 01/01/2021-31/12/2021)
- *Doctoral Students:*
 - **Álvaro López Gallifa** (Centro de Astrobiología, Spain,) - PhD student (01/08/2021-today)
- *Graduate Students:*
 - **David Haasler García** (University Complutense of Madrid, Spain) - Master thesis (September 2022- today), Master thesis to be presented on June 2023
 - **David San Andrés de Pedro** (University Complutense of Madrid, Spain) - Master thesis - June 17 2022.
 - **Lydia Markopouloti**. Erasmus+ student from University of Crete (07/04/2022-04/08/2022).
 - **Fran Sánchez** (Universidad Internacional de Valencia, Spain)-Master thesis-November 8 2021.
 - **Chaima Hajji** (Universidad Internacional de Valencia, Spain)- Master thesis - November 8 2021.
 - **Lucas Rodríguez-Almeida** (Center of Astrobiology CAB, INTA-CSIC, Spain), graduate student (16/11/2020-16/08/2021).
 - **Andrea Vagnoli** (University of Florence, Italy) - Master' thesis - December 17 2019
 - **Alessandro Coletta** (University of Florence, Italy) - Master's thesis - July 24 2019.
- *Undergraduate Students:*
 - **David Haasler García** (2021 Prácticas Curriculares Universidad Rey Juan Carlos, Madrid, Spain).
 - **Paula Molina Sanjurjo** (2021 Practicas curriculares and extracurriculares" Universidad Complutense de Madrid, Spain).
 - **Stefano Menchiari** (Physics degree thesis, University of Florence, Italy) - May 9 2018.
 - **Andrea Socci** (Physics degree thesis University of Florence, Italy) - December 20 2017.

D.5. Advisory Committees and Peer Review: I am member of the National Radioastronomy Observatory Science Review Panel (VLA and GBT telescopes) since 2021, and I am a reviewer for several funding agencies such as the National Research, Development and Innovation Office, NRD (Hungary), and the "Agencia Nacional de Investigación y Desarrollo" of Chile. I regularly serve as reviewer on a regular basis for several journal in astrophysics, chemistry and astrobiology: Astronomy & Astrophysics Journal, The Astrophysical Journal, Monthly Notices of the Royal Astronomical Society, ACS Earth and Space Chemistry, Astrobiology and Science China Physics, Mechanics & Astronomy Journal.

D.6. Participation at international collaborations networks: I am member of the Square Kilometer Array (SKA) "Cradle of Life" Science Working Group, and the Next Generation Very Large Array (ngVLA)

“Cradle of Life” Science Working Group, which aims to define the key driving science cases for the development of these future large international facilities. I am also member of the European Astrobiology Institute (EAI) “The pathway to complexity: From simple molecules to first life” Working Group. I am part of the scientific team of two ALMA Large Programs (ALCHEMI and ACES), and one VLA Large Program (VOLS).

D.7. Telescope observing time granted: I have led as principal investigator more than 39 observational projects that have been accepted after highly-competitive proposals calls in the most important world-wide astronomical facilities: the Atacama Large Millimeter Array (ALMA, more than 120 hours of total observing time in 7 different projects), Very Large Array (VLA), IRAM NOEMA interferometer, Sub-millimeter Array (SMA), IRAM 30m telescope, APEX telescope, Yebes telescope, Green Bank telescope (GBT), Effelsberg telescope, and Nobeyama radio telescope.

D.8. Public and Scientific Community Outreach: My research has been selected for more than 25 press releases of many word-leading research institutions and scientific journals: MPE, ESO, ALMA, ESA, NRAO, Leiden Univ., INAF, Queen Mary Univ. of London, University College London, Univ. of Bern, and Ural Federal Univ. I have also been interviewed by several Spanish TV (Telediario de TVE), radios (RNE, Onda Cero) and newspapers (El País, La Vanguardia, La Voz de Galicia). I am also actively involved in outreach public events outreach events to explain the benefits of astronomy and in a more general context science for society. I have given public talks for a general audience, Youtube talks/discussions, or open days of scientific institutions. I have also delivered several talks about astronomy and space exploration for kids in schools and high-schools. I am author of several [chapter books](#) and [scientific blogs](#) oriented to the general public.

D.9. Selected honors and awards:

- 2021: Best Poster award at the European Astrobiology Network Association (EANA) Conference 2021, “*Discovery in space of ethanalamine, the simplest phospholipid head group*”.
- 2020: Seal of Excellence for the project COOL (Cosmic Origins of Life), quality label awarded by the European Commission
- 2017: Seal of Excellence for the project BIOSFERA (Birth Of Stars and liFe: Edge Research at INAF), quality label awarded by the European Commission.
- 2017: Best Poster award at the International Astronomical Union Symposium 332: Astrochemistry VII: *The first detections of the key prebiotic molecule PO in star-forming regions*.
- 2014: Finalist of the “Best Spanish doctoral thesis in Astrophysics Prize”, awarded by the Spanish Astronomical Society (SEA).

D.10. Organisation of Scientific events: I have organised several international conferences:

- Scientific Organising Committee (co-chair) and Local Organising Committee member of the conference “*Cosmic Rays 2: the salt of the star formation recipe*”, Florence, Italy, 8-10 November 2022.
- Scientific Organising Committee (chair) of the EAS 2022 Symposium 9: “*The astrochemical heritage: from molecular clouds to planetary surfaces*”, Valencia, 30 June, 1 July 2022.
- “Scientific Organising Committee (co-chair) and Local Organising Committee member of the conference “*Cosmic Rays: the salt of the star formation recipe*”, Florence, Italy, 2-4 May 2018.
- Local Organising Committee member of the conference “*Life on Earth and beyond: emergence, survivability, and impact on the environment*”, Bertinoro, Italy, 19-24 March 2018.
- Local Organising Committee member of the conference “*Fractionation of isotopes in space: from the solar system to galaxies*”, Florence, Italy, 10-13 October 2016.