



## CURRICULUM VITAE (CVA)

|                                     |  |            |   |            |
|-------------------------------------|--|------------|---|------------|
| <b>Part A. PERSONAL INFORMATION</b> |  |            | <b>CV date</b>  | 02/04/2024 |
| First name                          | Miguel   |            |   |            |
| Family name                         | Sanz Novo  |            |   |            |
| Gender                              | Male   | Birth date | 09/12/1995  |            |
| ID number                           | 71160538X  | URL Web    | <a href="https://cab.inta-csic.es/astrochem/index.html">https://cab.inta-csic.es/astrochem/index.html</a> |            |
| e-mail                              | <a href="mailto:miguel.sanz.novo@cab.inta-csic.es">miguel.sanz.novo@cab.inta-csic.es</a> |            |   |            |
| ORCID                               | 0000-0001-9629-0257  |            |   |            |

### A.1. Current position

|                   |   |                |           |
|-------------------|---|----------------|-----------|
| Position          | Juan de la Cierva Postdoctoral Fellow   |                |           |
| Initial date      | 01/01/2024  |                |           |
| Institution       | Spanish Research Council (CSIC)   |                |           |
| Department/Center | Astrophysics / Centro de Astrobiología (CAB, CSIC-INTA)   |                |           |
| Country           | Spain   | Teleph. number | 695650002 |
| Key words         | Astrochemistry, Rotational Spectroscopy, Computational Chemistry, Astronomy & Astrophysics, Interstellar medium, Biomolecules |                |           |

### A.2. Previous positions (research activity interruptions, see call)

| Period              | Position/Institution/Country/Interruption cause                    |
|---------------------|--|
| Dec. 2022-Dec. 2023 | Postdoctoral Margarita Salas Fellow (UVa-CAB), España              |
| May. 2022-Dec. 2022 | Postdoctoral JCyL contract, University of Valladolid (UVa), España |
| Mar. 2022-May. 2022 | Postdoctoral POP-FPU contract, UVa, España                         |
| Oct. 2018-Mar. 2022 | Predoctoral FPU contract, UVa, España                              |
| Jun. 2018-Oct. 2018 | Laboratory Technician (European Project), FUNGE - UVa, España      |

### A.3. Education

| PhD, Licensed, Graduate                           | University/Country                | Year |
|---|-----------------------------------|------|
| PhD in Chemistry                                  | University of Valladolid / España | 2022 |
| Master degree in Advanced Techniques in Chemistry | University of Valladolid / España | 2018 |
| Graduate in Chemistry                             | University of Valladolid / España | 2017 |

## Part B. CV SUMMARY

After graduating from the Universidad de Valladolid (UVa, *Extraordinary Award B.S. Chemistry* 2017, ranked #1), and following up the M.S. Advanced Techniques in Chemistry (*Extraordinary Award M.S. Advanced Techniques in Chemistry* 2018, ranked #1), I did my PhD studies in Chemistry at UVa in both the Grupo de Espectroscopía Molecular (GEM) and the Theoretical and Computational Chemistry Group (TCC) under the joint supervision of Prof. José L. Alonso and Prof. Carmen Barrientos. The topic of my PhD thesis was the **synergetic experimental-theoretical study of interstellar molecules and biomolecules**, based on **rotational spectroscopic techniques** and **state-of-the-art quantum-chemical computations** (*Summa Cum Laude, International mention*, March 2022, and *Extraordinary Award PhD in Chemistry*, UVa, June 2023). Currently, I am a **Juan de la Cierva Postdoctoral Fellow** at the Centro de Astrobiología (CAB, CSIC-INTA), where I am **exploring the Ultra-deep Line Spectral Survey of the molecular cloud G+0.693-0.027** based on Yebes 40-m, IRAM 30-m, APEX, and GBT observations.

My research activity aims to **unveil the limits of molecular complexity in the interstellar medium (ISM)** and to **understand how the fundamental chemical ingredients for life evolve**, based on the detection of new interstellar molecules. My research works hinge around **Molecular Spectroscopy**, adopting a **multidisciplinary approach** that addresses **experimental, theoretical and observational aspects**. Such expertise, in **collaboration with world's leading institutions** in the field of **Radio astronomy** has led to surprising discoveries such as: i) **Theoretical investigation** of several **glycine isomers** and **glycine precursors**, its subsequent **rotational characterization** in the laboratory and their **interstellar search**, which has finally led to the detection of the **first glycine isomer** in the ISM: glycolamide; ii) Detection of the elusive **carbonic acid**, HOCOOH, the first interstellar species containing more than two oxygen atoms and the third carboxylic acid identified so far in the ISM. iii) First detection of **O-protonated carbonyl sulfide**, HOCS<sup>+</sup>, in the interstellar medium. iv) Discovery of the **first N-, S-**



and **O-bearing interstellar molecule, HNSO**. In parallel to this topic, I also perform **rotational studies** to disclose the **shape of relevant organic and biomolecules**, which has also impacted other fields outside the astrophysical community, such as **physical-chemistry** and **biochemistry** (highlighting the study of barbaralones, an archetypical fluxional molecule, which was [Front Cover](#) in *Angewandte Chemie Int. Ed.*).

### Publications and conferences

- [26 peer-reviewed publications since 2019](#) (**14 as first author** and **10 as second author**, Sec. C.1), highlighting: 1xAngew. Chem. (Front Cover, Impact factor:16.82), 2xApJL, 5xApJ, 4xA&A, 3xMNRAS, 2xPCCP (Front Cover), 1xJPCL (Front Cover), 1xJPCA (Front Cover)
- 26 conference communications at national and international meetings (18 as presenting author and 8 as contributing author, Sec. C.2)

### Relevant Grants, Awards and Distinctions

- *Postdoctoral Juan de la Cierva National Grant*. European Union – NextGenerationEU. Ministerio de Universidades 67.400,00 €. 01/01/2024.
- [ASEVA Best Doctoral Thesis Award \(4<sup>th</sup> edition\)](#), The Spanish Vacuum Society (ASEVA), Spanish Committee of the International Union of Pure and Applied Physics (IUPAP), 2023.
- [Jon Hougen Memorial Award](#), International Symposium on Molecular Spectroscopy (ISMS2023) University of Illinois, Urbana, EEUU. Date of grant: 23/06/2023,
- “*Premio Extraordinario de Doctorado*” in Chemistry, UVa. 29/06/2023.
- [Best Article of a Young Researcher in Atomic and Molecular Chemistry/Physics](#). Grupo Especializado de Física Atómica y Molecular (GEFAM, RSEF/RSEQ). Date of Grant: 17/01/2023.
- *Postdoctoral Margarita Salas Grant*. European Union – NextGenerationEU. Ministerio de Universidades. UVa. 69.200,00 €. 22/12/2022
- *Cum Laude* and *International Mention* (PhD Distinctions). University of Valladolid. 04/03/2022
- *Best Poster Communication Award*, J2IFAM2020 Congress, GEFAM, RSEF/RSEQ, Date of Grant: 06/03/2020
- *Predocctoral FPU National Grant*, Ministerio de Ciencia e Innovación. 83.232,00 € 2018-2022
- “*Premio Extraordinario Fin de Máster*”, M.S. Advanced Techniques in Chemistry. UVa. 27/09/2018
- *Research Collaboration Grant*, Social Council, UVa. 2017-2018
- “*Premio Extraordinario Fin de Carrera*”. B.S. Chemistry. UVa. 19/10/2017
- *Research Collaboration National Grant*, Ministerio de Educación y Cultura. 2016-2017

### International Collaborations and Research Stays at Excellence Research Centers

- *International Cooperation Network: iLINK-23017* funded by CSIC (2024-2025), involving CAB (CSIC-INTA), Max Plank Institute for Extraterrestrial Physics (Germany), Start and Planet Formation Laboratory, Riken (Japan), Physikalisches Institut, University of Cologne (Germany), Institute for Theoretical Chemistry, University of Stuttgart (Germany), Iasi Plasma Advance Research Center. Alexandry Ioan Cuza University of Iasi (Romania) and University of Tokyo (Japan).
- *Max Planck Institute for Radioastronomy* (Bonn, Germany). Supervisor: Karl M. Menten & Arnaud Belloche (19/04/2021-19/07/2021). Research area: Radioastronomical searches for new complex aldehydes previously characterized by the candidate researcher (using ALMA data)
- *Centro de Astrobiología (CAB, CSIC-INTA)* associated to the *NASA Astrobiology Program*. Madrid, Spain. Supervisor: Victor M. Rivilla (22/12/2022-Present). Research area: exploration of the Ultra-deep Line Spectral Survey of the molecular cloud G+0.693-0.027 based on radioastronomical observations.
- *International Cooperation Network: NANOCOSMOS*, under the ERC-2013-SyG-Synergy Grant 610256. (01/01/2014-22/01/2022)
- Coordinator of research works with International Institutions: Massachusetts Institute of Technology (MIT), National Radio Astronomy Observatory (NRAO), Max Plank Institute for Radioastronomy (MPIFR), University of Virginia, University of Cologne, University of Prague (materialized in diverse research articles and conferences, shown in Sec. C.1 and C.2)



## Part C. RELEVANT MERITS

### C.1. Ten most important publications in international peer-reviewed journals

- 1 Scientific paper.** M. Sanz-Novo (AC), V. M. Rivilla, H.S.P. Müller et al. (1/15). 2024. The Astrophysical Journal Letters ([in press](#)).
- 2 Scientific paper.** M. Sanz-Novo (AC), V. M. Rivilla, I. Jiménez-Serra et al. (1/15). 2024. *Interstellar detection of O-protonated carbonyl sulfide, HOCS<sup>+</sup>*. The Astrophysical Journal ([in press](#)).
- 3 Scientific paper.** M. Sanz-Novo (AC), V. M. Rivilla, I. Jiménez-Serra et al. (1/15). July 2023. *Discovery of the elusive carbonic acid (HOCOOH) in space*. The Astrophysical Journal. 954, 3. DOI: [10.3847/1538-4357/ace523](#) Press release in [New Scientist](#). and [Nautilus Magazine](#).
- 4 Scientific paper.** V. M. Rivilla (AC), M. Sanz-Novo, I. Jiménez-Serra et al. (2/16). July 2023. *First glycine isomer detected in the interstellar medium: glycolamide (NH<sub>2</sub>C(O)CH<sub>2</sub>OH)*. The Astrophysical Journal Letters, 953, L20. DOI: [10.3847/2041-8213/ace977](#)
- 5 Scientific paper.** M. Sanz-Novo; J. L. Alonso (AC); V. M. Rivilla; B. A. McGuire; I. León; I. Jiménez-Serra and J. Martín-Pintado. (1/7). 2022. *Laboratory detection and astronomical study of interstellar acetohydroxamic acid, a glycine isomer*, Astronomy & Astrophysics. 666, A134. Q1. DOI: [10.1051/0004-6361/202244330](#) (International collaboration, open access).
- 6 Scientific paper.** M. Sanz-Novo (AC); P. Ortega; P. Redondo; A. Largo; J. L. Alonso and C. Barrientos. (1/6). 2022. *Structure and Spectroscopic Signatures of Interstellar Sodium Isocyanate Isomers*. The Astrophysical Journal. 941, 40. Q1. DOI: [10.3847/1538-4357/ac9f35](#)
- 7 Scientific paper.** M. Sanz-Novo; A. Belloche; V. M. Rivilla; J. L. Alonso (AC) (1/14). 2022. *Toward the limits of complexity of interstellar chemistry: Rotational spectroscopy and astronomical search for n- and i-butanol*. Astronomy & Astrophysics. 666, A114. Google Scholar (5). Q1. DOI: [10.1051/0004-6361/202142848](#) (International collaboration, open access).
- 8 Scientific paper.** M. Sanz-Novo; Mauro Mato; I. León; A. M. Echavarren and J. L. Alonso (AC). (1/5). 2022. *Shape-Shifting Molecules: Unveiling the Valence Tautomerism Phenomena in Bare Barbaralones*. Angewandte Chemie Int Ed. e2021170, pp.1-6. Google Scholar (4). Q1. DOI: [10.1002/anie.202117045](#) ([Front Cover](#), National collaboration, open access).
- 9 Scientific paper.** M. Sanz-Novo, I. León, E. R. Alonso, J. L. Alonso (AC) (1/4). 2022. “Unleashing the shape of L-DOPA at last”, Phys. Chem. Chem. Phys., 24, 3546-3554. Google Scholar (3). Q1. DOI: [10.1039/D1CP05066D](#) ([Back cover](#), Issue 6).
- 10 Scientific paper.** M. Sanz-Novo; A. Belloche; R. T. Garrod; J.L Alonso (AC) et al. (1/9). 2020. *Interstellar glycolamide: A comprehensive rotational study and an astronomical search in Sgr B2(N)*. Astronomy & Astrophysics. 639, pp.1-26. Google Scholar (10). Q1. DOI: [10.1051/0004-6361/202038149](#) (International collaboration).

### C.2. Ten most relevant oral communications at International and National Congresses

- 1** M. Sanz-Novo. *Interstellar detection of carbonic acid (HOCOOH) at last*. XVII Iberian Joint Meeting on Atomic and Molecular Physics. 2023. Portugal. Participatory – oral communication. International Conference.
- 2** M. Sanz-Novo. *Pushing the limits of complexity of interstellar chemistry: a synergetic theoretical and experimental rotational study and beyond (Best thesis ASEVA Award)*. 19<sup>th</sup> International Conference on Thin Films (ICTF). 2023. Burgos. Spain, Participatory – Invited talk. International Conference
- 3** M. Sanz-Novo; J. L. Alonso; I. León; S. Mata; V. M. Rivilla, I. Jiménez-Serra, J. Martín-Pintado, B. A. McGuire. *Laboratory detection and astronomical search for an uncharted glycine isomer*. International Symposium on Molecular Spectroscopy (ISMS2023). University of Illinois. 2022. EEUU. Participatory – oral communication. International Conference.
- 4** M. Sanz-Novo; M. Mato, I. León et al. *Shape shifting molecules: unravelling the valence tautomerism phenomena in 1-substituted barbaralones*. XIV Conference of Young Researchers in Atomic and Molecular Physics (J2IFAM2023). Universidad Autónoma de Madrid. RSEQ/RSEF. 2023. Madrid. Spain. Participatory – Invited talk. National Conference.
- 5** M. Sanz-Novo; J. L. Alonso; A. Belloche et al. *Rotational spectroscopy and interstellar search for n- and i-butyraldehyde*. International Symposium on Molecular Spectroscopy (ISMS2022). University of Illinois. 2022. EEUU. Participatory – oral communication. International Conference (International collaboration).
- 6** G. Juárez; M. Sanz-Novo; E. R. Alonso; I. León; J. L. Alonso. *Unveiling the eight forms of caffeic acid*. International Symposium on Molecular Spectroscopy (ISMS2022). University of Illinois. 2022. EEUU. Participatory – oral communication. International Conference.



- 7 M. Sanz-Novo; E. R. Alonso; I. León; J. L. Alonso. *Unveiling the shape of neutral levodopa*. 27th Colloquium on High-Resolution Molecular Spectroscopy (HRMS Cologne 2021). Cologne center for terahertz spectroscopy. 2021. Germany. Participatory – oral communication. International Conference.
- 8 M. Sanz-Novo; M. Mato; I. León et al. *A rotational study of 1-substituted barbaralones*. International Symposium on Molecular Spectroscopy (ISMS2021). University of Illinois. 2021. EEUU. Participatory – oral communication. International Conference.
- 9 M. Sanz-Novo; I. León; S. Mata; J. L. Alonso. *A rotational study of interstellar acetohydroxamic acid, a glycine isomer*. International Symposium on Molecular Spectroscopy (ISMS2021). University of Illinois. 2021. EEUU. Participatory – oral communication. International Conference.
- 10 M. Sanz-Novo; E. R. Alonso; I. León; J. L. Alonso. *The shape of levodopa: a laser ablation rotational study*. International Symposium on Molecular Spectroscopy (ISMS2021). University of Illinois. 2021. EEUU. Participatory – oral communication. International Conference.

### C.3. Research projects

The candidate researcher has been responsible of several research lines in **6 projects** funded by diverse institutions: **ERC-Synergy, Plan Nacional, MINECO** and **JCyL**, which are listed below:

- 1 **Project**. PID2020-117742GB-I00, *Simulaciones computacionales en astroquímica: Propiedades espectroscópicas y reactividad de moléculas interestelares*. Ministerio de Ciencia e Innovación. PI Carmen Barrientos Benito. 01/09/2021-31/08/2025. 64.130 €. Participation: researcher. Research lines for which the researcher has been responsible: a) Reactivity and formation of new interstellar complex organic molecules, with a focus on glycine (simplest amino acid). b) Prediction of spectroscopic properties of potential prebiotic interstellar molecules and new metal-derivatives.
- 2 **Project**. VA244P20, *Laser ablation spectroscopic techniques: From building blocks and sweeteners to interstellar molecules*. Junta de Castilla y León. PI Carmen Barrientos Benito. 30/10/2020-30/10/2023. 172.000 €. Participation: researcher. Research lines: Application of laser ablation rotational spectroscopic techniques to the study of building blocks of life, and potential interstellar candidates and coordinator of their interstellar search with international institutions.
- 3 **Project**. PID2019-111396GB-I00, *Biomoléculas y moléculas del medio interestelar (ISM): Estructura, tautomerismo, generación por ablación-láser y búsqueda interestelar*. Ministerio de Ciencia e Innovación. PI José Luis Alonso Hernández. 01/06/2020-31/05/2023. 181.500 €. Participation: Team member. Research lines: Centimeter- (broadband and narrowband) and millimeter-wave spectroscopy of astrochemically-relevant prebiotic molecules (peptide-bond like molecules and cyano-bearing systems) and coordinator of their search in the interstellar medium.
- 4 **Project**. Grant n. 610256, NANOCOSMOS. *Gas and Dust from the Stars to the Laboratory: Exploring the Nanocosmos Program*: ERC-2013-SyG-Synergy Grant 610256. European Research Council. PI José Cernicharo. 01/01/2014-22/01/2022. 633.620 €. Participation: Team member. Research lines: Co-responsible of laboratory rotational studies on relevant interstellar molecules.
- 5 **Project**. CTQ2016-76393-P, *Biomoléculas y Moléculas del medio Interestelar: Relaciones estructura-propiedad, quiralidad y detección en el ISM*. Ministerio de Ciencia e Innovación. PI José Luis Alonso Hernández. 30/12/2016-31/12/2020. 206.910 €. Participation: Team member. Research lines: Co-responsible of rotational studies on prebiotic molecules of astrochemical relevance.
- 6 **Project**. VA077U16, *Relaciones estructura-propiedad en edulcorantes*. Junta de Castilla y León. José Luis Alonso Hernández. 30/06/2016- 30/06/2018. 120.000 €. Participation: Team member.

### C.4. Contracts, technological or transfer merits

- **Contract with Private Entity**. Dulces y conservas Helios S. A. *Relaciones estructura-propiedad en edulcorantes*. PI José Luis Alonso Hernández. Start date-Final date: 29/02/2016-present.
- **Teaching Innovation Projects**: a) *Estrategias de gamificación en las asignaturas de Química Física*. University of Valladolid. 24/11/2020 - 01/10/2023. Team member (ongoing). b) *Simulaciones virtuales como herramienta TIC para la enseñanza de la Química Física*. University of Valladolid. 09/11/2022 - 01/10/2023 Team member (ongoing).
- **ANECA accreditation**: *Profesor Ayudante Doctor, Profesor de Universidad Privada and Profesor Contratado Doctor*. 22/06/2022
- **Teaching Experience and Supervision**: a) 250 hours of teaching experience in the Chemistry Degree (UVa, 2018/2019-2022/2023). Experimental Chemistry IV (Molecular Spectroscopy & Chemical Kinetics) Experimental Chemistry II (Quantum Chemistry & Molecular Spectroscopy). b) Co-supervisor of: 1xTrabajo Fin de Grado (TFG, 2021/2022), 3xTFG (2022/2023) and 1xTFM (2022/2023). c) Academic Tutor of 5xPrácticas de Empresa (2021/2022)



- **Scientific outreach:** a) Judge for Snyder Prize, International Symposium of Molecular Spectroscopy (ISMS22 and ISMS23), Illinois, (2022 and 2023). b) Scientific Organizing Committee, “I PhD Day”, University of Valladolid. Real Sociedad Española de Química (RSEQ) (February 2022). c) Scientific Divulcation Activities: “Observando moléculas” (UVa, November 2021), “Decimocuarta Noche Europea de los investigadores” (Museo de la Ciencia de Valladolid, November 2019), “Encuentros sobre Fronteras de la Ciencia” (UVa, USAL, Fundación Duques de Soria, February 2017 and February 2018). d) Membership of Scientific Societies: Member of RSEQ and GEFAM since 2020 and ASEVA since 2023. e) Referee of Astronomy & Astrophysics and The Astrphysical Journal.