Borja Pérez-Díaz

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🌐 Website
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Employment History

08/2021 – 07/2025	**Ph.D. in Astrophysics,** Instituto de Astrofísica de Andalucía - Consejo Superior de Investigaciones Científicas, Granada, Spain.
04/2021 – 08/2021	**Researcher** Instituto de Astrofísica de Andalucía - Consejo Superior de Investigaciones Científicas, Granada, Spain.
08/2020 – 02/2021	**Researcher** Instituto de Astrofísica de Andalucía - Consejo Superior de Investigaciones Científicas, Granada, Spain.

Education

08/2021 – 07/2025	**Ph.D., Universidad de Granada**, in Astrophysics. Thesis title: *Interpretation of infrared emission lines from starburst galaxies and active galactic nuclei based on photoionization models.*
09/2019 – 06/2020	**M.Sc. Physics and Mathematics, Universidad de Granada**, in Astrophysics. Thesis title: *Chemical abundances in the Palomar Survey.*
09/2014 – 07/2019	**B.Sc. Physics, Universidad de Oviedo**, in Astrophysics. Thesis title: *The co-evolution nature of galaxies and their Active Galactic Nuclei.*
	B.Sc. Mathematics, Universidad de Oviedo, in Statistics. Thesis title: *Some statistical methods applied to Astrophysics.*

Awarded Grants

08/2021 – 07/2025	**Predoctoral Contracts for the training of Doctors (2020)** (COD: SEV-2017-0709-20-2), Spanish Ministry of Science, Innovation and Universities.
09/2019 – 06/2020	**Introductory research grants for students (2019)** (COD: JAEINT 19 00863), Spanish National Research Council.

Research Publications (NASA/ADS libraries)

Refereed publications	**NASA/ADS library:** https://ui.adsabs.harvard.edu/public-libraries/qKck9hm3SEWvi_bf9fNuvw.
CDS catalogues	**NASA/ADS library:** https://ui.adsabs.harvard.edu/public-libraries/Bs9yrGxvQJO_DT9OWdoNzA.

Research Publications (List)

Refereed Articles

1. E. Pérez-Montero, **B. Pérez-Díaz**, J. M. Vílchez, I. A. Zinchenko, A. Castrillo, M. Gavilán, S. Zamora, and Á. I. Díaz, "Sulphur abundances in star-forming regions from optical emission lines: A new approach based on photoionization models consistent with the direct method," *arXiv e-prints*, arXiv:2506.14736, arXiv:2506.14736, Jun. 2025. ⚭ DOI: 10.48550/arXiv.2506.14736. arXiv: 2506.14736 [astro-ph.GA].

2. E. Pérez-Montero, J. A. Fernández-Ontiveros, **B. Pérez-Díaz**, J. M. Vílchez, and R. Amorín, "Exploring the hardness of the ionizing radiation with the infrared softness diagram: II. Bimodal distributions in both the ionizing continuum slope and the excitation in active galactic nuclei," *Astronomy & Astrophysics*, vol. 696, A229, A229, Apr. 2025. ⚭ DOI: 10.1051/0004-6361/202453276. arXiv: 2503.09267 [astro-ph.GA].

3. A. Lumbreras-Calle, J. A. Fernández-Ontiveros, R. Infante-Sainz, M. Akhlaghi, B. Montoro-Molina, **B. Pérez-Díaz**, A. del Pino, H. Vives-Arias, A. Hernán-Caballero, C. López-Sanjuan, M. A. Martín-Guerrero, S. Eskandarlou, and A. Ederoclite, "Andromeda's tenuous veil: extensive nebular emission near (yet far from) M31 (Submitted to Astronomy & Astrophysics)," *arXiv e-prints*, arXiv:2412.08327, arXiv:2412.08327, Dec. 2024. ⚭ DOI: 10.48550/arXiv.2412.08327. arXiv: 2412.08327 [astro-ph.GA].

4. **B. Pérez-Díaz**, E. Pérez-Montero, I. A. Zinchenko, and J. M. Vílchez, "Chemical enrichment in LINERs from MaNGA: I. Tracing the nuclear abundances of oxygen and nitrogen in LINERs with varied ionizing sources," *Astronomy & Astrophysics*, vol. 694, A18, A18, Feb. 2025. ⚭ DOI: 10.1051/0004-6361/202452862. arXiv: 2411.16611 [astro-ph.GA].

5. **B. Pérez-Díaz**, E. Pérez-Montero, J. A. Fernández-Ontiveros, J. M. Vílchez, A. Hernán-Caballero, and R. Amorín, "Chemical abundances and deviations from the solar S/O ratio in the gas-phase interstellar medium of galaxies based on infrared emission lines," *Astronomy & Astrophysics*, vol. 685, A168, A168, May 2024. ⚭ DOI: 10.1051/0004-6361/202348318. arXiv: 2403.02903 [astro-ph.GA].

6. S. Goswami, J. M. Vilchez, **B. Pérez-Díaz**, L. Silva, A. Bressan, and E. Pérez-Montero, "Contribution of very massive stars to the sulfur abundance in star-forming galaxies: Role of pair-instability supernovae," *Astronomy & Astrophysics*, vol. 685, A81, A81, May 2024. ⚭ DOI: 10.1051/0004-6361/202348231. arXiv: 2402.13240 [astro-ph.GA].

7. E. Pérez-Montero, J. A. Fernández-Ontiveros, **B. Pérez-Díaz**, J. M. Vílchez, N. Kumari, and R. Amorín, "Exploring the hardness of the ionising radiation with the infrared softness diagram. I. Similar effective temperature scales for starbursts and (ultra)luminous infrared galaxies," *Astronomy & Astrophysics*, vol. 684, A40, A40, Apr. 2024. ⚭ DOI: 10.1051/0004-6361/202348089. arXiv: 2401.09765 [astro-ph.GA].

8. **B. Pérez-Díaz**, E. Pérez-Montero, J. A. Fernández-Ontiveros, J. M. Vílchez, and R. Amorín, "A departure from the mass-metallicity relation in merging galaxies due to an infall of metal-poor gas," *Nature Astronomy*, vol. 8, pp. 368–376, Mar. 2024. ⚭ DOI: 10.1038/s41550-023-02171-x. arXiv: 2306.14843 [astro-ph.GA].

9. A. Arroyo-Polonio, J. Iglesias-Páramo, C. Kehrig, J. M. Vílchez, R. Amorín, I. Breda, E. Pérez-Montero, **B. Pérez-Díaz**, and M. Hayes, "A MUSE/VLT spatially resolved study of the emission structure of Green Pea galaxies," *Astronomy & Astrophysics*, vol. 677, A114, A114, Sep. 2023. ⚭ DOI: 10.1051/0004-6361/202346192. arXiv: 2309.09585 [astro-ph.GA].

10. E. Pérez-Montero, R. Amorín, **B. Pérez-Díaz**, J. M. Vílchez, and R. García-Benito, "Assessing model-based carbon and oxygen abundance derivation from ultraviolet emission lines in AGNs," *Monthly Notices of the Royal Astronomical Society*, vol. 521, no. 1, pp. 1556–1569, May 2023. ⚭ DOI: 10.1093/mnras/stad621. arXiv: 2302.12560 [astro-ph.GA].

11. E. Pérez-Montero, I. A. Zinchenko, J. M. Vílchez, A. Zurita, E. Florido, and **B. Pérez-Díaz**, "The softness diagram for MaNGA star-forming regions: diffuse ionized gas contamination or local HOLMES

predominance?" *Astronomy & Astrophysics*, vol. 669, A88, A88, Jan. 2023. 🔗 DOI: 10.1051/0004-6361/202244591. arXiv: 2212.03216 [astro-ph.GA].

12   **B. Pérez-Díaz**, E. Pérez-Montero, J. A. Fernández-Ontiveros, and J. M. Vílchez, "Measuring chemical abundances in AGN from infrared nebular lines: HII-CHI-MISTRY-IR for AGN," *Astronomy & Astrophysics*, vol. 666, A115, A115, Oct. 2022. 🔗 DOI: 10.1051/0004-6361/202243602. arXiv: 2207.08718 [astro-ph.GA].

13   B. Montoro-Molina, M. A. Guerrero, **B. Pérez-Díaz**, J. A. Toalá, S. Cazzoli, M. M. Miller Bertolami, and C. Morisset, "Chemistry and physical properties of the born-again planetary nebula HuBi 1," *Monthly Notices of the Royal Astronomical Society*, vol. 512, no. 3, pp. 4003–4020, May 2022. 🔗 DOI: 10.1093/mnras/stac336. arXiv: 2202.00353 [astro-ph.SR].

14   L. Spinoglio, J. A. Fernández-Ontiveros, M. A. Malkan, S. Kumar, M. Pereira-Santaella, **B. Pérez-Díaz**, E. Pérez-Montero, A. Krabbe, W. Vacca, S. Colditz, and C. Fischer, "SOFIA Observations of Far-IR Fine-structure Lines in Galaxies to Measure Metallicity," *The Astrophysical Journal*, vol. 926, no. 1, 55, p. 55, Feb. 2022. 🔗 DOI: 10.3847/1538-4357/ac37b7. arXiv: 2111.04434 [astro-ph.GA].

15   **B. Pérez-Díaz**, J. Masegosa, I. Márquez, and E. Pérez-Montero, "Chemical abundances in the nuclear region of nearby galaxies from the Palomar Survey," *Monthly Notices of the Royal Astronomical Society*, vol. 505, no. 3, pp. 4289–4309, Aug. 2021. 🔗 DOI: 10.1093/mnras/stab1522. arXiv: 2105.11164 [astro-ph.GA].

Conference Proceedings

1   A. Lumbreras-Calle, J. A. Fernández-Ontiveros, R. Infante-Sainz, A. del Pino Molina, M. Akhlaghi, B. Montoro-Molina, H. Vives-Arias, **B. Pérez-Díaz**, M. Guerrero Roncel, S. Eskandarlou, A. Ederoclite, A. Hernán-Caballero, and C. López-Sanjuan, "The Andromeda Veil: Combining MEGARA and JAST80 to Probe the Nature of a Faint Nebula Towards M31," in *Highlights of Spanish Astrophysics XII*, M. Manteiga, F. González-Galindo, A. Labiano-Ortega, M. J. Martínez-González, N. Rea, M. Romero-Gómez, A. Ulla-Miguel, G. Yepes, C. Rodríguez-López, A. Gómez-García, and C. Dafonte, Eds., May 2025, p. 222.

2   **B. Pérez-Díaz**, E. Pérez-Montero, J. A. Fernández-Ontiveros, J. M. Vílchez, and R. Amorín, "A deep-dive beneath the mass-metallicity relation: Unveiling chemical enrichment in galaxies through infrared emission lines," in *Highlights of Spanish Astrophysics XII*, M. Manteiga, F. González-Galindo, A. Labiano-Ortega, M. J. Martínez-González, N. Rea, M. Romero-Gómez, A. Ulla-Miguel, G. Yepes, C. Rodríguez-López, A. Gómez-García, and C. Dafonte, Eds., May 2025, p. 92.

3   **B. Pérez-Díaz**, E. Pérez-Montero, J. A. Fernández-Ontiveros, and J. M. Vílchez, "Measuring chemical abundances in AGN from infrared nebular lines: HII-CHI-Mistry-IR for AGN," in *Highlights on Spanish Astrophysics XI*, M. Manteiga, L. Bellot, P. Benavidez, A. de Lorenzo-Cáceres, M. A. Fuente, M. J. Martínez, M. Vázquez Acosta, and C. Dafonte, Eds., May 2023, p. 118.

Catalogs

1   **B. Pérez-Díaz**, E. Perez-Montero, I. A. Zinchenko, and J. M. Vilchez, *VizieR Online Data Catalog: Chemical abundances in LINERs from MaNGA. I (Perez-Diaz+, 2025)*, Nov. 2024.

2   **B. Pérez-Díaz**, J. Masegosa, I. Marquez, and E. Perez-Montero, *VizieR Online Data Catalog: Chemical abundances of nearby galaxies (Perez-diaz+, 2021)*, Jun. 2024.

3   **B. Pérez-Díaz**, E. Perez-Montero, J. A. Fernandez-Ontiveros, J. M. Vilchez, A. Hernan-Caballero, and R. Amorin, *VizieR Online Data Catalog: AGN and SFGs abundances (Perez-Diaz+, 2024)*, Mar. 2024.

4   **B. Pérez-Díaz**, E. Perez-Montero, J. A. Fernandez-Ontiveros, J. M. Vilchez, and R. Amorin, *VizieR Online Data Catalog: Departure from mass-metallicity relation (Perez-Diaz+, 2024)*, Jan. 2024.

5 E. Perez-Montero, R. Amorin, **B. Pérez-Díaz**, and R. Garcia-Benito, *VizieR Online Data Catalog: HII-CHI-Mistry-UV for AGN. Abundances (Perez-Montero+, 2023)*, Mar. 2023.

6 **B. Pérez-Díaz**, E. Perez-Montero, J. A. Fernandez-Ontiveros, and J. M. Vilchez, *VizieR Online Data Catalog: HII-CHI-Mistry-IR for AGN. Abundances (Perez-Diaz+, 2022)*, Jul. 2022. 🔗 DOI: 10.26093/cds/vizier.36660115.

Conferences and seminars

Seminars
"The chemical content of the Narrow Line Region as inferred from optical and infrared nebular emission lines", Centro de Estudios de Física del Cosmos de Aragón (Teruel, Spain), January 9-14 2023.

Invited talks
"Gas-rich Systems - The chemical content of the gas-phase ISM as revealed through infrared emission lines", MIAPbP Program Abundance Gradients in the Local Universe - ADONIS (Garching, Germany), April 8-19 2024.

"Unveiling chemical enrichment in galaxies through infrared emission lines", Space Telescope Science Institute (STScI), Journal Club (Baltimore, United States of America), Jun 2023.

Contributed talks
"Sulfur and Nitrogen: Key Players in the Chemical Enrichment Story", European Astronomical Meeting 2025 (Cork, Ireland), June 23-27 2025.

"Far-IR Emission Lines: Revealing the True Chemical Enrichment History", European Astronomical Meeting 2025 (Cork, Ireland), June 23-27 2025.

"Unveiling chemical enrichment in galaxies through infrared emission lines", XVI Reunión Científica de la Sociedad Española de Astronomía (Granada, Spain), July 15-19 2024.

"Unveiling chemical enrichment in galaxies through infrared emission lines", IV Workshop on Chemical Abundances in Gaseous Nebulae (Sao José dos Campos, Brazil), May 6 - 10 2024.

"Unveiling chemical enrichment in galaxies through infrared emission lines", XIV Estallidos Workshop - Multifaced study of the star-formation in the Universe" (Madrid, Spain), February 5-7 2023.

"The chemical content of the NLR as estimated from IR emission lines in AGNs", VI Meeting of AGN Research in Spain in the Era of the New Observatories (Granada, Spain), January 30-February 1 2023.

"Chemical abundances in the NLR of AGN based on IR emission lines", XIII Estallidos Workshop - Starburst along the life of the Universe (Madrid, Spain), May 18-20 2022.

"Chemical abundances in the nuclear region of nearby galaxies from the Palomar Survey", III Workshop on Chemical Abundances in Gaseous Nebulae (Virtual), May 24-28 2021.

"Chemical abundances in nearby galaxies from the Palomar Survey", XIV SEA Scientific Meeting (Virtual), July 13-15 2020.

Observing Experience

Observing proposals
Guaranteed time, Nordic Optic Telescope (NOT), ALFOSC (Co-I).

111.253U/P111, Very Large Telescope (VLT), MUSE, 1h45m (Co-I).

Observing Experience (continued)

	109.239L/P109, Very Large Telescope (VLT), MUSE, 1h42m (Co-I).
Observing nights	2020, Calar Alto Observatory (CAHA), 2.2m Telescope, CAFOS, 1 night.
	2020, Nordic Optic Telescope (NOT), ALFOSC, 3 nights.
Data reduction	JWST pipeline for MIRI, NIRSpec and NIRCam. I personally participated in the JWST Data Masterclass organzied by ESA and held in Madrid.
	MaNGA DRP and MaNGA DAP. II worked with this pipeline with Dr. Igor Zinchenko for the current project of research.

Language skills

Spanish	Native speaker.
English	Strong competencies in reading, writing, and speaking.

Computer/coding experience

Coding	**Python**, high level of expertise. I have been programming in Python since 2016.
	R programming, high level of expertise. I have been programming in R for statistical analysis since 2015.
	Bash programming, moderate level of expertise. I have been programming short scripts in Bash to automatize work in clusters.
	Git programming, moderate level of expertise. I have been using git as control version as well as to create GitHub repositories publicly available.
	LaTeX, High level of expertise. I have been using LaTeX for all my scientific projects, papers and documents.
Software	IRAF package, moderate level of expertise. I have been using IRAF for data reduction for several sets of data. URL: https://iraf-community.github.io/.
	Cloudy photoionization code, moderate level of expertise. I have been using Cloudy during my Ph.D. for my projects. URL: https://gitlab.nublado.org/cloudy/cloudy.
	MAPPINGs photoionization/shock code, moderate level of expertise. I have been using MAPPINGs to produce grids of models to account for shock contribution. URL: https://mappings.readthedocs.io/en/latest/.
	Paris-Durham shock code, basic level of expertise. I have attended courses on the use of the Paris-Durham shock code. URL: https://ism.obspm.fr/shock.html.
	HII-CHI-Mistry python based code for the estimation of chemical abundances and physical parameters of the gas-phase ISM. Co-developer of the code, I maintained also the GitHub repository. URL: https://github.com/Estallidos/HII-CHI-Mistry.

Relevant Experience

Scientific community work

LOC
- Member of the Local Organization Committee (LOC) for the 2nd IAA-CSIC Severo Ochoa Advanced School on Galaxy Evolution - GALEVOL 2025 (Granada, Spain), May 19-23 2025.
- Volunteer in the Local Organization Committee (LOC) for the XVI Reunión Científica de la Sociedad Española de Astronomía (Granada, Spain), July 15-19 2024.
- Member of the Local Organization Committee (LOC) for the IAA-CSIC Severo Ochoa Advanced School on Galaxy Evolution - GALEVOL 2022 (Granada, Spain), May 23-27 2022.

Referee
- Scientific referee for Monthly Notices of the Royal Astronomical Society (MNRAS).
- Scientific referee for Astronomy & Astrophysics (AAp).

Training activities

- 2nd IAA-CSIC Severo Ochoa Advanced School on Galaxy Evolution, Instituto de Astrofísica de Andalucía (IAA-CSIC), Spain 05/2023. I attended seminars on the current state-of-the-art of the most promising fields and researchs on galaxy evolution.

- JWST Data Masterclass, European Space Astronomy Centre (ESAC), Spain 12/2023. In this training course I gained skills on the use of JWST data reduction pipeline for different instruments such as MIRI, NIRCam and NIRSpec.

- 2nd Severo Ochoa Advanced School on Star Formation, Instituto de Astrofísica de Andalucía (IAA-CSIC), Spain 11/2023 - 12/2023. Complementary to the previous school (STARFORM 2021), I have updated and discussed with the participants the new advances on our understanding of the star formation process.

- GALEVOL 2022 - Severo Ochoa Advanced School on Galaxy Evolution, Instituto de Astrofísica de Andalucía (IAA-CSIC), Spain 05/2022. In this school I attended seminars about the current state-of-the-art on the theory, observations and simulations of galaxies and their different ways of evolution.

- English for Academic Purposes, Instituto de Astrofísica de Andalucía (IAA-CSIC), Spain 03/2022. During this short training course I have perfected my skills for scientific writing as well as gain tools for presenting my own work.

- Inteligencia Artifical en 360, Universidad de Granada, Spain 01/2022-02/2022. During this course I acquired more skills to build-up Neural Networks and their applications.

- Interstellar Shock School, École de Physique des Houches and Université Grenoble Alphes, France, 06/2022. In this training program I have assisted to several courses on the theory of shocks in the ISM, key components for its observation and gain knowledge on the use of the Paris-Durham shock code for modeling low-velocity shocks.

- STARFORM 2021- Severo Ochoa Advanced School on Star Formation, Instituto de Astrofísica de Andalucía (IAA-CSIC), Spain 11/2021. In this school I have attended to seminars about the current state-of-the-art on the theory, observations and simulations of the processes that are involved in star formation.

- International Summer School on The Interstellar Medium of Galaxies, from the Epoch of Reionization to the Milky Way, 07/2021. During this school I attended several seminars as well as practice exercises with compute software that provided me with a better understanding of the gas-phase ISM and its modeling.

Relevant Experience (continued)

- SOMACHINE 2020 - Severo Ochoa School on Machine Learning, Big Data and Deep Learning in Astronomy, Instituto de Astrofísica de Andalucía (IAA-CSIC), Spain 11/2020. During this course I acquired knowledge on the creation, supervision and testing of Neural Networks as well as other utilities for data treatment.

- The Dark Sky as a Scientific, Cultural, Environmental and Touristic Resource, Universidad Internacional de Sevilla, Spain, 10/2020. During this course I gained knowledge to actively participate in protecting and preserving the night sky as well as warning the general public about the problem of light pollution.

Scientific visits

- Space Telescope Science Institute (STScI), United States of America, 05/2023 - 08/2023. For a three-month stage, I have worked under the supervision of Dr. Nimisha Kumari at the STScI, to gain knowledge on the capabilities of JWST and its data reduction. We also collaborated on research using photoionization models to constrain physical relations within the gas-phase ISM which can be applied for quick recipes in the estimation of electron temperature and density. I also gave an invited talk on my most recent research.

- Centro de Estudios de Física del Cosmos de Aragón (CEFCA) and Universidad Autónoma de Madrid (UAM), Spain 01/2023. Invited one week stage in each center for in-situ collaboration with members of the research group. As a consequence of the visits, I gave an invited seminar and published two papers.

Outreach activities

- Participation in public engagement events like the "Night of the European Researchers" in Granada, delivering talks to the general public, and leading activities for children to simplify complex astronomical concepts.

- Temporary member of the LGTBIQ committee at the Instituto de Astrofísica de Andalucía.

- Collaborator in "Astroaccesible" and "Fundación ONCE", dedicated to making astronomy accessible and promote diversity within the scientific community.

References

Dr. Enrique Pérez-Montero
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