

Dr. José Eduardo Méndez Delgado



Personal Information

- **Birthplace:** Morelia, Michoacán, México
- **Nationality:** Mexican
- **Address:** Mönchhofstraße 12-14, Heidelberg, Germany

Education

- **Ph.D. in Astrophysics**
Universidad de La Laguna (ULL) - Instituto de Astrofísica de Canarias (IAC), Spain
Thesis title: “Ionised gas flows in the Orion Nebula: properties and environmental dependencies”
Degree awarded with honors
Supervisors: Dr. César Esteban & Dr. Jorge García Rojas
2018 - 2022
- **M.Sc. in Astrophysics**
Universidad de La Laguna (ULL), Spain
Master’s thesis title: “The radial gradient of helium in the Milky Way”
Supervisor: Dr. César Esteban
2017-2019
- **B.Sc. in Physics**
Universidad Nacional Autónoma de México (UNAM), Mexico
Bachelor’s thesis title: “Temperature inhomogeneities and oxygen abundances in Planetary Nebulae of the Magellanic Clouds”
Degree awarded with honors
Supervisor: Dr. Manuel Peimbert Sierra
2012-2017

Professional Experience

- **Postdoctoral researcher**
Astronomisches Rechen-Institut, Zentrum für Astronomie der Universität Heidelberg, Heidelberg, Germany
2022-??
Chair of the nebular diagnostics and chemical abundances working group of the SDSS-V Local Volume Mapper (LVM).

Principal Investigator of the DEep Spectra of Ionized Regions Database (DESIRED)
Interstellar medium researcher in Physics at High Angular resolution in Nearby GalaxieS (PHANGS)

- **Resident Astrophysicist**

Instituto de Astrofísica de Canarias, San Cristóbal de La Laguna, Spain
2018-2022

Ph.D. student funded by the IAC. Contract obtained through international competition.

- **Summer Research Fellow**

Instituto de Astrofísica de Canarias, San Cristóbal de La Laguna, Spain
2018

Program funded by the IAC. Contract obtained through international competition.

Supervisors: Dr. José Miguel Rodríguez Espinosa & Dr. Helmut Dannerbauer & Dr. Casiana Muñoz Tuñón

- **Emeritus Professor Assistant**

Instituto de Astronomía, UNAM Mexico City, Mexico
2014-2017

Fellowship funded by the mexican Consejo Nacional de Ciencia y Tecnología (CONACyT). Supervisor: Dr. Manuel Peimbert Sierra.

Featured Scientific Collaborations

- **Sloan Digital Sky Survey-V Local Volume Mapper (LVM)**

Position: Chair of the Nebular Diagnostics & Chemical Abundances Working Group

LVM is an optical, integral-field spectroscopic survey that targets the Milky Way, Small and Large Magellanic Clouds, and other Local Volume galaxies. LVM employs new telescopes and newly built spectrographs covering a wavelength range of 3600-9600 Å, with a spectral resolution of $R \sim 4000$. The number of projects and scientific research carried out in the working group is extensive and diverse. For instance, we are analyzing the internal physics of hundreds of ionized nebulae covered by the survey. Currently, various physical processes are under study, including stellar feedback processes and their impact within the surrounding ionized gas, shocks, stellar populations, gas flows, physical conditions, chemical abundances, dust production and destruction, etc. Additionally, we will analyze large-scale Galactic properties, radial gradients of chemical abundances, and the analysis of azimuthal variations.

- **“DEep Spectra of Ionized REgions Database (DESIRED)”**

Position: Principal investigator

DESIRED is the homogeneous compilation of ALL deep optical spectroscopic data from the literature. Each nebular spectrum includes, at least, a direct detection of an auroral line, necessary for determining the electron temperature of the gas. This parameter is essential for obtaining reliable chemical abundances. However, we do not limit ourselves to collecting the typical ‘strong lines’ (e.g., [OIII] 5007, [NII] 6584) as has been done in previous works. Considering that the physics revealed through weak lines (e.g., CII 4267, [FeIII] 4658) is novel and important, we place special emphasis on compiling the COMPLETE information from the observations. Currently, the database includes more than 1500 objects, and we have several ongoing studies. In its initial stage, DESIRED has served as the basis for the articles Méndez-Delgado et al. 2023a and Méndez-Delgado et al. 2023b and two M.Sc. thesis.

- **“Physics at High Angular resolution in Nearby GalaxieS (PHANGS)”**

Position: Interstellar medium researcher

PHANGS is an international collaboration specialized in the detailed analysis of high resolution observations of nearby galaxies with several telescopes, including ALMA, Hubble, JWST and the VLT. We aim to understand the interplay of the small-scale physics of gas and star formation with galactic structure and galaxy evolution. My interests focus on large-scale galactic phenomena and their impact on the physical conditions and chemical abundances of the interstellar medium as well as the stellar feedback.

Scholarships

- **Resident Astrophysicist Position**
2018-2022
Instituto de Astrofísica de Canarias, Spain
Academic excellence fellowship for doctoral studies
- **PhD Scholarship**
2019-2021
Consejo Nacional de Ciencia y Tecnología (CONACyT), Mexico
Academic excellence scholarship for doctoral studies
- **Summer Research Scholarship**
2018
Instituto de Astrofísica de Canarias, Spain
Academic excellence fellowship for a research stay
- **Fundación Carolina Fellowship**
2017-2019
Fundación Carolina, Spain
Academic excellence fellowship for master studies
- **Fundación Laura Alejandra Gallardo Fellowship**
2014-2017
Fundación Laura Alejandra Gallardo, Mexico
Academic excellence fellowship for bachelor studies

Awards

- **Michoacan's State Youth Award for Academic Merit**
2014
Government of Michoacan
Award granted by the State of Michoacan for the most outstanding academic career among youth

Teaching

- **Computational Science I**
2021
"Venía Docendi" Professor, Facultad de Física, Universidad de La Laguna
B.Sc. Course
San Cristóbal de La Laguna, Spain
- **Computational Science I**
2020
"Venía Docendi" Professor, Facultad de Física, Universidad de La Laguna
B.Sc. Course
San Cristóbal de La Laguna, Spain
- **Computational Science I**
2019
"Venía Docendi" Professor, Facultad de Física, Universidad de La Laguna
B.Sc. Course
San Cristóbal de La Laguna, Spain
- **Computational Science I**
2018
"Venía Docendi" Professor, Facultad de Física, Universidad de La Laguna
B.Sc. Course
San Cristóbal de La Laguna, Spain

- **Differential and Integral Calculus II**
2017
Assistant Professor, Facultad de Ciencias, UNAM
B.Sc. Course
Mexico City, Mexico
- **Thermodynamics**
2017
Assistant Professor, Facultad de Ciencias, UNAM
B.Sc. Course
Mexico City, Mexico
- **Differential and Integral Calculus I**
2016
Assistant Professor, Facultad de Ciencias, UNAM
B.Sc. Course
Mexico City, Mexico
- **Physics**
2016
Assistant Professor, Facultad de Ciencias, UNAM
B.Sc. Course
Mexico City, Mexico

Mentoring

- **“Mapping electron temperature variations in nearby star-forming regions with SDSS-V/LVM”**
2023-2026
Co-directing Ph.D. thesis in Astrophysics
Natascha Sattler
Heidelberg University, Germany
- **“Revealing the internal physics of the Huygens region with MUSE”**
2023-2024
Co-directing M.Sc. thesis in Astrophysics
Silvia Anastasia Popa
Heidelberg University, Germany
- **“Investigating the Excitation Mechanism of the C II $\lambda 6578$ Line in Planetary Nebulae”**
2022-2023
Co-directed M.Sc. thesis in Astrophysics
Elena Reyes Rodríguez
Universidad de La Laguna, Tenerife, Spain
- **“Temperature Relations for the Cl^{2+} Ion in HII Regions and the Determination of Chemical Abundances”**
2022-2023
Co-directed M.Sc. thesis in Astrophysics
Maialen Orte García
Universidad de La Laguna, Tenerife, Spain

Refereeing

- **Astrophysical Journal**
- **Astronomical Journal**
- **Monthly Notices of the Royal Astronomical Society**
- **Astronomy & Astrophysics**

Organization of academic events

- **XI Día de Nuestra Ciencia**
May 28, 2019.
SOC and LOC member of the congress
Tenerife, Spain
- **X National Astronomy Olympiad in Mexico**
2014.
Co-organizer of the event
Puebla, Mexico
- **VI Latin American Astronomy and Astronautics Olympiad**
October 10-16, 2014.
Observer of the event
Montevideo, Uruguay

Invited talks

- **IV Workshop of Chemical Abundances in Gaseous Nebulae: A workshop in honor of Jose Manuel Vilchez**
May 6-10, 2024.
“Nebular studies in the SDSS-V LVM: understanding our Galaxy to understand the Universe”
Sao Jose dos Campos, Brazil
- **LXVI Congreso Nacional de Física**
October 8-13, 2023.
“El universo podría ser más metálico de lo que creíamos”
Morelia, Mexico
- **IAU Symposium 384: Planetary Nebulae: a Universal Toolbox in the Era of Precision Astrophysics**
September 4-8, 2023.
“The abundance discrepancy in ionized nebulae: which are the correct abundances?”
Krakow, Poland
- **SDSS-V Collaboration Meeting 2023**
July 31-August 4, 2023.
“HII regions beyond spherical cows: temperature and density inhomogeneities”
(Online) New York, USA
- **XIII Día de Nuestra Ciencia**
June 2, 2022.
“HII regions and their internal complexities”
Tenerife, Spain
- **ESO Hypatia Colloquium**
June 22, 2021.
“Photoionized Herbig-Haro objects in the Orion Nebula through deep high-spectral resolution spectroscopy”
(Online) Garching bei München, Germany

Colloquia

- **Instituto de Astronomía UNAM**
June 22, 2021.
“El efecto t^2 : los elementos pesados en el universo podrían ser mucho más abundantes de lo que pensábamos”
Mexico City, Mexico

- **Instituto Nacional de Astrofísica, Óptica y Electrónica (INAOE)**
August 18, 2023.
“Temperature and density inhomogeneities in H II regions: the universe could be richer in heavy elements than we thought”
(Online) Puebla, Mexico
- **Instituto de Astrofísica de Canarias (IAC)**
June 13, 2023.
“Temperature inhomogeneities cause the abundance discrepancy in H II regions”
Tenerife, Spain
- **Max Planck Institute for Astronomy (MPIA)**
June 2, 2023.
“Temperature inhomogeneities cause the abundance discrepancy in H II regions”
Heidelberg, Germany
- **Instituto de Astronomía UNAM**
August 17, 2022.
“Radial gradients of chemical abundances in the Milky Way considering internal temperature inhomogeneities”
Mexico City, Mexico
- **Instituto de Astrofísica de Canarias (IAC)**
June 17, 2021.
“Photoionized Herbig-Haro objects in the Orion Nebula. Laboratories to better understand ionized nebulae”
(Online) Tenerife, Spain
- **Instituto de Radioastronomía y Astrofísica UNAM**
June 17, 2021.
“Photoionized Herbig-Haro objects in the Orion Nebula. Laboratories to better understand ionized nebulae”
(Online) Morelia, Mexico
- **Facultad de Ciencias UNAM**
February 16, 2017.
“Divulgación de la Ciencia y su papel en la Agenda Pública”
Mexico City, Mexico

Contributed talks

- **ESO Metal Production and Distribution in a Hierarchical Universe II**
November 13 - 17, 2023.
“Metals in the Universe could be much more abundant than we thought”
Santiago, Chile
- **XV Scientific Meeting of the Spanish Astronomical Society**
September 3-10, 2022.
“The Orion Nebula through its photoionized Herbig-Haro objects”
Tenerife, Spain
- **IX Meeting of mexican PhD students in Astrophysics (IX Reunión de Estudiantes de Astronomía)**
December 3, 2021.
“Photoionized Herbig-Haro objects in the Orion Nebula”
Online
- **III workshop on Chemical Abundances in Gaseous Nebulae: From the Milky Way to the Early Universe**
May 24-28, 2021.
“Echelle spectroscopy of HH objects in the Orion Nebula. Laboratories to better understand ionized

nebulae”
Online

- **XIII Congreso de estudiantes de Física (ULL)**
April 15-16, 2021.
“Ionized gas flows in the Orion Nebula: properties and environmental dependences”
Online
- **XIV Scientific Meeting of the Spanish Astronomical Society**
July 13-15, 2020.
“Photoionized Herbig-Haro objects in the Orion Nebula through VLT’s deep spectroscopy I: HH529 II-III”
Online
- **XI Congreso de estudiantes de Física (ULL)**
March 15-16, 2018.
“Inhomogeneidades de temperatura y abundancias químicas”
Online

Refereed publications

- **Effects of density and temperature variations on the metallicity of Mrk71**
2024 *Nature Astronomy*
Méndez-Delgado, J. E.; Esteban, C.; García-Rojas, J.; Kreckel, K.; Peimbert, M.
Accepted. Preprint version available. Final version under embargo by Nature Astronomy until 05/02/2024
- **Density biases and temperature relations for DESIRED HII regions**
2023 *Monthly Notices of the Royal Astronomical Society*
Méndez-Delgado, J. E.; Esteban, C.; García-Rojas, J.; Arellano-Córdova, K. Z.; Kreckel, K.; Gómez-Llanos, V.; Egorov, O. V.; Peimbert, M.; Orte-García, M.
2023MNRAS.523.2952M
- **Temperature inhomogeneities cause the abundance discrepancy in H II regions**
2023 *Nature*
Méndez-Delgado, J. E.; Esteban, C.; García-Rojas, J.; Kreckel, K.; Peimbert, M.
2023Natur.618..249M
- **Photoionized Herbig-Haro objects in the Orion Nebula through deep high-spectral resolution spectroscopy - III. HH 514**
2022 *Monthly Notices of the Royal Astronomical Society*
Méndez-Delgado, J. E.; Esteban, C.; García-Rojas, J.; Henney, W. J.
2022MNRAS.514..744M
- **Gradients of chemical abundances in the Milky Way from HII regions: distances from Gaia EDR3 parallaxes and temperature inhomogeneities**
2022 *Monthly Notices of the Royal Astronomical Society*
Méndez-Delgado, J. E.; Amayo, A.; Arellano-Córdova, K. Z.; Esteban, C.; García-Rojas, J.; Carigi, L.; Delgado-Inglada, G.
2022MNRAS.510.4436M
- **Photoionized Herbig-Haro Objects in the Orion Nebula through Deep High Spectral Resolution Spectroscopy. II. HH 204**
2021 *The Astrophysical Journal*
Méndez-Delgado, J. E.; Henney, W. J.; Esteban, C.; García-Rojas, J.; Mesa-Delgado, A.; Arellano-Córdova, K. Z.
2021ApJ...918...27M
- **Photoionized Herbig-Haro objects in the Orion Nebula through deep high-spectral resolution spectroscopy - I. HH 529 II and III**
2021 *Monthly Notices of the Royal Astronomical Society*

Méndez-Delgado, J. E.; Esteban, C.; García-Rojas, J.; Henney, W. J.; Mesa-Delgado, A.; Arellano-Córdova, K. Z.
2021MNRAS.502.1703M

- **Helium abundances and its radial gradient from the spectra of H II regions and ring nebulae of the Milky Way**
2020 *Monthly Notices of the Royal Astronomical Society*
Méndez-Delgado, J. E.; Esteban, C.; García-Rojas, J.; Arellano-Córdova, K. Z.; Valerdi, M.
2020MNRAS.496.2726M
- **Atomic Data Assessment with PyNeb: Radiative and Electron Impact Excitation Rates for [Fe II] and [Fe III]**
2023 *Atoms*
Mendoza, C; **Méndez-Delgado, J. E.**; Bautista, M; García-Rojas, J.; Morisset, C.
2023Atoms..11...63M
- **About Metallicity Variations in the Local Galactic Interstellar Medium**
2022 *The Astrophysical Journal*
Esteban, C.; **Méndez-Delgado, J. E.**; García-Rojas, J.; Arellano-Córdova, K. Z.
2022ApJ...931...92E
- **Backscattering and Line Broadening in Orion**
2023 *The Astrophysical Journal*
O'Dell, C. R.; Ferland, G. J.; **Méndez-Delgado, J. E.**
2023AJ....165...21O
- **On the radial abundance gradients of nitrogen and oxygen in the inner Galactic disc**
2021 *Monthly Notices of the Royal Astronomical Society*
Arellano-Córdova, K. Z.; Esteban, C.; García-Rojas, J.; **Méndez-Delgado, J. E.**
2021MNRAS.502..225A
- **The Galactic radial abundance gradients of C, N, O, Ne, S, Cl, and Ar from deep spectra of H II regions**
2020 *Monthly Notices of the Royal Astronomical Society*
Arellano-Córdova, K. Z.; Esteban, C.; García-Rojas, J.; **Méndez-Delgado, J. E.**
2020MNRAS.496.1051A
- **PHANGS-JWST: Data Processing Pipeline and First Full Public Data Release**
The Astrophysical Journal
Williams, T. et al. (inc. **Méndez-Delgado, J. E.**)
2024 Under review. Preprint version available.
- **Quantifying energetics of molecular superbubbles in PHANGS galaxies**
2023 *Astronomy & Astrophysics*
Watkins, E. J. et al. (inc. **Méndez-Delgado, J. E.**)
2023A&A...676A..67W
- **The Eighteenth Data Release of the Sloan Digital Sky Surveys: Targeting and First Spectra from SDSS-V**
2023 *The Astrophysical Journal Supplement Series*
Almeida, A. et al. (inc. **Méndez-Delgado, J. E.**)
2023ApJS..267...44A
- **Quantifying the energy balance between the turbulent ionised gas and young stars**
2023 *Astronomy & Astrophysics*
Egorov, O. V. et al. (inc. **Méndez-Delgado, J. E.**)
2023A&A...678A.153E
- **Investigating the Drivers of Electron Temperature Variations in HII Regions with Keck-KCWI and VLT-MUSE**
2024 *The Astrophysical Journal*
Rickards Vaught, R. J. et al. (inc. **Méndez-Delgado, J. E.**)

Posters and Congress Attendance

- **European Astronomical Society Annual Meeting**
June 27- July 1, 2022
Valencia, Spain
- **European Astronomical Society Annual Meeting**
June 28- July 2, 2021
Online
- **IAC-RIA workshop EMIR y MEGARA en GTC: preparación de fase 2, tratamiento y reducción de datos**
July 1-4, 2019
Tenerife, Spain
- **European Astronomical Society Annual Meeting**
June 24- 28, 2019
Lyon, France
- **II workshop on Chemical Abundances in Gaseous Nebulae**
March 11-14, 2019
São José dos Campos, Brazil
- **FRIDA + GTCAO: ciencia con la primera instrumentación de óptica adaptativa en GTC meeting**
October 26, 2018
Madrid, Spain
- **XXVI Congreso Nacional de Astronomía**
October 10-13, 2017
Monterrey, Mexico
- **First Mexican AstroCosmoStatistics School**
April 16-21, 2016
León, Mexico
- **Second Guatemalan School of Astrophysics**
November 30- December 4, 2015
Antigua Guatemala, Guatemala

Outreach academic press releases

- **“Schwere Elemente kommen im Universum vermutlich häufiger vor als gedacht”**
October 18, 2023.
Heidelberg University
Germany
- **“New analysis reveals more heavy elements in the universe”**
May 17, 2023.
Astronomisches Rechen-Institut
Germany
- **“Mayor, la cantidad de algunos elementos químicos en nebulosas”**
May 18, 2023.
Universidad Nacional Autónoma de México
Mexico
- **“An old problem about the measurement of the chemical composition of the universe has been resolved”**
May 17, 2023.
Instituto de Astrofísica de Canarias
Spain

- **“Possible evidence of planet formation found in the Orion Nebula”**
June 9, 2022.
Instituto de Astrofísica de Canarias
Spain
- **“Anatomy of the impact of a protostellar jet in the Orion Nebula”**
September 2, 2021.
Instituto de Astrofísica de Canarias
Spain

Selected non-academic press releases

- **“Resuelven mexicano y colegas enigma astrofísico”**
June 18, 2023.
Reforma
Mexico
- **“Grupo de astrofísicos, liderado por un mexicano, resuelve un misterio de hace 80 años”**
May 27, 2023.
Sin Embargo
Mexico
- **“Astrofísico egresado de la UNAM revela posible formación planetaria en Nebulosa de Orión”**
July 6, 2022.
MVS noticias
Mexico
- **“Investigadores del IAC desvelan los efectos del impacto de un jet protoestelar en la Nebulosa de Orión”**
September 2, 2021.
Radio y Televisión Canaria
Spain
- **“Observan efectos del impacto de chorro protoestelar en Orión”**
September 3, 2021.
Deutsche Welle
Germany

Observational work

- **Local Volume Mapper observer**
2023-
Responsible for operating the LVM telescope and conducting observations for the survey approximately once a week.
Chile
- **IAC80 telescope**
2018
4 nights of experience as observer
Spain
- **Mercator telescope**
2018
1 night of experience as observer.
Spain

- **Isaac Newton Telescope**
2018
2 nights of experience as observer.
Spain
- **Hubble Space Telescope proposal COS Cycle 31, ID. 17426**
2023
23 orbits granted
Co-I
- **Gran Telescopio de Canarias proposal OSIRIS, ID. 83-GTC78/23B**
2023
16hrs granted
Co-I
- **Northern Extended Millimeter Array proposal IRAM, ID. W22AU**
2023
11.45hrs granted
PI
- **Calar Alto Observatory proposal PMAS, ID. F21-3.5-015/ F2021**
2021
1 night granted
Co-I
- **Calar Alto Observatory proposal PMAS, ID. 21B-3.5-008/ 21B**
2021
2 nights granted
Co-I
- **McDonald observatory proposal VIRUS-P, ID. 2.7KA proposal 21-32.7/ 2021-3**
2021
4 nights granted
Co-I
- **Gran Telescopio de Canarias proposal MEGARA, ID. 84-GTC78/ 19B**
2023
7hrs granted
Co-I

Skills

- **Programming:** Python, IRAF, spectroscopic techniques
- **Software:** LaTeX, Git
- **Languages:** English (C1, IELTS Academic Certificate), Spanish (Native)