

Jesús M. Rueda-Becerril — Ph.D.

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Skills

Proficient: Fortran, Python, NumPy, Pandas, SciPy, Jupyter, Matplotlib, Shell, git (GitHub, BitBucket), HPC (MPI, OpenMP, GPU), Slurm, L^AT_EX, HDF5 file format

Familiar: Java, SQL (PL/SQL, PostgreSQL), R, C/C++, Julia, Scikit-Learn, Docker, Splunk, Jenkins, OpenShift

Basic: MongoDB, TensorFlow, PyTorch, MLFlow

Experience

Software Engineer

Apr 2022 – Jan 2024

Paychex

- Developed high quality code using Java, Bootstrap, Kafka, PL/SQL, and deployed into production using Jenkins and OpenShift, following software development best practices.
- Collaborated with stakeholders and other software development teams to assess product needs and meet code standards for continuous integration model.
- Developed Java Kafka consumers for the streamlined transfer of large volumes of client data across databases.
- Conducted data processing and extensive quantitative analysis in PL/SQL and created Splunk dashboards and alerts for analysis of production data.
- Developed and deployed Python tests to ensure software quality and continuous integration.

Research Scientist

Jan 2018 – Apr 2022

UMSNH (Mexico), Purdue University, Rochester Institute of Technology

- Led a team of specialists on a NSF-sponsored project and successfully upgraded a hydrodynamic code to perform HPC simulations of supermassive black hole binaries. Designed the experiments and evaluated state-of-the-art mathematic and numerical techniques implemented in the code by running simulations at *Frontera* supercomputer (TACC, UT at Austin). Worked in a detail-oriented manner to successfully benchmark and identify performance optimization opportunities of the code.
- Worked in a highly collaborative environment with multi-institutional, cross-functional teams developing large-scale HPC simulations of neutron star mergers. This collaboration produced 2 papers with high impact results.
- Successfully applied and obtained a \$68,000 NASA grant for one year as primary researcher. Managed 3 Ph.D. researchers to study the nature of radiation from active galaxies with state-of-the-art mathematical and numerical methods. This work produced 3 papers and 2 proceedings with high impact results, and 5 presentations to technical audiences.
- Participated in weekly paper discussion and knowledge sharing at the Purdue Astronomy Journal Club.
- Developed a Python script that would process images for a machine learning (SVM) training framework. Conducted a workshop to train and share knowledge with graduate students on creation and manipulation of high-volume datasets in HDF5 format.

Graduate Research Assistant

Oct 2009 – Jul 2017

UMSNH (Mexico), Universitat de València (Spain)

- Developed Shell and Python tools for automation and pipelines for data processing and curation of large volume datasets in HDF5 format, ensuring data quality and integrity for downstream analysis.
- Developed Python scripts to perform exploratory data analysis on datasets from NASA telescopes. Conducted diverse analyses to identify patterns in spectra and light-curves that allowed to make insightful predictions. This work produced 2 papers and communicated my results to technical audiences.
- Developed a numerical code to study the behavior of light near black holes. This work produced one paper with high impact results.

Education

Ph.D. in Astrophysics

Universitat de València, Valencia, Spain

Oct. 2011 – Jul. 2017

Excellent *Cum Laude*

M.Sc. in Physics

Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Mexico

Aug. 2009 – Sep. 2011

B.Sc. in Physics

Universidad Autónoma del Estado de México, Toluca, Mexico

Aug. 2004 – Dec. 2008

“Dr. Juan Josafat Pichardo” Award

Projects

Paramo

Oct 2018 – Apr 2022

Open Source Code for Radiative Transfer Simulations in Relativistic Astrophysics

[GitHub](#)

- Independently developed this code for distributed settings to perform HPC simulations of radiative transfer in relativistic astrophysics.
- Optimized the code with OpenMP to reduce simulation time from 2 minutes to 5 seconds.
- Researched and applied mathematical concepts of machine learning (gradient descent) to adjust the parameters of the code to classify observations from NASA telescopes.
- This code has been used for at least 5 scientific publications and also for graduate pedagogical purposes.
- Developed data analysis and data visualization tools in Python.

Co-Founder, Mexican Scientists Abroad

Aug 2019 – Feb 2021

Group of Mexican Scientists narrowing the gap between science and common knowledge

[Homepage](#)

- Collaborated with a group of multidisciplinary scientists to develop Python scripts for [statistically modeling and forecasting the COVID-19 outbreak](#) in Mexico.
- Wrote [blogposts](#) and [infographics](#) for Spanish-speaking populations to reduce the spread of misinformation.

Certifications and Credentials

Mathematical Foundations of Machine Learning

Udemy, [Credential ID: UC-605df108-ae80-4297-8c8f-6bc15b967511](#)

Python for Statistical Analysis

Udemy, [Credential ID: UC-e8557ac8-13f9-41bf-ab46-f196a041b725](#)

Python Fundamentals

DataCamp, [Statement of Accomplishment #403,521](#)

Data Manipulation with Python

DataCamp, [Statement of Accomplishment #409,710](#)

Importing & Cleaning Data

DataCamp, [Statement of Accomplishment #409,699](#)

Publications

Articles

- [8] Davis, Z., **Rueda-Becerril, J. M.**, & Giannios, D. *Balancing Turbulent Heating with Radiative Cooling in Blazars*, [MNRAS](#) **513**, 5766–5779, (2022), [arXiv:2201.07790](#).
- [7] Lopez-Armengol, F. G., Etienne, Z. B., [...], **Rueda-Becerril, J. M.**, [...] *Handing off the outcome of binary neutron star mergers for accurate and long-term postmerger simulations*, [Phys. Rev. D](#) **106**, 083015, (2022), [arXiv:2112.09817](#)
- [6] Murguia-Berthier, A., Noble, S., [...], **Rueda-Becerril, J. M.**, [...] *HARM3D+NUC: A New Method for Simulating the Post-merger Phase of Binary Neutron Star Mergers with GRMHD, Tabulated EOS, and Neutrino Leakage*, [ApJ](#) **919**, 95, (2021), [arXiv:2106.05356](#)
- [5] **Rueda-Becerril, J. M.**, Harrison, A. O. & Giannios, D. *Blazar jets launched with similar energy per baryon, independently of their power*, [MNRAS](#) **501**, 4092–4102, (2021), [arXiv:2009.02273](#).
- [4] Zhang, H., Christie, I., Petropoulou, M., **Rueda-Becerril, J. M.** & Giannios, D. *Inverse Compton Signatures of Gamma-Ray Burst Afterglows*, [MNRAS](#) **496**, 974–986, (2020), [arXiv:1910.14049](#).

- [3] **Rueda-Becerril, J. M.**, Mimica, P. & Aloy, M. A. *On the influence of a hybrid thermal–non-thermal distribution in the internal shocks model for blazars*, [**MNRAS** **468**, 1169–1182, \(2017\)](#), [arXiv:1612.06383](#).
- [2] **Rueda-Becerril, J. M.**, Mimica, P. & Aloy, M. A. *The influence of the magnetic field on the spectral properties of blazars*, [**MNRAS** **438**, 1856–1869 \(2014\)](#), [arXiv:1310.5441](#).
- [1] Guzmán, F. S. & **Rueda-Becerril, J. M.** *Spherical boson stars as black hole mimickers*, [**Phys. Rev. D** **80**, 084023 \(2009\)](#), [arXiv:1009.1250](#).

Proceedings.....

- 5. **Rueda-Becerril, J. M.** *A numerical approach for radiative cooling in relativistic outflows*, [**Astron. Nachr.**, **9th International Workshop on Astronomy and Relativistic Astrophysics: from Quarks to Cosmos** **342**, 277–282, \(2021\)](#), [arXiv:2011.13797](#).
- 4. **Rueda-Becerril, J. M.**, Harrison, A. O. & Giannios, D. *The blazar sequence revised*, [**Astron. Nachr.**, **9th International Workshop on Astronomy and Relativistic Astrophysics: from Quarks to Cosmos** **342**, 147–152, \(2021\)](#), [arXiv:2011.13805](#).
- 3. **Rueda-Becerril, J. M.**, Mimica, P. & Aloy, M. A. *Numerical simulations of the internal shock model in magnetized relativistic jets of blazars*, [**PoS\(SWIFT 10\)** **233**, 159 \(2014\)](#), [arXiv:1502.07882](#).
- 2. **Rueda-Becerril, J. M.**, Mimica, P., Aloy, M. A. & Aloy, C. *Numerical study of broadband spectra caused by internal shocks in magnetized relativistic jets of blazars*, [**EPJ Web Conf.** **61**, 02007 \(2013\)](#), [arXiv:1309.4612](#).
- 1. Mimica, P., Aloy, M. A., **Rueda-Becerril, J. M.**, Tabik, S. & Aloy, C. *Numerical simulations of dynamics and emission from relativistic astrophysical jets*, [**J. Phys.: Conf. Ser** **42**, 012001 \(2013\)](#), [arXiv:1211.1794](#).