

Jesús Misráyim Rueda-Becerril

PhD

Profile

Doctor in Astrophysics with high expertise in programming, data analysis and problem solving. I am creative, innovative, analyst and hard worker.

During my PhD studies I developed high programming skills in several languages such as Python, R, FORTRAN 95, C, Shell and version control tools like Git using platforms such as GitHub and Bitbucket. I worked on developing sophisticated numerical tools which were implemented to simulate blazar flares (prompt high energy radiation from relativistic jets of active galactic nuclei). This has shown my fast learning skill of new programming languages and develop efficient codes to solve the problem posed.

I am coauthor of three articles in peer reviewed scientific journals and author of a doctoral thesis, qualified as innovative, in which several numerical and programming issues were overcome, reason why it received the distinction of excellent. In addition, I have good English skills which makes me capable of discussing and interact fluently in both Spanish and English.

I want to apply my mathematical knowledge, programming skills and data analysis experience to machine learning, data mining, decision making and modelling.

Education

- 2011–2017 **PhD in Physics**, *Universitat de València*, Valencia, Spain, *Grade Excellent distinction*.
Supervisors: Prof. Miguel Ángel Aloy Torás and Dr. Petar Mimica
Thesis: *Numerical treatment of radiation processes in the internal shocks of magnetized relativistic outflows*
- 2009–2011 **MSc in Physics**, *Instituto de Física y Matemáticas, Universidad Michoacana de San Nicolás de Hidalgo*, Morelia, Michoacan, Mexico.
Supervisor: Prof. José Antonio González Cervera
Thesis: *Study of TOV stars with the SPH method*
- 2004–2009 **BSc in Physics**, *Universidad Autónoma del Estado de México*, Toluca, State of Mexico, Mexico.
Supervisor: Prof. Francisco S. Guzmán Murillo
Thesis: *Numerical solution of null geodesics for the generation of gravitational lenses in spherically symmetric space-times*

Interests

- High energy astrophysics
- Particles acceleration processes.
 - Active galactic nuclei (jet formation and composition, jet magnetization, blazars, radio galaxies, quasars, TEDs).
 - Microquasars.
 - Gamma-ray bursts.

Av. Paseo Rajolar 2, Piso 7 – 46100, Burjassot – Valencia, SPAIN

☎ +34 615 728 749 • ✉ jesus.rueda@uv.es • in [jeruebe](#) • 📧 [jesus_mrb](#)

🔗 [altjerue](#)

1/7

- Numerical Astrophysics
 - Numerical solutions to the radiation transport equation with astrophysical applications.
 - Numerical simulations of particle acceleration processes.
 - Numerical hydrodynamics and magnetohydrodynamics.
 - Performance, stability, convergence and accuracy of numerical codes.
- Computer Sciences
 - Decision-making optimization
 - Machine learning (supervised and unsupervised)
 - Neuronal networks
 - Text mining
 - Network analysis

Publications

Articles

3. J. M. Rueda-Becerril, P. Mimica, and M. A. Aloy. On the influence of a hybrid thermal-non-thermal distribution in the internal shocks model for blazars. *Mon. Not. R. Astron. Soc.*, 468:1169–1182, June 2017.
2. J. M. Rueda-Becerril, P. Mimica, and M. A. Aloy. The influence of the magnetic field on the spectral properties of blazars. *Mon. Not. R. Astron. Soc.*, 438:1856–1869, February 2014.
1. F. S. Guzmán and J. M. Rueda-Becerril. Spherical boson stars as black hole mimickers. *Phys. Rev. D*, 80(8):084023, October 2009.

Proceedings

3. J. Rueda-Becerril, P. Mimica, and M. A. Aloy. Numerical simulations of the internal shock model in magnetized relativistic jets of blazars. In *Proceedings of Swift: 10 Years of Discovery (SWIFT 10)*, page 159, Rome, Italy, December 2014.
2. J. M. Rueda-Becerril, P. Mimica, M. A. Aloy, and C. Aloy. Numerical study of broadband spectra caused by internal shocks in magnetized relativistic jets of blazars. In *The Innermost Regions of Relativistic Jets and Their Magnetic Fields*, volume 61 of *European Physical Journal Web of Conferences*, page 02007, June 2013.
1. P. Mimica, M. A. Aloy, J. M. Rueda-Becerril, S. Tabik, and C. Aloy. Numerical simulations of dynamics and emission from relativistic astrophysical jets. In *24th IUPAP Conference on Computational Physics*, volume 454 of *Journal of Physics: Conference Series*, page 012001, August 2013.

Awards and Scholarships

- 2014–2016 **Fellowship** from the Mexican Federal Government to study abroad awarded by the National Council of Science and Technology (CONACyT).
- 2011–2014 **Fellowship** “Santiago Grisolia” awarded by the Council of Education, Research, Culture and Sport of the Valencian Community.
- 2009–2011 **Fellowship** for academic training for MSc studies granted by the Mexican Council of Science and Technology (CONACyT).
- 2009 **Award** “Lic. Juan Josafat Pichardo Cruz”, granted by the UAEMéx, for finishing the BSc thesis and graduating within a year after completing the undergraduate credits.

Av. Paseo Rajolar 2, Piso 7 – 46100, Burjassot – Valencia, SPAIN

☎ +34 615 728 749 • ✉ jesus.rueda@uv.es • in [jeruebe](#) • 📧 [jesus_mrb](#)

🔄 [altjerue](#)

25 Jun–24 Aug 2007 **Fellowship** for a temporary stay in a national research center under the XVII summer of scientific investigation program awarded by the Mexican Academia of Science.

Meetings and conferences

Oral presentations

- 2014 **Rueda-Becerril, J.M.**; Mimica, P.; Aloy, M.A., *Numerical simulations of the internal shock model in magnetized relativistic jets of blazars*, IVICFA's Fridays: Computation in Physics, Paterna, Spain, 17 October.
- 2014 **Rueda-Becerril, J.M.**; Mimica, P.; Aloy, M.A., *Influence of the magnetic field on the spectral properties of blazars in the internal shocks scenario*, Extreme-Astrophysics in an Ever-Changing Universe: Time-Domain Astronomy in the 21st Century, Ierápetra, Greece, 16–20 June.
- 2013 **Rueda-Becerril, J.M.**; Mimica, P.; Aloy, M.A., *Numerical study of broadband spectra caused by internal shocks in magnetized relativistic jets*, XXXIV Biennial meeting of the Royal Spanish Society of Physics, Valencia, Spain, 15–19 July.
- 2009 **Rueda-Becerril, J.M.**, *¿Decía Einstein la verdad?*, weekly colloquium of Physics students *Café Ciencias*, Toluca, Mexico, 11 March.

Poster presentations

- 2014 **Rueda-Becerril, J.M.**; Mimica, P.; Aloy, M.A., *Numerical simulations of the internal shock model in magnetized relativistic jets of blazars*, Swift: 10 years of Discovery, Rome, Italy, 2–5 December.
- 2013 **Rueda-Becerril, J.M.**; Mimica, P.; Aloy, M.A., *Numerical study of broadband spectra caused by internal shocks in magnetized relativistic jets of blazars*, The Innermost Regions of Relativistic Jets and Their Magnetic Fields, Granada, Spain, 10–14 June.
- 2007 **Rueda-Becerril, J.M.**; Leyte González, R.; García Santibañez, F.; Rosendo-Francisco, P., *Analysis of the superficial structure of graphite samples submitted to an electric arc*, L National Physics Meeting, Boca del Río, Mexico, 29 October–2 November.
- 2006 **Rueda-Becerril, J.M.**; Leyte González, R.; García Molina, N.; Rosendo-Francisco, P., *Modifications on the superficial structure of graphite samples*, XLIX National Physics Meeting, San Luis Potosí, Mexico, 16–19 October.
- 2005 **Rueda-Becerril, J.M.**; Gómez Díaz, A.; Rosendo-Francisco, P., *Studies of microwave effects of graphite samples*, XLVIII National Physics Meeting, Guadalajara, Mexico, 17–21 October.

Attendance only

- 2016 CoCoNuT Meeting 2016, Burjassot, Spain, 14–16 December
- 2008 LI National Physics Meeting, Zacatecas, Mexico, 20–24 October

Organization

- 2012 Contribution to the organization of the X Scientific Meeting of the Spanish Astronomical Society, Valencia, Spain, 14–16 December

Av. Paseo Rajolar 2, Piso 7 – 46100, Burjassot – Valencia, SPAIN

☎ +34 615 728 749 • ✉ jesus.rueda@uv.es • in [jeruebe](#) • 📧 [jesus_mrb](#)

🔗 [altjerue](#)

3/7

Research experience

2011–2017 **Graduate research assistant**, *DAA, UV, Burjassot, Spain.*

- Automatized the launching of simulations, treatment of data and generation of plots for an extensive parameter space study of the internal shocks code developed by Petar Mimica and Miguel A. Aloy in order to find traces left in the spectra due to the magnetization of the shocked shells of plasma.
- Extracted and interpreted from the simulations of the main characteristics of blazars SEDs, e.g. Compton dominance, synchrotron and Compton peaks, spectral index using Python and Shell.
- Extracted, cleaned and processed data from the *Fermi* LAT Second AGN Catalog database for the comparison with our simulations.
- We confronted a challenge when we intended to include further microphysical phenomena in the simulations. To overcome this
 - Implemented a routine for a more general distribution of particles (thermal-nonthermal) to be treated in the original code.
 - Calculated tables with the Magnetobremssstrahlung emission of charged particles of arbitrary velocity and the emissivity for isotropic distributions of electrons using a code that I developed from scratch.
- Contributed to the writing of and coauthored two manuscript for publication in a peer-reviewed journal.
- Developed high expertise with Python, R, RStudio, FORTRAN 95, Shell, git, GitHub, Bitbucket.

2010–2011 **Graduate research assistant**, *IFM, UMSNH, Morelia, Mexico.*

- A problem posed for master thesis was the simulation of a TOV star using smoothed-particle hydrodynamics (SPH) numerical method. For this I developed a newtonian and relativistic SPH codes in FORTRAN 95.
- The evolution of the system was carried out using Predictor-Corrector routine which I also wrote in FORTRAN 95.
- For the initial conditions I used the numerical solution of the TOV field equations, using a fourth order Runge-Kutta solver also written in FORTRAN 95.
- For the analysis and plotting I used and mastered gnuplot.

2008–2009 **Graduate research assistant**, *Faculty of Sciences, UAEMéx, Toluca, Mexico.*

- Predict the trajectory of light around black holes and similar objects such as Boson stars was the problem posed for the bachelor degree thesis. To solve such problem I wrote the geodesic equation for a spherically symmetric and static space-time and solved them using a RK4 routine, written in FORTRAN 95. I characterized such routine studying its convergence and stability for both an analytic and numeric metrics.
- I interpreted light trajectories due to curved space-times and characterized such trajectories for gravitational lenses.
- Contributing to the writing of and coauthored a manuscript for publication in a peer-reviewed journal.

2007–2008 **Undergraduate research assistant**, *Faculty of Sciences, UAEMéx, Toluca, Mexico.*

Internship service project

Supervisor: Prof. Jorge Orozco Velasco.

- Writing the elliptic equations in finite differences form
- Characterization of the typical kinds of boundary conditions:
 - Dirichlet
 - Neumann
- Writing of a code which solves the two-dimensional Laplace equation in Cartesian coordinates with Dirichlet and Neumann boundary conditions.

Av. Paseo Rajolar 2, Piso 7 – 46100, Burjassot – Valencia, SPAIN

☎ +34 615 728 749 • ✉ jesus.rueda@uv.es • in [jeruebe](#) • 📧 [jesus_mrb](#)

🔗 [altjerue](#)

4/7

- 25 Jun–24 Aug 2007 **Undergraduate research assistant**, *Mexican Academia of Science*, Morelia, Mexico.
National program for temporary stays at national research centers for undergraduate science students.
Supervisor: Prof. Francisco S. Guzmán Murillo.
- Numerical solution of the wave equation with finite differences.
 - Numerical solution of Burgers' equation with finite differences.
 - Numerical solution of the general relativistic one-dimensional wave equation in the 3+1 formalism with finite differences.
- 2005–2008 **Undergraduate researcher assistant**, *Faculty of Sciences, UAEMéx*, Toluca, Mexico.
Volunteer work in a faculty research project
Supervisor: Prof. Porfirio D. Rosendo-Francisco
- Exposure of graphite samples to microwaves
 - Ultrasonic cleaning of graphite samples.
 - Systematic exposure graphite samples to microwaves (2.45 GHz).
 - Observation of the superficial effects using a metallographic microscope.
 - Characterization of the structures observed.
 - Exposure of graphite samples to electric arcs
 - Ultrasonic cleaning of graphite samples.
 - Characterization of a Tesla coil.
 - Input current.
 - Output flux of electrons.
 - Controlled handling of a Tesla coil.
 - Systematic exposure of the surface of graphite samples to a perpendicular and tangential electric arc.
 - Observation of surface effects with a metallographic microscope.
 - Characterization of the zones around the contact region.
 - Characterization of the temperature around the contact region.
 - Characterization of the structures which appeared after the exposure.
 - Analysis of X-rays spectra of the samples.
 - Identification of induced families of lattice planes.

Professional development

- 7–16 Feb 2017 **Data Analysis and Machine Learning with Python**, *UV*, Burjassot, Spain.
No. of hours: 8
- 23–16 May 2014 **The Universe in the light of PLANCK and BICEP2**, *UV*, Burjassot, Spain.
No. of credits: 2
- 23–27 Sep 2013 **Dark Matter**, *UV*, Burjassot, Spain.
No. of credits: 2
- 23 Apr–8 May 2013 **International Cagèse School on Cosmic Accelerators**, *Institut d'Études Scientifiques de Cargèse*, Cargèse, France.
- 9–12 Apr 2012 **Introduction to C++ Programming**, *UV*, Burjassot, Spain.
No. of credits: 6
- 27 Mar–4 Apr 2012 **Numerical Relativistic Astrophysics**, *UV*, Burjassot, Spain.
No. of hours: 9
- 5–9 March 2012 **Fortran for Scientific Computing**, *High Performance Computing Center Stuttgart*, Stuttgart, Germany.
No. of hours: 33
- Jun 2006 **Advanced Summer School**, *CINVESTAV*, Ciudad de México, Mexico.
- Aug 2006 **Advanced Summer School**, *Instituto de Física of the Universidad de Guanajuato*, León, Mexico.

Av. Paseo Rajolar 2, Piso 7 – 46100, Burjassot – Valencia, SPAIN

☎ +34 615 728 749 • ✉ jesus.rueda@uv.es • in [jeruebe](#) • 📧 [jesus_mrb](#)

🔗 [altjerue](#)

5/7

Computer skills

Proficient	Unix (Linux, macOS), FORTRAN (77, 90, 95, 2003), Python, Shell, Mathematica, L ^A T _E X, gnuplot, grace, OpenMP, GeoGebra, Emacs, HDF5, Makefile, Git, GitHub, R, RStudio
Intermediate	C, C++, Julia, Elisp, MPI, SageMath, yEd, OpenOffice, Microsoft Office (Word, Excel, PowerPoint), iWork (Pages, Numbers, Keynote), DOT, TikZ/PGF
Basic	HTML, Matlab, Maple, Java, Swift, Perl

Other activities

Aug 2007–May 2009	Physics students representative at the Governing Council of the Faculty of Sciences of the UAEMéx
-------------------	---

Languages

Spanish	Mother tongue
English	Proficient
Catalan	Basic
French	Basic
German	Basic

Someone
Somewhere

September 3, 2017

Dear,

I have recently finished my PhD at the University of Valencia (SPAIN), under the supervision of Prof. Miguel Ángel Aloy and Dr. Petar Mimica. As part of my post-graduate studies I have investigated the nature of blazars connecting their measured spectral features and lightcurves to the physics of the underlying plasma. The working hypothesis of my PhD has been that the observed blazar variability can be explained with the so-called “internal shock” model. According to this model, shocks inside of an heterogeneous beam of relativistic plasma accelerate leptons (or even hadrons in some variants of the model) to high energies. Since the plasma is threaded by both small-scale (randomly oriented) and large-scale magnetic fields, magneto-bremsstrahlung (MBS) emission is naturally produced (in practice, this is synchrotron for high frequencies and relativistic electrons, though my formalism is general and deals with the cyclotron emission as well). Inverse Compton upscattering of either external photon fields or the produced MBS photons shapes the high-frequency emission of blazars in the working model. Due to the non-linear and complex character of the plasma dynamics (governed by the equations of relativistic magneto-hydrodynamics) as well as the processes of particle acceleration and MBS emission, a fully numerical modeling has been performed. During my PhD, I have improved the existing numerical tools available in my host group at the University of Valencia, both extending the previous plasma radiation mechanisms and the analysis tools to perform systematic parameter coverage of the physical properties of plasma from which the emission results (with special emphasis on the plasma magnetization). The kind of numerical simulations I have performed during my PhD involved solving the kinetic and radiative transfer equations in a magnetized medium (for further details see Rueda-Becerril et al. 2014, 2017).

I am highly interested on the origins of high energy radiation from particle acceleration processes. I am convinced that the experience and knowledge I have acquired during my PhD studies will prove highly useful and valuable to your research program if I should be selected, in addition to further contribute to the advancement of this field.

I can provide more details about any aspect of my work you are interested in. Also, I am available for a telephone or videoconference interview every weekday. I am looking forward to hearing from you soon.

Best regards,

Jesús Misráyim Rueda-Becerril

Attached: curriculum vitæ

Jesús Misráyim Rueda-Becerril

Av. Paseo Rajolar 2, Piso 7 – 46100, Burjassot – Valencia, SPAIN

☎ +34 615 728 749 • ✉ jesus.rueda@uv.es • in [jeruebe](#) • [jesus_mrb](#)

altjerue

7/7