

# Jesús Misráyim Rueda-Becerril

*PhD candidate*

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in [Jesus Rueda-Becerril](#)  
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## Education

- 2011– **PhD in Physics**, *Universitat de València*, Valencia, Spain.  
Supervisors: Prof. Miguel Ángel Aloy Torás & Dr. Petar Mimica  
Tesis: *Radiation Transport in Relativistic Magnetized Fluids — Applications to 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*

## Computer skills

- Proficient Unix (Linux, macOS), FORTRAN (77, 90, 95, 2003), Python, Shell, Mathematica,  $\LaTeX$ , gnuplot, grace, OpenMP, GeoGebra, Emacs, HDF5, Makefile, Git
- Intermediate C, C++, R, Julia, Elisp, MPI, SageMath, yEd, OpenOffice, Microsoft Office, iWork, DOT, TikZ/PGF
- Basic HTML, Matlab, Maple, Java, Swift, Perl

## 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. *ArXiv e-prints*, December 2016.
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.

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## Awards and Scholarships

- 2014–2016 **Fellowship** for studies abroad granted by the Mexican Council of Science and Technology.
- 2011–2014 **Fellowship** “Santiago Grisolia” granted by the Council of Education, Research, Culture and Sport of Valencia, Spain.
- 2009–2011 **Fellowship** for academic training for MSc studies granted by the Mexican Council of Science and Technology.
- 2009 **Award** “Lic. Juan Josafat Pichardo Cruz”, granted by the UAEMéx, for finishing a thesis and graduating within a year after completing the undergraduate credits.
- 25 Jun–24 Aug 2007 **Fellowship** for a temporary stay in a research center under the XVII summer of scientific investigation program by the Mexican Academia of Science.

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## Interests

- Blazars
- Acceleration processes in the emission region.
  - Location of the emission region.
  - The spectral effects due to different constituents of the material in the emission region.
- Numerical Astrophysics
- Numerical solutions to the transport equation with astrophysical applications.
  - Numerical treatment of internal shocks for blazars and GRBs.
  - Numerical treatment of the microphysics involved in the emission region of blazars and in GRBs.

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## Research experience

- 2011– **Graduate research assistant**, *DAA, UV*, Burjassot, Spain.
- PhD studies
- Parameter study using the code developed by Petar Mimica & Miguel A. Aloy for the internal shocks (IS) model.
    - Development of software capable of automatizing the launch of simulations of ISs
    - Development of software capable of automatizing the generation of plots from the IS code.
    - Interpretation of lightcurves (LCs) and spectral energy distributions (SEDs)
    - Identification and interpretation of the main physical parameters in the shocks.
    - Identification of the physical parameters in the model which led to observational data.
  - Processing and analysis of data from Fermi 2LAC catalogue.
  - Identification and interpretation of the main characteristics of blazars SEDs (Compton dominance, synchrotron and Compton peaks, spectral index).
  - Calculation of the spectral index from SED data, specifically in the 0.1–10 GeV band.
  - Parabolic fitting of SEDs.
  - Injection of a hybrid thermal-nonthermal distribution of particles in the IS model.
  - Calculation of Magnetobremstrahlung tables of charged particles of arbitrary velocity.
  - Calculation of the emissivity for isotropic distributions of particles using Magnetobremstrahlung tables.
  - Implementation of Magnetobremstrahlung and hybrid distributions to the ISs code.
  - Contribution to the writing of two manuscript for publication in a peer-reviewed journals.
- 2010–2011 **Graduate research assistant**, *IFM, UMSNH*, Morelia, Mexico.
- Master thesis
- Writing of a Newtonian SPH code.
  - Implementation of a Predictor-Corrector method for the time evolution of the hydrodynamic equations.
  - Implementation of a Newton-Rapson method for the recovery of the hydrodynamic primitive variables.
  - Solving of the Sod shock tube.
  - Solving of an isothermal collapse.
  - Writing of a relativistic SPH code.
  - Relativistic Sod shock tube resolved.
  - Writing of the TOV field equations.
  - Solution of the TOV equations with an RK4 code to generate the initial conditions of the SPH code.

- 2008–2009 **Graduate research assistant**, *Faculty of Sciences, UAEMéx*, Toluca, Mexico.  
 Bachelor thesis
- Writing of the geodesic equation for a spherically symmetric and static space-time.
  - Writing of a fourth order Runge-Kutta solver (RK4)
  - Testing of the RK4 with ordinary differential equations with well known analytic solution
  - Characterization of the RK4 code
    - Convergence
    - Stability
  - Application of RK4 for the geodesics equation in a Schwarzschild space-time
  - Implementation of a first order interpolation routine for the Christoffel symbols from a numerical metric.
  - Implementation of the code to the Boson stars (numerical) solution of Einstein's field equations.
  - Application of RK4 for the geodesics equation in a
  - Characterization of gravitational lenses around:
    - Black holes,
    - Boson stars.
  - Interpretation of light trajectories due to curved space-times.
  - Contributing to the writing of a manuscript for publication in a peer-reviewed journal.
- 2007–2008 **Undergraduate research assistant**, *Faculty of Sciences, UAEMéx*, Toluca, Mexico.  
 Internship service  
 Supervisor: Prof. Jorge Orozco.
- 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 with Dirichlet and Neumann boundary conditions.
- 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 student.  
 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 Science, UAEMéx*, Toluca, Mexico.  
 Exposure of graphite samples to microwaves Supervisor: Prof. Porfirio D. Rosendo-Francisco
- 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.

## 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

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### Professional development

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

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### Other activities

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

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## Languages

Spanish Mother tongue  
English Proficient  
Catalan Basic  
French Basic  
German Basic

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## References

- Prof. Miguel Ángel Aloy Torás · +34 96 354 3080 · Miguel.A.Aloy@uv.es · UV
- Dr. Petar Mimica · +34 96 354 3080 · Petar.Mimica@uv.es · UV
- Prof. Francisco Siddhartha Guzmán Murillo · +52 443 322 3500 ext 1264 · guzman@ifm.umich.mx · IFM, UMSNH
- Prof. José Antonio González Cervera · +52 443 322 3500 ext 1263 · gonzalez@ifm.umich.mx · IFM, UMSNH
- Prof. Jorge Orozco Velasco · jov@uaemex.mx · UAEMéx