

# Sofía Rojas Ruiz | Curriculum Vitae

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## Research Interests

Galaxies, AGN and quasars in the epoch of reionization, multiwavelength observations (optical-IR-radio), the co-evolution of galaxy – black hole – jet , galaxy overdensities and protoclusters.

## Education

- International Max Planck Research School - Heidelberg (IMPRS-HD)
  - Natural Sciences Ph.D. in Astrophysics 2019 – Present
  - “Accreting supermassive black holes in the first billion years: impact on their environments from parsecs to mega-parsecs”
- The University of Texas at Austin
  - B.S. Astronomy & B.S. Physics, GPA:3.52 2015 – 2019
- Corazonista School - Bogotá, Colombia
  - High School GPA:3.96 2007 – 2013

## Previous Employment

- The University of Texas at Austin (UT Austin)
  - Undergraduate Research Assistant 2016 – 2019
  - Search for galaxies at z~8-10 in the HST-BoRG survey under the supervision of Dr. Steven Finkelstein.
- Max Planck Institute for Astronomy – Heidelberg
  - Summer Research Intern Summer 2018
  - Analyzed varying chemical abundances in nuclear star clusters with Dr. Nadine Neumayer and Dr. Nikolay Kacharov.
- The National Radio Astronomy Observatory
  - Summer Research Intern Summer 2017
  - Analyzed and mapped star formation in different areas of LIRG-type interacting galaxies under the supervision of Dr. Eric Murphy.

## Awards (Links on titles)

- Research Funding.....
- European Southern Observatory Science Support Discretionary Fund (ESO-SSDF) Fall 2020
  - Awarded to an ESO-Chile Fellow and a student visitor to complete a research project.
  - IMPRS Fellowship for PhD at International Max Planck Research School - Heidelberg Spring 2019
  - Awarded every year to the most outstanding applicant to fund the full studies of the Ph.D. (4 years).
  - Student Researcher Award, UT Office of Undergraduate Research Spring 2019
  - Two fellowships awarded yearly to students in all areas of research to advance and showcase their projects.
  - Undergraduate Research Fellowship, UT Office of Undergraduate Research Spring 2018
  - Financial support for a research project conducted at the university.
  - John W. Cox Endowment for the Advanced Studies in Astronomy Summer 2016
  - Awarded to develop a research project at the Astronomy Department during the summer.
  - FRI Summer Research Fellowship Summer 2016
  - Awarded to a freshman student developing a summer research project at the College of Natural Sciences.

- Scholarships.....
- Ralph Cutler Greene Endowed Scholarship, UT Astronomy Department Spring 2019
  - Awarded annually to an outstanding senior astronomy student entering their final year.
  - General ISSS Financial Aid, UT International Office Fall 2016-Spring 2019
  - Awarded every year in cash assistance to international students who demonstrate financial need.
  - Melvin J. Rieger Scholarship Fund in Physics, UT Physics Department Fall 2018-Spring 2019
  - Endowed scholarship awarded every academic year to an outstanding physics student.
  - Jeannie Hunter Hackett Memorial Scholarship, PART - Austin Chapter Spring 2018
  - Awarded every year to an outstanding UT Austin junior or senior from Latin America.
  - College of Natural Sciences out-of-state tuition waiver Fall 2016-Spring 2018
  - Waiver allowing non-resident of Texas students to pay one year of tuition at in-state rates.

- **Thomas and Elizabeth Merner Scholarship, College of Natural Sciences** Fall 2017-Spring 2018  
Awarded to students in financial need and with strong academic performance
- **Brian M. Welch Endowed Memorial Scholarship, College of Natural Sciences** Fall 2016-Spring 2017  
Offered to students in the College of Natural Sciences with a minimum 3.0 GPA.
- **Abel Family Scholarships in Physics, UT Physics Department** Fall 2016-Spring 2017  
Awarded to outstanding students in the Physics Department

## Honors.....

- **Astronomy Departmental Honors, UT Austin.** Spring 2019  
Awarded to students presenting a written and oral thesis in astronomy and who have a GPA above 3.50.
- **Graduate Physics Departmental Honors, UT Austin** Spring 2019  
Awarded to students graduating with a thesis in physical sciences and a GPA above 3.50.
- **Graduate of Distinction in Research, College of Natural Sciences, UT Austin** Spring 2019  
Awarded to students who demonstrated excellence in the area of Research during their career.
- **College of Natural Sciences Aspire Professor's Choice Awards** Spring 2018  
Awarded every year to honor excellent Black and LatinX students nominated by their professors.
- **College of Natural Sciences Aspire Research Excellence Award** Spring 2017  
Awarded every year to honor the research accomplishments of Black and LatinX students.
- **Honors in IV Colombian Astronomy Olympiad** 2013  
Received 4th place at the national competition and was selected to participate in the Latin American Olympiad.
- **Bronze Medal in V Latin American Olympiad of Astronomy and Astronautics** 2013  
Awarded every year to students from Latin America participating in this competition.
- **High School Valedictorian, Corazonista School Bogotá** 2013  
Awarded to one graduating student with the best academic record during the periods of 6th to 11th grades.

## Telescope Experience

### Observing Proposals Led.....

- **James Webb Space Telescope (JWST) Cycle 1 GO 2426 (Rojas–Ruiz Co-PI)**  
“Spectroscopic Confirmation and Characterization of Bright Galaxies at  $z \sim 9$ .”  
Awarded 18.2 hours with NIRSpec/Fixed slit from the JWST TAC.
- **Very Large Array (VLA) 21A-307 (Rojas–Ruiz PI)**  
“Constraining the Synchrotron Lifetime of an Extreme Radio Quasar at Redshift 6.”  
Awarded 5.00 hours at Priority A from the NRAO TAC.

### Co-I proposals.....

- **JWST Cycle 1 GO 2079** (PI: F. Wang, Co-PIs: J. Hennawi and X. Fan), 61.5/29.6 with NIRCам/WFSS  
“A SPectroscopic survey of biased halos In the Reionization Era (ASPIRE): A JWST Quasar Legacy Survey.”
- **JWST Cycle 1 GO 2234** (PI: E. Bañados), 17.8 hours with NIRCам/imaging.  
“The JWST-legacy Narrow-band Survey of H-alpha and [OIII] Emitters in the Epoch of Reionization.”
- **NOEMA S22DF** (PI: Y. Khusanova), 19.0 hours.  
“Detecting outflows in a radio-loud broad absorption line quasar at  $z = 6.12$ .”
- **VLA 21B-151/22A-319** (PI: T. Connor), 6.0/6.0 hours.  
“Signatures of Inverse Compton Emission in the Epoch of Reionization.”
- **NOEMA S21DG** (PI: Y. Khusanova), 28.0 hours.  
“The origin of extreme [CII] and FIR continuum emission in the radio and X-ray brightest quasars at  $z > 6$ ”
- **NOEMA W21EC/S21DK/S20CY** (PI: E. Bañados), 8.0/8.0/8.0 hours.  
“The host galaxies of the most distant radio quasars at  $z > 6$ ”
- **HST Cy 28: 16258** (PI: C. Mazzucchelli), 25 orbits.  
“The Environment of the most distant Radio Loud Quasar”
- **HST Cy 27: 15862** (PI: S. Finkelstein), 14 orbits.  
“Confirmation of a Large, Robust Sample of  $z=9-10$  Galaxies in the CANDELS Fields.”

- **HST Cy 26: 15697** (PI: S. Finkelstein), 2 orbits.  
“Photometric Confirmation of the Brightest Known Galaxy Candidate at  $z > 9$ .”
- **Keck Observatory/MOSFIRE 2018A/B, 2019A/B** (PI: R. Larson), 2 nights per semester.  
“Islands of Reionization”

#### Observing trips.....

- The MPG/ESO 2.2m Telescope, La Silla Observatory.
- Keck I Telescope with the MOSFIRE spectrograph, W.M Keck Observatory.
- The 2.7m, 0.8m, and 0.9m telescopes at McDonald Observatory.
- The Mayall 4-meter telescope at Kitt Peak National Observatory.
- The 40-ft radio telescope at Green Bank Observatory.

#### Work with data from.....

- Hubble Space Telescope data (WFC3/UVIS and WFC3/IR Instruments.)
- Spitzer Space Telescope IRS data.
- VLA, NOEMA and ALMA interferometry data.
- VLT X-Shooter integrated light spectral data.

### Research Skills

- Use of  $\text{\LaTeX}$  and programming experience with the Interactive Data Language (IDL), Python, and Mathematica for array manipulations, reading multi-dimensional catalogs, statistical analyses, and plotting.
- Reduction of spectral data with **Pypelt**.
- Data reduction and alingment of data from the *Hubble Space Telescope* using **DrizzlePac**.
- Reduction and analysis of interferometry data with **GILDAS** and **CASA**.
- Performance of photometry in images using **Source Extractor**.
- Application of the **EAZY** program “Easy and Accurate Z(photometric redshifts) from Yale” to find photometric redshifts of galaxies.
- Utilization of Software **CUBISM** (Cube Builder for IRS Spectral Mapping) and **SMART** (Spectroscopy Modeling Analysis and Reduction Tool) to reduce and analyze Mid-Infrared spectra from galaxies.
- Use of the code **MOOG** to generate synthetic spectra for analyzing the chemical composition of stars.

### Publications

- **Rojas-Ruiz, Sofía**; Bañados, Eduardo; Neeleman, Marcel et al. **2021**, *The Impact of Powerful Jets on the Far-infrared Emission of an Extreme Radio Quasar at  $z \sim 6$* , *ApJ*, 920, 150
- **Rojas-Ruiz, Sofía**; Finkelstein, Steven L.; Bagley, Micaela B. et al. **2020**, *Probing the Bright End of the Rest-frame Ultraviolet Luminosity Function at  $z = 8-10$  with Hubble Pure-parallel Imaging*, *ApJ*, 891, 146
- Khusanova, Yana et al. (**Rojas-Ruiz, Sofía** 4<sup>th</sup> of 12 authors) **2022**, *The [CII] and FIR properties of  $z > 6$  radio-loud quasars* [arXiv:2204.08973](https://arxiv.org/abs/2204.08973)
- Larson, Rebecca L. et al. (**Rojas-Ruiz, Sofía** 7<sup>th</sup> of 13 authors) **2022**, *Searching for Islands of Reionization: A Potential Ionized Bubble Powered by a Spectroscopic Overdensity at  $z = 8.7$* , *ApJ*, 930, 104
- Tacchella, Sandro et al. (**Rojas-Ruiz, Sofía** 16<sup>th</sup> of 21 authors) **2021**, *On the Stellar Populations of Galaxies at  $z = 9 - 11$ : The Growth of Metals and Stellar Mass at Early Times*, *ApJ*, 927, 170
- Finkelstein, Steven L. et al. (**Rojas-Ruiz, Sofía** 21<sup>st</sup> of 24 authors) **2021**, *A Census of the Bright  $z=8.5-11$  Universe with the Hubble and Spitzer Space Telescopes in the CANDELS Fields*, *ApJ*, 928, 52
- Connor, Thomas et al. (**Rojas-Ruiz, Sofía** 7<sup>th</sup> of 11 authors) **2021**, *Enhanced X-Ray Emission from the Most Radio-powerful Quasar in the Universe's First Billion Years*, *ApJ*, 911, 120

#### Magazines.....

- Valentina Abril-Melgarejo, Lauren Flor Torres, Luz Ángela García, Claudia P. Gutiérrez, Andrea Guzmán Mesa, Ana Paola Mikler, Eliana Nossa, **Sofía Rojas-Ruiz**, **2021**, *Experiencias, retos y desafíos para las científicas en el trabajo en Astrociencia en Colombia*, [Revista Digital Fulica](https://revista.digitalfulica.org/)

## Conference Talks

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Invited.....

- **VII Colombian Congress of Astronomy and Astrophysics, Tunja, Colombia - CoCoA**  
*New Light of the First-born Galaxies and Quasars with JWST.* 2022

Contributed.....

- **European Astronomical Society Annual Meeting (EAS), Leiden, Netherlands**  
*Interactions of Radio Jets and Interstellar Medium in an Extreme Radio-loud Quasar* 2021
- **Black Holes and Galaxies at the Edge of the Universe, Ringberg Castle, Germany**  
*Search for Bright Galaxies at  $z \sim 7 - 11$ , Keypoints for Upcoming JWST.* 2020

## Seminar & Colloquia Talks

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- **Hypatia Colloquium, European Southern Observatory (ESO) ([Watch here](#)).**  
*The Role of Powerful Radio Jets in the Host Galaxy of a Quasar in the First Gyr of the Universe* 2022
- **(Invited) Orígenes Seminar, Universidad de Antioquia, Colombia**  
*The Impact of Powerful Jets on the Far-infrared Emission of an Extreme Radio Quasar at  $z \sim 6$*  2021
- **Galaxy Coffee at the Max Planck Institute for Astronomy, Heidelberg, Germany**  
*The Impact of Powerful Jets on the Far-infrared Emission of an Extreme Radio Quasar at  $z \sim 6$*  2021
- **(Invited) Astronomy Seminar, Universidad de Los Andes, Colombia**  
*The Impact of Powerful Jets on the Far-infrared Emission of an Extreme Radio Quasar at  $z \sim 6$*  2021
- **(Invited) Thirty Minute Talk (TMT) Seminar, European Southern Observatory, Chile**  
*Search for Bright Galaxies at  $z=8-10$  with the Hubble Space Telescope* 2020
- **(Invited) Galaxy Coffee at Max Planck Institute for Astronomy, Heidelberg, Germany**  
*Search for Bright Galaxies at  $z=8-10$  with the Hubble Space Telescope* 2019
- **Extragalactic Seminar at The University of Texas at Austin**  
*Search for Bright Galaxies at  $z=8-10$  with the Hubble Space Telescope* 2017
- **Texas Astronomy Undergraduate Research Symposium, Baylor University**  
*Search for Bright Galaxies at  $z=8-10$  with the Hubble Space Telescope* 2016

## Outreach Talks

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- **School IED Monseñor Agustín Gutiérrez, Fómeque, Colombia**  
*Interview with an Astronomer (as part of the [RECA - Education Node Initiative](#))* 2022
- **School Inst. Educ. Municipal Juan XXIII- Sede Tierra Morada, Facatativá, Colombia**  
*Cosmology for Kids ([RECA - Education Node](#))* 2021
- **Colombian Astronomy Association (ACDA)**  
*Finding the First Galaxies in the Universe* 2021
- **Astronomy on Tap - Bogotá, Colombia**  
*Search for Bright Galaxies at  $z = 8 - 10$  with the Hubble Space Telescope* 2018

## Poster Presentations

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- **Investigating the Mpc-scale Environment around the  $z \sim 7.54$  Quasar ULAS J1342+0928**  
*Rojas Ruiz, S., Mazzucchelli, C., Bañados, E., et al.*
  - Quasars and Galaxies through Cosmic Time, virtual conference 2022
  - 'Formation and Evolution of Galaxy Clusters Across Cosmic Time',  
XXXII Canary Islands Winter School of Astrophysics, La Laguna, Tenerife, Spain. 2021
- **The Host Galaxy of an Extreme Radio Quasar at  $z \sim 6$**   
*Rojas Ruiz, S., Bañados, E., Neeleman, M., et al.*
  - Extragalactic jets on all scales - launching, propagation, termination, MPIA and IIT Indore, Virtual 2021
  - Summer All Zoom Epoch of Reionization Astronomy Conference (SAZERAC) 2020
- **Search for Bright Galaxies at  $z=8-10$  with the Hubble Space Telescope.**  
*Rojas Ruiz, S., Finkelstein, S., Bagley, M. B. et al.*
  - 'First Light School': Stars, Galaxies and Black Holes in the Epoch of Reionization, Brazil 2019

- 'Barefoot Reionization': Exploring the first billion years of the Universe, Australia 2019
- 233rd American Astronomical Society (AAS), #233, id. 144.03 2019
- Board of Visitors Meeting, UT Austin 2018
- Frank N. Bash Symposium, UT Austin 2017
- College of Natural Sciences Research Forum, UT Austin 2016

#### **Infrared-Bright Interacting Galaxies.**

- *Rojas Ruiz, S., Murphy, E. J., Armus, L., Smith, J.D.T., Bradford, C.M., Stierwalt, S.* 2018  
231th American Astronomical Society (AAS), #231, id. 251.07

## **Teaching Experience**

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### **Heidelberg University, Germany**

- *Tutor of the class 'Introduction to Astronomy and Astrophysics'* Winter 2021  
Prepared classes of additional material on topics of Galactic and Extragalactic Astronomy. Specifically presented research on nuclear star clusters, dwarf galaxies and Dark Matter, galaxy clusters and lensing, and galaxies and quasars in the Epoch of Reionization. Also helped students reviewing and clarifying the homework exercises.

### **Mentoring Program for Future Colombian Astronomers**

- *Red de Estudiantes Colombianos de Astronomía (RECA)* 2020 – 2021  
Mentored students in pursuit of doctoral education in Astronomy overseas. Helped them prepare for the TOEFL English test, guided application materials, gathered funding resources and supported the student until successful acceptance to high-quality astronomy programs in Europe. <https://www.astroreca.org/en/mentorias>

### **Heidelberg University, Germany**

- *Tutor of Advanced Lab F36: 'Wavefront analysis with a Shack-Hartmann wavefront sensor.'* Summer 2020  
Prepared short quizzes for the preparation of the lab, instructed and graded students on the development of the experiment.

### **The University of Texas at Austin**

- *Undergraduate Learning Assistant of "AST 301: Introduction to Astronomy"* Fall 2016  
Collaborated on preparing activities to teach this class targeted for non-science majors and helped them prepare for exams.

## **Service to the Community**

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- *Referee for the Astrophysical Journal (ApJ)* 2021
- *Committee Organizer of the Network of Colombian Astronomy Students* 2021 - 2022  
(Red de Estudiantes Colombianos de Astronomía - RECA) <https://www.astroreca.org/en/nosotros>
- *Committee Member of RECA - Education Node, Colombia* 2021 - 2022  
<https://www.astroreca.org/en/educacion>
- *Member of selection board for 'She is Astronaut', She is Foundation, Colombia* 2021 & 2022  
<https://she-is.org/she-is-astronauta/>

## **University Involvement**

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- *Student advisor of the Texas Institute for Discovery Education in Science (TIDES) Board* 2017-2019
- *Astronomy Students Association, UT elected Webmaster* 2016-2017
- *Student in the Freshman Research Initiative stream "Exploring the Universe with White Dwarfs"* 2016
- *Undergraduate Women in Physics, UT chapter member* 2015-2019
- *Society of Physics Students, UT chapter member* 2015

## **Extracurricular Activities**

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- *Stargazing with Newtonian telescope* 2007-present
- *Co-Organizer of Astronomy on Tap Bogotá, Colombia* 2017-2018
- *Build Hydraulic Rockets* 3 yrs
- *Outreach volunteer of the Colombian Astronomy Association "ACDA"* 4 yrs
- *Salsa dancing* 15 yrs

- *Play tennis* 13 yrs
- *Play soccer* 2 yrs
- *Languages: Spanish (Native), English (Fluent), and German (A2.2 level).*