

Curriculum Vitae

# Paula Sánchez Sáez

## Postdoctoral Fellow

### European Southern Observatory (ESO)

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Citizenship: Chile

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## ABOUT ME

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I am an astronomer who fell in love with data science. I have focused my research on topics related to the processing of large astronomical data sets and machine learning applications. My main research interests are the study of transients and variable objects in the universe (time-domain astronomy) and applying statistical, machine learning, and deep learning techniques to discover and understand different populations of Active Galactic Nuclei (AGN).

## EDUCATION

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PhD in ASTRONOMY, **Universidad de Chile**, Santiago, Chile 2013 - 2019  
Thesis: "AGN variability in the era of Big Data" | Advisor: Paulina Lira.

Bachelor's Degree in ASTRONOMY, **Universidad de Chile**, Santiago, Chile January 2013  
Graduated with Highest Honors.

## SKILLS

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- Languages: SPANISH: Mothertongue, ENGLISH: Fluent, GERMAN: Basic.
- Computing:
- Expert: Python (e.g., Astropy, Pandas, Scikit-learn, Keras, TensorFlow).
  - Proficient: Excel, SExtractor, GitHub, SQL, LINUX, MAC OS, LATEX, Topcat.
  - Competent: C, Java, Matlab, R, IRAF.
- Astronomy:
- Building, testing, optimisation, monitoring, and publication of reduction and calibration pipelines for the processing of astronomical data.
  - Statistical analysis, time series analysis, machine learning classification.
  - Experience observing with optical ground-based telescopes
  - Experience working on survey observational strategy optimization.
  - Experience providing support to users of astronomical services.
  - Experience working within multidisciplinary and international teams.

## RESEARCH EXPERIENCE

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**European Southern Observatory (ESO)**, Garching, Germany November 2021 - present  
*ESO Fellow*

- 75% independent research: working on Machine Learning studies for the identification of Changing-look AGN and low-mass AGN.
- 25% functional work at ESO: development of the 4MOST feedback loop, 4MOST PAE (second half of 2023), 4MOST commissioning (2024).

**Millennium Institute of Astrophysics (MAS)**, Macul, Chile April 2020 - October 2021  
**Pontificia Universidad Católica de Chile (PUC)**

*FONDECYT fellow*

Working on AGN variability studies in the context of the

**ALeRCE** project.

<b>Inria Chile</b> , Las Condes, Chile <i>Postdoctoral Researcher</i> Working on Deep Learning studies for the ALerCE project.	December 2020 - August 2021
<b>Millennium Institute of Astrophysics (MAS)</b> , Macul, Chile <b>Pontificia Universidad Católica de Chile (PUC)</b> <b>Universidad Adolfo Ibáñez (UAI)</b> <i>Postdoctoral Researcher</i> Working on Machine Learning classification of variable and transient objects for the ALerCE project.	May 2019 - April 2020
<b>European Southern Observatory (ESO)</b> , Vitacura, Chile <i>ESO Studentship Programme Chile</i> Working with Konrad Tristram on dust reverberation mapping of AGN.	April 2018 - March 2019
<b>Kavli Institute for Astronomy and Astrophysics (KIAA)</b> , Beijing, China <i>Visiting student</i> Working with Luis Ho on spectral analysis of variable AGN.	March 2017 - June 2017
<b>Penn State University (PSU)</b> , State College, USA <i>Visiting student</i> Working with Niel Brandt on the classification of AGN using Machine Learning.	January - February 2017

## GRANTS AND HONORS

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- ESO Science Support Discretionary Fund (SSDF 2023)  
7.000 EUR
- ESO Garching Fellowship  
Independent Fellowship. 2021-2024
- Fondecyt Postdoctorado 2020  
Independent Fellowship. 27.000.000 CLP per year. 2020-2021
- L'Oréal-UNESCO-CHILE For Women in Science Award  
7.000.000 CLP 2016
- Funding for projects of graduate students, Universidad de Chile.  
2.500.000 CLP 2015
- Funding for projects of graduate students, Universidad de Chile.  
2.500.000 CLP 2016
- Conicyt Scholarship, Doctorado Nacional. 2013 - 2017  
7.000.000 CLP per year
- Outstanding Student, FCFM, Universidad de Chile. 2008, 2009, 2011

## TALKS AT INTERNATIONAL CONFERENCES (SELECTED)

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- The restless nature of AGN: 10 years later, Napoli, Italy June 2023
- Statistical Challenges in Modern Astronomy VIII, State College, USA June 2023
- Science with the future WideField Spectroscopic Telescope, Vienna, Austria May 2023
- ORIGINS Data Science Days, Garching, Germany January 2023
- Origin, growth and feedback of black holes in dwarf galaxies, San Sebastian, Spain September 2022
- Bayesian Deep Learning for Cosmology and Time Domain astrophysics, Paris, France June 2022
- Machine Learning for Astrophysics - ML4Astro, Catania, Italy May 2022
- SciOps 2022: Artificial Intelligence for Science and Operations in Astronomy,  
Garching, Germany May 2022
- **Invited talk:** Low-latency alerts & Data analysis for MMA, virtual meeting January 2022
- **Invited talk:** Machine Learning in Astronomy, from classical to physics-informed,  
virtual meeting July 2021

- Supermassive Black Hole Studies with the Legacy Survey of Space and Time, virtual meeting July 2021
- EAS Annual Meeting 2021, virtual meeting June 2021
- **Invited talk:** Supermassive Black Hole Studies with LSST, part of 236th AAS meeting June 2020
- **Invited talk:** XVI Latin American Regional IAU Meeting (LARIM), Antofagasta, Chile November 2019
- Quasars in Crisis 2019, Edinburgh, Scotland August 2019
- TORUS 2018: The many faces of the AGN obscuration, Puerto Varas, Chile December 2018
- Massive black holes in evolving galaxies, Paris, France June 2018
- **Invited talk:** IV Encuentro Red INCHE, Barcelona, Spain October 2017
- LSST AGN Science Collaboration Meeting, Grapevine, TX, USA January 2017
- Hidden Monsters Hanover, NH, USA August 2016
- AGN: what's in a name, Garching, Germany June 2016

## SEMINARS

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- Hamburg Observatory, Hamburg, Germany May 2023
- European Southern Observatory (ESO) Lunch talk, Garching, Germany April 2023
- ESO AI Forum: Tutorial Deep Learning (CNNs and RNNs), Garching, Germany April 2022
- Yale Data Science x Astronomy-Astrophysics, virtual talk November 2021
- SWIFAR in Yunnan university, virtual talk May 2021
- Uppsala University, virtual talk April 2021
- Universidad de Valparaiso, Valparaiso, Chile October 2020
- Caltech, ZTF Machine Learning group, Pasadena, USA August 2020
- LSST AGN science collaboration August 2020
- University of Southampton, Southampton, England August 2019
- Deutsches Elektronen-Synchrotron (DESY), Berlin, Germany November 2018
- Universidad de Valparaiso, Valparaiso, Chile October 2018
- European Southern Observatory (ESO), Vitacura, Chile September 2018
- Association of Universities for Research in Astronomy (AURA), La Serena, Chile September 2018

## ACCEPTED OBSERVING PROPOSALS AS PI

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- VLT/X-SHOOTER (1.3 hours): "Is ZTF19acnsky a newborn AGN or a long lived TDE?", DDT, July 2022
- LCO 1M (47 hrs): "Improving Target and Observation Manager (TOM) Synergies with Community Brokers", TOM Development Program 2020A, 2020B.
- SOAR/Goodman (3 nights): "Spectroscopic follow up of AGN candidates from The QUEST-La Silla AGN Variability Survey", CNTAC 2016B.
- SOAR/Goodman (3 nights): "Spectroscopic follow up of AGN candidates from The QUEST-La Silla AGN Variability Survey", CNTAC 2017A.
- NTT/EFOCS2 (4 nights): "Spectroscopic follow up of AGN candidates from The QUEST-La Silla AGN Variability Survey", ESO 101.A.

## OBSERVING EXPERIENCE

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- Clay Magellan Telescope, LCO MagE (2 nights), MIKE (1 night), LDSS3 (1 night)
- DuPont Telescope, LCO WFCCD (17 nights)
- Blanco Telescope, Tololo Observatory COSMOS (4 nights)
- SOAR Telescope, Cerro Pachon Observatory GOODMAN (7 nights)
- NTT Telescope, La Silla Observatory EFOCS2 (4 nights)

## TEACHING AND OUTREACH EXPERIENCE

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- La Serena School for Data Science 2022 August 2022
- Lecturer: Deep Learning
- Project supervisor.

ESO Summer Research Programme Supervision of undergraduate student Nicolás Guerra.	July - August 2022
ESO Summer Research Programme Lecture: Using Deep Learning to foster astronomical discoveries.	July 2022
Universidad de los Andes Lecturer: Introducción a la Astronomía	2020 - 2021
La Serena School for Data Science 2021 Lecturer: Deep Learning Project supervisor.	August 2021
Supervision of three undergraduate students Instituto de Astrofísica, PUC 2020 Summer Internship program	December 2019 - March 2020
Center for the Study and Development of Talent (PENTA-UC) Lecturer: Intergalactic Journey (2 semesters, for talented high school students)	2017 - 2018
Co-Supervision of Master student Nicolás Miranda Universidad de Chile	2016 - 2018
Co-Supervision of undergraduate student Victoria Pérez Universidad de Chile	2017
FCFM, Universidad de Chile Teaching Assistant: Introduction to Physics (3 semesters), Calculus of Several Variables (1 semester), Intergalactic Medium (1 semester), Planetary Science (1 semester), Radiative Processes (1 semester), EdV Planetary Science (2 semesters), EdV Astronomy (1 semester).	2010-2016
Universidad Andrés Bello Teaching Assistant: Introduction to Physics (3 semesters).	2011-2012
Outreach activities in different contexts: Organization of the ESO-Vitacura Girls' Day. Participant in Cazadoras de estrellas. Participant in Día de la astronomía en Chile. Member of the "Observatorio Astronómico Nacional" (Chile) outreach group.	2013 - 2019

## ADDITIONAL PROFESSIONAL EXPERIENCE

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### ESO Duties:

Support for the 4MOST infrastructure working group 2 (IWG2)

### Collaborations:

Deputy Lead of the wide-field spectroscopic telescope (WST) Time Domain Working Group

ORIGINS Data Science Lab (ODSL) Fellow

Member of the 4MOST Chilean AGN/Galaxy Evolution Survey (ChANGES)

Member of the ALERCE broker

Member of the LSST AGN Science Collaboration

### Community services:

Peer Review: referee for Monthly Notices of the Royal Astronomical Society (MNRAS), Astronomy & Astrophysics (A&A), and the AAS Journals

Main organizer of the Artificial Intelligence (AI) Forum at ESO

Member of the ESO Fellowship Selection Committee Europe (FSCE) 2022

Fellows Representative at ESO Garching (March 2022 - March 2023)

Students Representative at ESO Chile (2018 - 2019)

Graduate Student Representative, Astronomy Department, Universidad de Chile (2014 - 2016)

**Participation in Astroinformatics and Astrostatistics schools:**

- Deep Learning Basics Train-the-Trainer Workshop February 2023
- Target and Observation Manager (TOM) Toolkit Workshop September-October 2019
- XXX Canary Islands Winter School of Astrophysics: "Big Data Analysis in Astronomy" November 2018
- 11th Heidelberg Summer School: "Astrostatistics and Data Mining" September 2016
- La Serena School for Data Science: "Applied Tools for Data-driven Sciences" August 2014

**LOC/SOC member:**

- (SOC) Extreme SMBH accretion at the COSPAR2024 July 2024
- (SOC) AISSAI Anomaly Detection Workshop January 2024
- (SOC) Cosmics streams 2023 December 2023
- (SOC) Science with the future WideField Spectroscopic Telescope May 2023
- (SOC) LSTT Brokers Workshop November 2021
- (SOC/LOC) LSST Enabling Science 2020 broker workshop October 2020
- (SOC/LOC) The ALeRCE broker tutorial September 2020
- (SOC/LOC) ALeRCE Hackathon January 2020
- (LOC) TORUS2018 workshop. December 2018
- (SOC head/LOC) 2do Workshop de estudiantes de Astronomía en Chile March 2017
- (SOC head/LOC) 1er Workshop de estudiantes de Astronomía en Chile May 2016

# List of Publications

## PEER-REVIEWED PUBLICATIONS AS FIRST AUTHOR

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- **P. Sánchez-Sáez**, J. Arredondo, A. Bayo, P. Arévalo, F. E. Bauer, G. Cabrera-Vives, et al., 2023, *Astronomy & Astrophysics*, accepted for publication. “Persistent and occasional: searching for the variable population of the ZTF/4MOST sky using ZTF data release 11”.
- **P. Sánchez-Sáez**, H. Lira, L. Martí, N. Sánchez-Pi, J. Arredondo, F. E. Bauer, A. Bayo, et al., 2021, *Astronomical Journal*, 162, 206. “Searching for Changing-state AGN in Massive Data Sets. I. Applying Deep Learning and Anomaly-detection Techniques to Find AGN with Anomalous Variability Behaviors”.
- **P. Sánchez-Sáez**, I. Reyes, C. Valenzuela, F. Förster, S. Eyheramendy, F. Elorrieta, et al. 2021, *Astronomical Journal*, 161, 141. “Alert Classification for the ALERCE Broker System: The Light Curve Classifier”.
- **P. Sánchez-Sáez**, P. Lira, R. Cartier, N. Miranda, L. C. Ho, P. Arévalo, F. E. Bauer, P. Coppi, and C. Yovaniniz, 2019, *Astrophysical Journal Supplement Series*, 242, 10. “The QUEST-La Silla AGN Variability Survey: selection of AGN candidates through optical variability”.
- **P. Sánchez-Sáez**, P. Lira, J. Mejía-Restrepo, L. C. Ho, P. Arévalo, M. Kim, R. Cartier, P. Coppi, 2018, *Astrophysical Journal*, 864, 87. “The QUEST-La Silla AGN variability survey: connection between AGN variability and black hole physical properties”.
- **Sánchez, P.**, Lira, P., Cartier, R., Pérez, V., Miranda, N., Yovaniniz, C., Arévalo, P., Milvang-Jensen, B., Fynbo, J., Dunlop, J., Coppi, P., Marchesi, S., 2017, *Astrophysical Journal*, 849, 110. “Near-infrared variability of obscured and unobscured X-ray-selected AGN in the COSMOS field”.

## PEER-REVIEWED PUBLICATIONS AS CO-AUTHOR

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- M. Pérez-Carrasco, G. Cabrera-Vives, L. Hernández-García, F. Förster, **P. Sánchez-Sáez**, et al., 2023, *Astronomical Journal*, accepted for publication. “Alert Classification for the ALERCE Broker System: The Anomaly Detector”.
- L. Hernández-García, F. Panessa, G. Bruni, L. Bassani, P. Arévalo, V. M. Patiño-Alvarez, A. Tramacere, P. Lira, **P. Sánchez-Sáez** et al., 2023, *Monthly Notices of the Royal Astronomical Society*, accepted for publication. “Multiwavelength monitoring of the nucleus in PBC J2333.9-2343: the giant radio galaxy with a blazar-like core”.
- López-Navas E., Arévalo, P., Bernal, S., Graham, Matthew J., Hernández-García, L., Lira, P., **Sánchez-Sáez P.**, 2023, *Monthly Notices of the Royal Astronomical Society*, 518, 1531 “The Type 1 and Type 2 AGN dichotomy according to their ZTF optical variability”.
- F. Förster, A. M. Muñoz Arancibia, I. Reyes-Jainaga, A. Gagliano, D. Britt, S. Cuellar-Carrillo, F. Figueroa-Tapia, A. Polzin, Y. Yousef, J. Arredondo et al. (including **P. Sánchez-Sáez**), 2022, *Astronomical Journal*, 164, 195. “DELIGHT: Deep Learning Identification of Galaxy Hosts of Transients using Multiresolution Images”.
- A. B. Kovacevic, V. Radovic, D. Ilic, L.C. Popovic, R. J. Assef, **P. Sánchez-Sáez**, R. Nikutta, C. M. Raiteri, et al., 2022, *The Astrophysical Journal Supplement Series*, 262, 49. “The LSST Era of Supermassive Black Hole Accretion Disk Reverberation Mapping”.
- D. De Cicco, F. E. Bauer, M. Paolillo, **P. Sánchez-Sáez**, W. N. Brandt, F. Vagnetti, G. Pignata, M. Radovich, and M. Vaccari, 2022, *Astronomy & Astrophysics*, 664, 117. “A structure function analysis of VST-COSMOS AGN”.
- Jankov, I.; Kovacevic, A. B.; Ilic, D.; Popovic, Luka C. ; Radovic, V.; Cvorovic-Hajdinjak, I.; Nikutta, R.; and **Sánchez-Sáez, P.**, 2022. *Astronomische Nachrichten*, 343, e210090. “Photoreverberation mapping of quasars in the context of Legacy Survey of Space and Time observing strategies”.

- Cvorovic-Hajdinjak, I., Kovacevic, A. B., Ilic, D., Popovic, L. C., Dai, X., Jankov, I., Radovic, V., **Sánchez-Sáez, P.**, and Nikutta, R., 2022. *Astronomische Nachrichten*, 343, e210103. “Conditional Neural Process for nonparametric modeling of active galactic nuclei light curves”.
- E. D. Hueichapan, C. Contreras, R. Cartier, P. Lira, **P. Sánchez-Sáez**, B. Milvang-Jensen, J. P. U. Fynbo, J. P. Anderson, M. Hamuy, 2022. *Monthly Notices of the Royal Astronomical Society*, 513, 2965. “Two years of optical and NIR observations of the superluminous supernova UID 30901 discovered by the UltraVISTA SN survey”.
- López-Navas, E. ; Martínez-Aldama, M. L.; Bernal, S.; **Sánchez-Sáez, P.**; Arévalo, P. ; Graham, Matthew J.; Hernández-García, L. ; Lira, P.; Rojas Lobos, P. A., 2022. *Monthly Notices of the Royal Astronomical Society: Letters*, 513, 57. “Confirming new changing-look AGN discovered through optical variability using a random forest-based light-curve classifier”.
- R. Carrasco-Davis, E. Reyes, C. Valenzuela, F. Förster, P. A. Estévez, G. Pignata, F. E. Bauer, I. Reyes, **P. Sánchez-Sáez**, et al., 2021, *the Astronomical Journal*, 162, 231. “Alert Classification for the ALerCE Broker System: The Real-time Stamp Classifier”
- F. Förster, G. Cabrera-Vives, E. Castillo-Navarrete, P. A. Estévez, **P. Sánchez-Sáez**, et al., 2021, *the Astronomical Journal*, 161, 242. “The Automatic Learning for the Rapid Classification of Events (ALerCE) Alert Broker”
- D. De Cicco , F. E. Bauer, M. Paolillo, S. Cavuoti , **P. Sánchez-Sáez**, W. N. Brandt, G. Pignata, M. Vaccari, M. Radovich, 2021. *Astronomy & Astrophysics*, 645, 103. “A random forest-based selection of optically variable AGN in the VST-COSMOS field”
- O. Rodríguez; G. Pignata; M. Hamuy; A. Clocchiatti; M. M. Phillips; K. Krisciunas; N. I. Morrell; G. Folatelli; M. Roth; S. Castellón; Y. Apostolovski; P. López; S. Marchi; R. Ramírez; **P. Sánchez**, 2019, *Monthly Notices of the Royal Astronomical Society*, 483, 5459. “Type II Supernovae as Distance Indicators at Near-IR Wavelengths”.
- Lira, P.; Kaspi, S.; Netzer, H.; Botti, I.; Morrell, N.; Mejia-Restrepo, J.; **Sánchez-Sáez, P.**; Martinez, J; Lopez, P, 2018, *Astrophysical Journal*, 865, 56. “Reverberation mapping of luminous quasars at high-z”.
- R. Cartier, P. Lira, P. Coppi, **P. Sánchez**, P. Arévalo, F. E. Bauer, D. Rabinowitz, Robert Zinn, R. R. Muñoz, N. Meza, 2015, *Astrophysical Journal* , 810, 164. “The QUEST-La Silla AGN Variability Survey”.
- Fathivavsari, H.; Petitjean, P.; Noterdaeme, P.; Pâris, I.; Finley, H.; López, S.; Srianand, R.; **Sánchez, P.**, 2015, *Monthly Notices of the Royal Astronomical Society*, 454, 876. “A coronagraphic absorbing cloud reveals the narrow-line region and extended Lyman alpha emission of QSO J0823+0529”.

## SUBMITTED PUBLICATIONS

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- P. Arévalo, E. Churazov, P. Lira, **P. Sánchez-Sáez**, S. Bernal, et al., 2023, *Astronomy & Astrophysics*, submitted. “The universal power spectrum of Quasars in optical wavelengths: Break timescale scale directly on both black hole mass and accretion rate”.
- E. López-Navas, **P. Sánchez-Sáez**, P. Arévalo, S. Bernal, M. J. Graham, et al., 2023, *Monthly Notices of the Royal Astronomical Society*, submitted. “Selection of changing-look AGN through multi-wavelength photometric variability”.
- N. Astorga, I. Reyes, G. Cabrera-Vives, F. Förster et al. (including **P. Sánchez-Sáez**), 2023, *Nature Astronomy*, submitted. “ATAT: Astronomical Transformer for time series And Tabular data”
- P. Arévalo, P. Lira, **P. Sánchez-Sáez**, P. Patel, E. López-Navas et al., 2023, *Monthly Notices of the Royal Astronomical Society*, submitted. “Optical variability in Quasars: Scalings with black hole mass and Eddington ratio depend on the observed timescales”.

## NON-REFEREED PUBLICATIONS

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- F.E. Bauer, P. Lira, T. Anguita, P. Arevalo, R. Assef, et al. (including **P. Sánchez-Sáez**), 2023, The Messenger, submitted. “Chilean AGN/Galaxy Extragalactic Survey (ChANGES)”.
- R. Cartier, P. Lira, P. Coppi, **P. Sánchez**, P. Arévalo, F. E. Bauer, R. R. Muñoz, 2016, The Messenger, 163, 26. “The QUEST-La Silla AGN Variability Survey”.