

Tomás Ahumada, PhD

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Research Interests

My research aims to better understand the most energetic events in the universe. I use optical telescopes to search for the electromagnetic counterparts to compact binary mergers (binary neutron star and neutron star–black hole) and collapsing massive stars. Each new discovery brings us closer to revealing the origin of the heaviest elements in the periodic table and provides insights into the extreme physics around black holes and their accretion disks. My work has focused on the follow-up of triggers from gamma-ray missions, such as the *Fermi* Space Telescope and the Neil Gehrels *Swift* Observatory, as well as events from the Laser Interferometer Gravitational-Wave Observatory (LIGO). I use the Zwicky Transient Facility as a discovery engine, with my work primarily focused on optimizing the observing schedule and discovering fast-evolving transients in large databases. Additionally, I have experience coordinating follow-up observations across different time zones and analyzing pan-chromatic astronomical datasets using both analytical and Bayesian frameworks. The search for exotic transients has exposed me to other challenges, such as optimizing database queries, which led to the development of mock transient databases for ZTF and the Rubin Observatory. I am also interested in machine learning applications to astronomical data, such as clustering gamma-ray bursts or employing novel neural networks for image subtraction.

Employment

California Institute of Technology

Presidential Postdoctoral Fellow

Pasadena, CA

Sept 2022 – Present

NASA Goddard Space Flight Center

Graduate Research Assistant

Greenbelt, MD

Mar 2018 – July 2022

University of Maryland at College Park

Graduate Research Assistant

College Park, MD

Mar 2018 – Jul 2022

Gemini Observatory

Intern

La Serena, Chile

Feb 2017 – Aug 2017

Pontificia Universidad Católica de Chile

Undergraduate Research Assistant

Santiago, Chile

Mar 2016 – Dec 2016

Cerro Tololo Inter-American Observatory

Research Experience for Undergraduates

La Serena, Chile

Jan 2016 - Mar 2016

Education

University of Maryland at College Park

Ph.D. in Astronomy

College Park, MD

July 2022

Thesis: A portrait of the binary compact merger as a young: Short GRB, Gravitational wave, Afterglow, and Kilonova. Advisor: Dr. Leo Singer

M.Sc. in Astronomy

July 2019

Thesis: In search of the short gamma-ray burst optical counterpart with the Zwicky Transient Facility

Pontificia Universidad Católica de Chile

Santiago, Chile

B.Sc. in Astronomy

July 2016

Senior Thesis: Finding quasars in *ATLAS* fields through Machine Learning. Advisor: Prof. Felipe Barrientos and Prof. Karim Pichara

Fellowships and Awards

Presidential Postdoctoral Fellowship - Caltech (2023-2025)
Data Science Fellowship Program - LSST Collaboration(2021-2023)
Matrícula de Honor - P. Universidad Católica de Chile (2012, 2013)

Talks, conferences and meetings

Mining GRB afterglows and kilonovae with wide FOV telescopes <i>Contributed Talk at the Cosmic Streams conference</i>	Conference, Talk <i>December 2023</i>
In search of multi-messenger sources <i>Seminar at Pontificia Universidad Católica de Valparaíso</i>	PUCV, Seminar <i>December 2023</i>
In search of multi-messenger sources <i>Seminar at Pontificia Universidad Católica de Chile</i>	PUC, Seminar <i>December 2023</i>
The LIGO fourth observing run <i>Contributed Talk at the ZTF team meeting</i>	Conference, Talk <i>October 2023</i>
Optical searches of Fermi GRBs using the Zwicky Transient Facility <i>Invited Talk at the Australian National University, Canberra, Australia</i>	ANU, Talk <i>December 2022</i>
Optical searches of Fermi GRBs using the Zwicky Transient Facility <i>Invited Talk at the Swinburne University, Melbourne, Australia</i>	Swinburne, Talk <i>December 2022</i>
From alerts to science <i>Invited Talk at the Rubin Kickstarter Science Colloquia , Virtual</i>	Virtual, Talk <i>October 2022</i>
In search of the short GRB optical counterpart <i>Invited Talk at the Osservatorio Astronomico di Roma, Monte Porzio, Italy</i>	OAR, Talk <i>June 2022</i>
In search of the short GRB optical counterpart <i>Invited Talk at the Princeton Journal Club, Princeton, USA</i>	Princeton, Talk <i>October 2021</i>
Discovery and confirmation of the shortest gamma-ray burst from a collapsar <i>Invited Talk at the Gemini science coffee, La Serena, Chile</i>	Gemini South, Talk <i>October 2020</i>
Discovery and confirmation of the shortest gamma-ray burst from a collapsar <i>NASA Astroparticle Physics Lab meeting</i>	NASA GSFC, Talk <i>September 2020</i>
Discovery and confirmation of the shortest gamma-ray burst from a collapsar <i>Invited Talk at the Marcel Grossmann 16th meeting, conference</i>	Conference, Talk <i>July 2020</i>
ZTF10abwysqy, the shortest gamma-ray burst with a collapsar origin <i>ZTF team meeting, Pasadena, CA, USA</i>	Caltech, Talk <i>October 2020</i>
In search of the optical counterpart of short gamma-ray bursts <i>American Astronomical Society meeting, Honolulu, HI, USA</i>	AAS, Talk <i>January 2020</i>
Astrobitos - The Astrobites in Spanish <i>American Astronomical Society meeting, Honolulu, HI, USA</i>	AAS, Poster <i>January 2020</i>
The Extended Globular Cluster System of NGC3923 <i>GROWTH team meeting, Mumbai, India</i>	IIT Bombay, Talk <i>December 2018</i>
The Extended Globular Cluster System of NGC3923 <i>American Astronomical Society meeting, Grapevine, TX, USA</i>	AAS, Poster <i>January 2017</i>
Identifying Quasars in ATLAS fields <i>ANILLO workshop 2016, Santiago, Chile</i>	P.Universidad Catolica, Talk <i>December 2016</i>
The Extended Globular Cluster System of NGC3923 <i>REU Workshop, Cerro Tololo Inter-American Observatory, La Serena, Chile</i>	CTIO, Talk <i>March 2016</i>

Mentoring

- Undergraduate** *Summer 2023*
Mentor of the LIGO-SURF student Marianna Pezzella
- Undergraduate** *January 2021*
Mentor of Lenin Nolasco and Maria-Clara Heringer at the GRADMAP Winter Workshop

Teaching Experience

- Head Teaching Assistant** *August 2021*
Head TA at the virtual ZTF summer school
- Lecturer** *July 2021*
Lecturer in the Python seminars for PAARC
- Lecturer** *January 2021*
Lecturer of the Python module on image analysis at the GRADMAP Winter Workshop
- Graduate Teaching Assistant** *November 2020*
TA at the virtual GROWTH school
- Graduate Teaching Assistant, University of Maryland** *September 2017 - December 2017*
Graduate Teaching assistant to: Solar System Astronomy and Stars and Stellar Systems.
- Teaching Assistant, Pontificia Universidad Católica de Chile** *2013 - 2016*
Teaching assistant to: Modern Physics, General Physics, Astronomy workshop and various labs.
- Physics Teacher** *Apr 2014 - Jun 2016*
Teach physics in a free online-streaming college preparation course, available on Youtube

Allocated time and observing experience

- PI Gemini North and South (55+hrs) - 2021A, 2023A, 2023B.
- Co-I Lowell Discovery Telescope (21hrs) 2021A, 2021B.
- PI Las Cumbres Observatory (11hrs) 2023B.
- Co-I Las Cumbres Observatory (27hrs) 2019A, 2019B, 2020A, 2020B.
- Co-I Dark Energy Camera (20+hrs) 2020A, 2023B.
- Co-I SOAR telescope (12hrs) 2020A, 2023B.
- Co-I Gemini North and South (12hrs) 2020A.

Observing experience.....

- CTIO 0.9m
- Kitt Peak 2.1m (KPED, SEDMv2)
- Keck I (LRIS)
- Keck II (KCWI, DEIMOS)
- Gemini North and Gemini South (GMOS)
- Lowell Discovery Telescope (LMI)
- Palomar 200-inch Telescope (DBSP, WASP, WIRC)

Volunteering and Community Service

- Community** *Apr 2013 - Jun 2017*
- Lead the volunteering NGO TECHO intervention in a suburban area in the Santiago Metropolitan area.
 - Tutor teenagers from low economic backgrounds in their school assignments.
 - Awarded funds (3500 USD) for upgrades in the community center.

Astronomy

- Content writer in the astronomy science blog [Astrobitos](#) since January 2018.
- Undergraduate representative and Academic Advisor of the Astronomy Undergraduate Program during 2015.
- Millennium Institute of Astrophysics instructor for science fairs.
- Volunteer at the Smithsonian National Air and Space Museum during 2018, Washington DC.
- Volunteer at Skype with a scientist. [Youtube link](#)

Additional

- Junior Member of the American Astronomical Society.
- Programming Languages: Python, C.
- OS: Linux, Mac, Windows.
- Native in Spanish, full professional proficiency in English (TOEFL score 102), basic knowledge in Italian, Portuguese and French.

Publications

In addition to the articles listed below, I have contributed to another 8 refereed articles, and 80+ (20+ first author) non-referred publications, i.e. GCN. See the full list [NASA/ADS](#).

Major contribution

1. **Tomás Ahumada**, Shreya Anand, Michael W. Coughlin, Vaidehi Gupta, Mansi M. Kasliwal, et al. Searching for gravitational wave optical counterparts with the Zwicky Transient Facility: summary of O4a. *arXiv e-prints*, page arXiv:2405.12403, May 2024
2. Fabio Ragosta, **Tomás Ahumada**, Silvia Piranomonte, Igor Andreoni, Andrea Melandri, Alberto Colombo, and Michael W. Coughlin. Kilonova Parameter Estimation with LSST at Vera C. Rubin Observatory. , 966(2):214, May 2024
3. Gokul P. Srinivasaragavan, Vishwajeet Swain, Brendan M. O'Connor, Shreya Anand, **Tomás Ahumada**, Daniel A. Perley, et al. Characterizing the Ordinary Broad-lined Type Ic SN 2023pel from the Energetic GRB 230812B. *arXiv e-prints*, page arXiv:2310.14397, October 2023
4. **Tomás Ahumada**, Shreya Anand, Michael W. Coughlin, Igor Andreoni, Erik C. Kool, et al. In Search of Short Gamma-Ray Burst Optical Counterparts with the Zwicky Transient Facility. , 932(1):40, June 2022
5. **Tomás Ahumada**, Leo Singer, Shreya Anand, Michael W Coughlin, Mansi M Kasliwal, et al. Discovery and confirmation of the shortest gamma ray burst from a collapsar. *Nature astronomy*, 2021
6. Shreya Anand, Michael W Coughlin, Mansi M Kasliwal, Mattia Bulla, **Tomás Ahumada**, et al. Optical follow-up of the neutron star–black hole mergers s200105ae and s200115j. *Nature astronomy*, 5(1):46–53, 2021
7. Mansi M Kasliwal, Shreya Anand, **Tomás Ahumada**, et al. Kilonova luminosity function constraints based on zwicky transient facility searches for 13 neutron star merger triggers during o3. *The Astrophysical Journal*, 905(2):145, 2020
8. Michael W Coughlin, **Tomás Ahumada**, et al. Growth on s190425z: searching thousands of square degrees to identify an optical or infrared counterpart to a binary neutron star merger with the zwicky transient facility and palomar gattini-ir. *The Astrophysical Journal Letters*, 885(1):L19, 2019
9. Michael W Coughlin, **Tomás Ahumada**, et al. 2900 square degree search for the optical counterpart of short gamma-ray burst grb 180523b with the zwicky transient facility. *Publications of the Astronomical Society of the Pacific*, 131(998):048001, 2019

Significant contribution

10. Tomás Cabrera, Antonella Palmese, Lei Hu, Brendan O'Connor, K. E. Saavik Ford, Barry McKernan, Igor Andreoni, **Tomás Ahumada**, et al. Searching for electromagnetic emission in an AGN from the gravitational wave binary black hole merger candidate S230922g. *arXiv e-prints*, page arXiv:2407.10698, July 2024
11. Daniel A. Perley, Anna Y. Q. Ho, Michael Fausnaugh, Gavin P. Lamb, Mansi M. Kasliwal, **Tomás Ahumada**, and journal = arXiv e-prints keywords = Astrophysics - High Energy Astrophysical Phenomena year = 2024 month = jan eid = arXiv:2401.16470 pages = arXiv:2401.16470 doi = 10.48550/arXiv.2401.16470 archivePrefix = arXiv eprint = 2401.16470 primaryClass = astro-ph.HE adsurl = https://ui.adsabs.harvard.edu/abs/2024arXiv240116470P adsnote = Provided by the SAO/NASA Astrophysics Data System others, title = "AT2019pim: A Luminous Orphan Afterglow from a Moderately Relativistic Outflow"
12. T. Hussenot-Desenonges, T. Wouters, N. Guessoum, and others (includes **Tomás Ahumada**). Multi-band analyses of the bright GRB_{230812B} and the associated SN2023pel. *arXiv e-prints*, page arXiv:2310.14310, October 2023

13. Niharika Sravan, Matthew J. Graham, Michael W. Coughlin, **Tomás Ahumada**, and Shreya Anand. Machine-directed gravitational-wave counterpart discovery. *arXiv e-prints*, page arXiv:2307.09213, July 2023
14. Igor Andreoni, Michael W. Coughlin, Daniel A. Perley, and others (includes **Tomás Ahumada**). A very luminous jet from the disruption of a star by a massive black hole. , 612(7940):430–434, December 2022
15. Igor Andreoni, Erik C Kool, Ana Sagués Carracedo, Mansi M Kasliwal, Mattia Bulla, **Tomás Ahumada**, et al. Constraining the kilonova rate with zwicky transient facility searches independent of gravitational wave and short gamma-ray burst triggers. *The Astrophysical Journal*, 904(2):155, 2020
16. Igor Andreoni, Daniel A Goldstein, Shreya Anand, Michael W Coughlin, Leo P Singer, **Tomás Ahumada**, et al. Growth on s190510g: Decam observation planning and follow-up of a distant binary neutron star merger candidate. *The Astrophysical Journal Letters*, 881(1):L16, 2019

Minor contribution

17. Yashvi Sharma, Jesper Sollerman, Shrinivas R. Kulkarni, and others (includes **Tomás Ahumada**). Dramatic Rebrightening of the Type-changing Stripped-envelope Supernova SN 2023aew. , 966(2):199, May 2024
18. Michael A. Kuhn, Lynne A. Hillenbrand, and others (includes **Tomás Ahumada**). The 2022–2023 accretion outburst of the young star V1741 Sgr. , 529(3):2630–2646, April 2024
19. Weizmann Kiendrebeogo and others (includes **Tomás Ahumada**). Updated observing scenarios and multi-messenger implications for the International Gravitational-wave Network’s O4 and O5. *arXiv e-prints*, page arXiv:2306.09234, June 2023
20. Michael W. Coughlin, Joshua S. Bloom, and others (includes **Tomás Ahumada**). A Data Science Platform to Enable Time-domain Astronomy. , 267(2):31, August 2023
21. Shreya Anand, Jennifer Barnes, Sheng Yang, Mansi M. Kasliwal, , and others (includes **Tomás Ahumada**). Collapsars as Sites of r-process Nucleosynthesis: Systematic Near-Infrared Follow-up of Type Ic-BL Supernovae. *arXiv e-prints*, page arXiv:2302.09226, February 2023
22. Vikram Ravi and others (includes **Tomás Ahumada**). Deep Synoptic Array Science: Discovery of the Host Galaxy of FRB 20220912A. , 949(1):L3, May 2023
23. Katelyn Breivik, Andrew J. Connolly, K. E. Saavik Ford, Mario Jurić, and others (includes **Tomás Ahumada**). From Data to Software to Science with the Rubin Observatory LSST. *arXiv e-prints*, page arXiv:2208.02781, August 2022
24. Harsh Kumar, Rahul Gupta, Divita Saraogi, and **Tomás Ahumada** and others. The long-active afterglow of GRB 210204A: detection of the most delayed flares in a gamma-ray burst. , 513(2):2777–2793, June 2022
25. Robert Stein, Simeon Reusch, Anna Franckowiak, Marek Kowalski, and others (includes **Tomás Ahumada**). Neutrino follow-up with the Zwicky transient facility: results from the first 24 campaigns. , 521(4):5046–5063, June 2023
26. Simeon Reusch, Robert Stein, Marek Kowalski, Sjoert van Velzen, Anna Franckowiak, and others (includes **Tomás Ahumada**). Candidate Tidal Disruption Event AT2019fdr Coincident with a High-Energy Neutrino. , 128(22):221101, June 2022
27. Siddharth R. Mohite, Priyadarshini Rajkumar, Shreya Anand, David L. Kaplan, Michael W. Coughlin, and others (includes **Tomás Ahumada**). Inferring Kilonova Population Properties with a Hierarchical Bayesian Framework. I. Nondetection Methodology and Single-event Analyses. , 925(1):58, January 2022
28. Igor Andreoni, Michael W. Coughlin, , and others (includes **Tomás Ahumada**). Fast-transient Searches in Real Time with ZTFReST: Identification of Three Optically Discovered Gamma-Ray Burst Afterglows and New Constraints on the Kilonova Rate. , 918(2):63, September 2021

29. Josiah N Purdum and others (includes **Tomás Ahumada**). Time-series and phasecurve photometry of episodically-active asteroid (6478) gault in a quiescent state using apo, growth, p200 and ztf. *arXiv preprint arXiv:2102.13017*, 2021
30. Mouza Almualla and others (includes **Tomás Ahumada**). Towards regular serendipitous detections of kilonovae by wide-field surveys. *arXiv preprint arXiv:2011.10421*, 2020
31. Bryce T Bolin and others (includes **Tomás Ahumada**). Characterization of temporarily captured minimoon 2020 cd3 by keck time-resolved spectrophotometry. *The Astrophysical Journal Letters*, 900(2):L45, 2020
32. Robert Stein and others (includes **Tomás Ahumada**). A high-energy neutrino coincident with a tidal disruption event. *arXiv preprint arXiv:2005.05340*, 2020
33. Igor Andreoni and others (includes **Tomás Ahumada**). Growth on s190814bv: Deep synoptic limits on the optical/near-infrared counterpart to a neutron star–black hole merger. *The Astrophysical Journal*, 890(2):131, 2020
34. Daniel A Goldstein and others (includes **Tomás Ahumada**). Growth on s190426c: Real-time search for a counterpart to the probable neutron star–black hole merger using an automated difference imaging pipeline for decam. *The Astrophysical Journal Letters*, 881(1):L7, 2019
35. Michael W Coughlin and others (includes **Tomás Ahumada**). The kitt peak electron multiplying ccd demonstrator. *Monthly Notices of the Royal Astronomical Society*, 485(1):1412–1419, 2019
36. Daniel A Perley and others (includes **Tomás Ahumada**). The fast, luminous ultraviolet transient at2018cow: extreme supernova, or disruption of a star by an intermediate-mass black hole? *Monthly Notices of the Royal Astronomical Society*, 484(1):1031–1049, 2019