Tomás Ahumada

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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, USA	Sept 2022 – Present
NASA Goddard Space Flight Center, Graduate Research Assistant	Pasadena, CA, USA	Mar 2018 – July 2022
University of Maryland at College Park, Graduate Research Assistant	Pasadena, CA, USA	Mar 2018 – Jul 2022
Gemini Observatory, Intern	La Serena, Chile	Feb 2017 – Aug 2017
Pontificia Universidad Católica de Chile, Undergraduate Research Assistant	Santiago, Chile	Jan 2016 - Mar 2016
Cerro Tololo Inter-American Observatory, Research Experience for Undergraduates	La Serena, Chile	Jan 2016 - Mar 2016

Education

PhD **University of Maryland at College Park**, College Park, MD, USA — July 2022

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

MSc **University of Maryland at College Park**, College Park, MD, USA — July 2019

BSc **Pontificia Universidad Católica de Chile**, Santiago, Chile — 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 (2022-2024)
- Data Science Fellowship Program - LSST Collaboration(2021-2023)
- Matrícula de Honor - P. Universidad Católica de Chile (2012, 2013)

Talks, conferences and meetings

Seminar at Los Alamos National Laboratory: Searching for gravitational wave optical counterparts with the ZTF during O4a	July 2024
Seminar at the Center for Astrophysics at HarvardSearching for gravitational wave optical counterparts with ZTF	April 2024
Invited Talk at AstroAI lunch at the Center for Astrophysics at Harvard: The observer's perspective: How can AI aid the detection of compact binary mergers?	April 2024
Contributed Talk at the Cosmic Streams conference: Mining GRB afterglows and kilonovae with wide FOV telescopes	Dec 2023
Seminar at Pontificia Universidad Católica de Valparaíso: In search of multi-messenger sources	Dec 2023
Seminar at Pontificia Universidad Católica de Chile: In search of multi-messenger sources	Dec 2023
Contributed Talk at the ZTF team meeting: The LIGO fourth observing run	Oct 2023
Invited Talk at the Australian National University, Canberra, Australia: Optical searches of Fermi GRBs using the Zwicky Transient Facility	Dec 2022
Invited Talk at the Swinburne University, Melbourne, Australia: Optical searches of Fermi GRBs using the Zwicky Transient Facility	Dec 2022
Invited Talk at the Rubin Kickstarter Science Colloquia: From alerts to science	Oct 2022
Invited Talk at the Osservatorio Astronomico di Roma, Monte Porzio, Italy: In search of the short GRB optical counterpart	June 2022
Invited Talk at the Princeton Journal Club, Princeton, USA: In search of the short GRB optical counterpart	Oct 2021
Invited Talk at the Gemini science coffee, La Serena, Chile: Discovery and confirmation of the shortest gamma-ray burst from a collapsar	Oct 2020
NASA Astroparticle Physics Lab meeting: Discovery and confirmation of the shortest gamma-ray burst from a collapsar	Sept 2020
Invited Talk at the Marcel Grossmann 16th meeting, conference: Discovery and confirmation of the shortest gamma-ray burst from a collapsar	July 2020
ZTF team meeting, Pasadena, CA, USA: ZTF10abwysqy, the shortest gamma-ray burst with a collapsar origin	Oct 2020
American Astronomical Society meeting, Honolulu, HI, USA: In search of the optical counterpart of short gamma-ray bursts	Jan 2020
American Astronomical Society meeting, Honolulu, HI, USA: Astrobitos - The Astrobites in Spanish	Jan 2020
GROWTH team meeting, Mumbai, India: In search of the optical counterpart of short gamma-ray bursts	Dec 2018
American Astronomical Society meeting, Grapevine, TX, USA: The Extended Globular Cluster System of NGC3923	Jan 2017
ANILLO workshop 2016, Santiago, Chile: Identifying Quasars in ATLAS fields	Dec 2016
REU Workshop, Cerro Tololo Inter-American Observatory, La Serena, Chile: The Extended Globular Cluster System of NGC3923	March 2016

Mentoring

Mentor of the Undergraduate LIGO-SURF student Anurathi Madasi	Summer 2024
Mentor of the Summer Research Connection students Mallika Sheshadri and Sofía Tejada	Summer 2024
Mentor of the Undergraduate LIGO-SURF student Marianna Pezzella	Summer 2023
Mentor of the Undergraduate GRADMAP Winter Workshop students Lenin Nolasco and Maria-Clara Heringer	Summer 2023

Teaching Experience

Head Teaching Assistant at the virtual ZTF summer school	August 2021

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

Allocated time and observing experience

- PI Keck II (KCWI 10hrs) - 2024A.
- PI Gemini North and South (55+hrs) - 2021A, 2023A, 2023B.
- Co-I Lowell Discovery Telescope (21hrs) 2021A, 2021B.
- PI Las Cumbres Observatory (24hrs) 2023B, 2024A.
- 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

- Lead the volunteering NGO TECHO intervention in a suburban area in the Santiago Metropolitan area. — Apr 2013 – Jun 2017
- 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

- Programming Languages: Python, C.
- OS: Linux, Mac, Windows.
- Native in Spanish, Professional proficiency in English, basic knowledge in Italian, Portuguese and French.

Publications

In addition to the articles listed bellow, I have contributed to 80+ (20+ fist 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. *Publications of the Astronomical Society of the Pacific*, 136(11):114201, nov 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-line Type Ic SN 2023pel from the Energetic GRB 230812B. , 960(2):L18, January 2024

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**, et al. AT2019pim: A Luminous Orphan Afterglow from a Moderately Relativistic Outflow. *arXiv e-prints*, page arXiv:2401.16470, January 2024

12. T. Hussenot-Desenonges, T. Wouters, N. Guessoum, and others (includes **Tomás Ahumada**). Multiband analyses of the bright GRB 230812B and the associated SN2023pel. , 530(1):1–19, May 2024

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. H. Sun, W. X. Li, L. D. Liu, Gao, **Tomás Ahumada**, and others (includes **Tomás Ahumada**). Extragalactic fast X-ray transient from a weak relativistic jet associated with a Type Ic-BL supernova. *arXiv e-prints*, page arXiv:2410.02315, October 2024

18. B. T. Bolin, F. J. Masci, M. W. Coughlin, and and others (includes **Tomás Ahumada**) Duev. The Palomar twilight survey of 'Ayló'chaxnim, Atiras, and comets. *arXiv e-prints*, page arXiv:2409.15263, September 2024

19. 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

20. 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

21. Kiendrebeogo and others (includes **Tomás Ahumada**). Updated Observing Scenarios and Multimessenger Implications for the International Gravitational-wave Networks O4 and O5. , 958(2):158, December 2023

22. 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

23. Shreya Anand, Jennifer Barnes, Sheng Yang, Mansi M. Kasliwal, , and others (includes **Tomás Ahumada**). Collapsars as Sites of r-process Nucleosynthesis: Systematic Photometric Near-infrared Follow-up of Type Ic-BL Supernovae. , 962(1):68, February 2024

24. Vikram Ravi and others (includes **Tomás Ahumada**). Deep Synoptic Array Science: Discovery of the Host Galaxy of FRB 20220912A. , 949(1):L3, May 2023

25. 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

26. 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

27. 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

28. 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

29. 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. Non-detection Methodology and Single-event Analyses. , 925(1):58, January 2022

30. 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

31. 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

32. Mouza Almualla and others (includes **Tomás Ahumada**). Towards regular serendipitous detections of kilonovae by wide-field surveys. *arXiv preprint arXiv:2011.10421*, 2020

33. 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

34. Robert Stein and others (includes **Tomás Ahumada**). A high-energy neutrino coincident with a tidal disruption event. *arXiv preprint arXiv:2005.05340*, 2020

35. 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

36. 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

37. 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

38. 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