Andrew Casey-Clyde, Ph.D.

Research Scientist | Data Scientist

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Summary

Ph.D.-trained data scientist with 8+ years of expertise in statistical modeling, predictive analytics, and machine learning. Skilled in leveraging Python, SQL, and advanced methods – such as Bayesian inference – to derive actionable insights from complex datasets. Proven ability to communicate technical findings to diverse audiences, lead cross-functional collaborations, and optimize workflows for research advancements. Passionate about driving data-informed innovation in industry.

Skills

Programming Languages: Python, SQL, Java, C++, C

Data Science & Machine Learning: Predictive Modeling, Bayesian Inference, Regression Analysis, Neural Networks, Causal Inference, Optimization, Data Visualization, Experimental Design, Hypothesis Testing

Tools & Platforms: NumPy, SciPy, Scikit-learn, Keras, TensorFlow, Git, Jupyter

Soft skills: Communication, Leadership, Collaboration, Problem-Solving, Project Management,

Experience

Yale University — **New Haven, Connecticut**
Visiting Research Assistant — *Aug. 2023 – Dec. 2024*
- Developed hierarchical Bayesian models for multi-modal astrophysical datasets, improving population predictions.
- Led cross-functional collaboration with 100+ scientists; results published in top-tier journal.
- Leveraged survival analysis techniques to analyze noisy, incomplete datasets, producing actionable insights.

University of Connecticut — **Storrs, Connecticut**
Graduate Research and Teaching Assistant — *Aug. 2019 – Dec. 2024*
- Designed hierarchical Bayesian models to enhance predictive analytics using multi-modal data; methods published in a high-impact journal.
- Optimized predictive model efficiency by $300\times$ using Hamiltonian Monte Carlo, reducing computational costs significantly.
- Secured $8,000 NASA Space Grant Fellowship based on innovative research proposals.

San José State University — **San Jose, California**
Graduate Research and Teaching Associate — *Sep. 2016 – Aug. 2019*
- Built convolutional neural network pipelines for galaxy classification across large datasets.
- Developed Bayesian analysis techniques for predictive spatial mapping of astronomical observations.

Salient Process, Inc. — **Sacramento, California**
Software Engineer — *Feb. 2015 – Aug. 2016*
- Led development of SPARK UI toolkit (acquired by IBM), showcasing practical experience in software engineering.
- Pioneered Git-based version control for streamlined software management.
- Designed and maintained software tools, improving productivity and quality of deliverables.

Education

University of Connecticut — **Storrs, Connecticut**
Ph.D. Physics, GPA: 3.823 — *2024*
Dissertation: *Multi-messenger Constraints on Supermassive Black Hole Binaries.*

San José State University — **San Jose, California**
M.S. Physics, GPA: 3.791 — *2019*
Select courses: Machine Learning & Data Analysis in Astronomy, Statistical & Machine Learning Classification, Deep Learning

University of California, Davis — **Davis, California**
B.S. Physics, GPA: 2.945 — *2014*

Selected Projects

Optimized Predictive Modeling for Multi-Modal Data
- Reduced predictive analysis time by over 99% using hierarchical Bayesian techniques.
- Improved prediction robustness for astrophysical populations, with direct applications to forecasting models.

Galaxy Classification with Neural Networks in the Sloan Digital Sky Survey
- Designed and implemented scalable pipelines for analyzing large-scale galaxy datasets using convolutional neural networks.
- Developed modular and transferable solutions adaptable to broader classification tasks, including computer vision.

High-Performance Predictive Models
- Applied advanced survival analysis techniques to multi-modal datasets, enabling accurate predictions of population dynamics for next-generation astronomical surveys.

Publications & Presentations Summary

- Co-authored 18 peer-reviewed papers on Bayesian inference, gravitational waves, and large-scale data analysis.
- Delivered 35 presentations and seminars to technical and professional audiences.

Ph.D. Dissertation

Title: *Multi-Messenger Constraints on Supermassive Black Hole Binaries*

Advisors: Chiara M. F. Mingarelli, Jonathan R. Trump, Daniel Anglès-Alcàzar

Description: Developed statistical and computational models to analyze the nanohertz gravitational wave background (GWB) and its connection to supermassive black hole binaries (SMBHBs) using observational data. Found SMBHBs may be eight times more prevalent than expected, quasars up to seven times more likely to host SMBHBs, and identified a 16 nHz anomaly in the GWB spectrum ($\sim 2\sigma$ confidence). Demonstrated expertise in data modeling, statistical inference, and analyzing complex datasets.

Master's Thesis

Title: *Integrated Kinematic Fitting of Gas Streams in the Milky Way's Circumnuclear Disk*

Advisors: Elisabeth A. C. Mills, Aaron Romanowsky

Description: Developed a computational model using a leapfrog integration scheme to simulate the orbit of dense molecular gas around our galaxy's central supermassive black hole (SMBH). Built a Bayesian analysis pipeline to fit the model to observational data, estimating the gas passes within ~ 5 lightyears of the SMBH. Demonstrated expertise in algorithm development, statistical modeling, and data analysis.

Selected Coursework & Professional Development

Center for Computational Astronomy, Flatiron Institute — **New York, New York**
Machine Learning Workshop — *Apr. 6 – Jun. 17, 2021*

University of Connecticut
Stars and Compact Objects · General Relativity and Cosmology

San José State University
Machine Learning and Data Analysis in Astronomy · Statistical and Machine Learning Classification · Deep Learning · Computational Physics · Numerical Analysis and Scientific Computing · Methods in Mathematical Physics

Professional Associations

NANOGrav
Full Member — *2021–present*
Associate member: 2021 – 2023

UConn Physics Graduate Student Association
Member — *2019–2024*
Event Coordinator: 2019–2020, 2022–2023

American Astronomical Society
Graduate Student Member — *2018–2024*

American Physical Society
Graduate Student Member — *2018–2024*

Fellowships

[1] **Casey-Clyde, J. Andrew**. 2021-05-23/2021-08-22. *Multi-Messenger Detections and Constraints of Supermassive Black Hole Binaries*. Fellowship P-1709. Connecticut: NASA Connecticut Space Grant Consortium. $8,000 USD.

Publications

Published

[1] Agazie, Gabriella, [...], **Casey-Clyde, J. Andrew**, et al. Jan. 2025. "The NANOGrav 15 Yr Data Set: Looking for Signs of Discreteness in the Gravitational-wave Background". *The Astrophysical Journal* 978, p. 31.

[2] Johnson, Aaron D., [...], **Casey-Clyde, J. Andrew**, et al. May 2024. "NANOGrav 15-Year Gravitational-Wave Background Methods". *Physical Review D* 109, p. 103012.

[3] Davis, Megan C., [...], **Casey-Clyde, J. Andrew**, et al. Apr. 2024. "Reliable Identification of Binary Supermassive Black Holes from Rubin Observatory Time-domain Monitoring". *The Astrophysical Journal* 965, p. 34.

[4] Kelley, Luke Zoltan, [...], **Casey-Clyde, J. Andrew**, et al. Apr. 2024. "Nanograv/Holodeck: V1.5.2". *Zenodo*.

[5] Agazie, Gabriella, [...], **Casey-Clyde, J. Andrew**, et al. Mar. 2024. "The NANOGrav 12.5 Yr Data Set: A Computationally Efficient Eccentric Binary Search Pipeline and Constraints on an Eccentric Supermassive Binary Candidate in 3C 66B". *The Astrophysical Journal* 963, p. 144.

[6] Agazie, Gabriella, [...], **Casey-Clyde, J. Andrew**, et al. Mar. 2024. "The NANOGrav 12.5 Yr Data Set: Search for Gravitational Wave Memory". *The Astrophysical Journal* 963, p. 61.

[7] Agazie, Gabriella, [...], **Casey-Clyde, J. Andrew**, et al. Mar. 2024. "The NANOGrav 15 Yr Data Set: Search for Transverse Polarization Modes in the Gravitational-wave Background". *The Astrophysical Journal* 964, p. L14.

[8] Bécsy, Bence, [...], **Casey-Clyde, J. Andrew**, et al. Dec. 2023. "How to Detect an Astrophysical Nanohertz Gravitational Wave Background". *The Astrophysical Journal* 959, p. 9.

[9] Agazie, Gabriella, [...], **Casey-Clyde, J. Andrew**, et al. Oct. 2023. "The NANOGrav 15 Yr Data Set: Search for Anisotropy in the Gravitational-wave Background". *The Astrophysical Journal* 956, p. L3.

[10] Khusid, Nicole M., [...], **Casey-Clyde, J. Andrew**, et al. Sept. 2023. "Strongly Lensed Supermassive Black Hole Binaries as Nanohertz Gravitational-wave Sources". *The Astrophysical Journal* 955, p. 25.

[11] Agazie, Gabriella, [...], **Casey-Clyde, J. Andrew**, et al. Aug. 2023. "The NANOGrav 15 Yr Data Set: Constraints on Supermassive Black Hole Binaries from the Gravitational-wave Background". *The Astrophysical Journal* 952, p. L37.

[12] Agazie, Gabriella, [...], **Casey-Clyde, J. Andrew**, et al. July 2023. "The NANOGrav 15 Yr Data Set: Bayesian Limits on Gravitational Waves from Individual Supermassive Black Hole Binaries". *The Astrophysical Journal* 951, p. L50.

[13] Arzoumanian, Zaven, [...], **Casey-Clyde, J. Andrew**, et al. July 2023. "The NANOGrav 12.5 Yr Data Set: Bayesian Limits on Gravitational Waves from Individual Supermassive Black Hole Binaries". *The Astrophysical Journal* 951, p. L28.

[14] Falxa, M., [...], **Casey-Clyde, J. A.**, et al. June 2023. "Searching for Continuous Gravitational Waves in the Second Data Release of the International Pulsar Timing Array". *Monthly Notices of the Royal Astronomical Society* 521, pp. 5077–5086.

[15] Koss, Michael J., [...], **Casey-Clyde, J. Andrew**, et al. Jan. 2023. "UGC 4211: A Confirmed Dual Active Galactic Nucleus in the Local Universe at 230 Pc Nuclear Separation". *The Astrophysical Journal* 942, p. L24.

[16] Mingarelli, Chiara M. F. and **Casey-Clyde, J. Andrew**. Nov. 2022. "Seeing the Gravitational Wave Universe". *Science* 378, pp. 592–593.

[17] Antoniadis, J., [...], **Casey-Clyde, J. A.**, et al. Mar. 2022. "The International Pulsar Timing Array Second Data Release: Search for an Isotropic Gravitational Wave Background". *Monthly Notices of the Royal Astronomical Society* 510, pp. 4873–4887.

[18] **Casey-Clyde, J. Andrew** et al. Jan. 2022. "A Quasar-based Supermassive Black Hole Binary Population Model: Implications for the Gravitational Wave Background". *The Astrophysical Journal* 924, p. 93.

Submitted

[1] Agazie, Gabriella, [...], **Casey-Clyde, J. Andrew**, et al. Nov. 2024. *The NANOGrav 15 Yr Data Set: Harmonic Analysis of the Pulsar Angular Correlations*.

[2] Chen, Yifan, [...], **Casey-Clyde, J. Andrew**, et al. Nov. 2024. *Galaxy Tomography with the Gravitational Wave Background from Supermassive Black Hole Binaries*.

[3] Laal, Nima, [...], **Casey-Clyde, J. Andrew**, et al. Nov. 2024. *Deep Neural Emulation of the Supermassive Black-hole Binary Population*.

[4] Semenzato, Federico, **Casey-Clyde, J. Andrew** et al. Nov. 2024. *Cross-Correlating the Universe: The Gravitational Wave Background and Large-Scale Structure*.

[5] Agazie, Gabriella, [...], **Casey-Clyde, J. Andrew**, et al. Aug. 2024. *The NANOGrav 15 Yr Data Set: Running of the Spectral Index*.

[6] Agazie, Gabriella, [...], **Casey-Clyde, J. Andrew**, et al. July 2024. *The NANOGrav 15 Yr Data Set: Posterior Predictive Checks for Gravitational-Wave Detection with Pulsar Timing Arrays*.

[7] **Casey-Clyde, J. Andrew** et al. May 2024. *Quasars Can Signpost Supermassive Black Hole Binaries*.

White Papers

[1] Haiman, Zoltán, [...], **Casey-Clyde, J. Andrew**, et al. June 2023. *Massive Black Hole Binaries as LISA Precursors in the Roman High Latitude Time Domain Survey*.

[2] Shen, Yue, **Casey-Clyde, J. Andrew** et al. June 2023. *Discovery and Characterization of Galactic-scale Dual Supermassive Black Holes Across Cosmic Time*.

Presentations

Technical Presentations

[1] **Casey-Clyde, J. Andrew**. Dec. 2024. *Multi-Messenger Constraints on Supermassive Black Hole Binaries*. Invited Talk. Princeton University, Princeton, New Jersey.

[2] **Casey-Clyde, J. Andrew**. Nov. 2024. *Multi-Messenger Constraints on Supermassive Black Hole Binaries*. Dissertation Defense. University of Connecticut, Storrs, Connecticut.

[3] **Casey-Clyde, J. Andrew**. Sept. 2024. *Multi-Messenger Constraints on Supermassive Black Hole Binaries*. Invited Talk. University of Kansas, Lawrence, Kansas.

[4] **Casey-Clyde, J. Andrew**. Apr. 2024. *Multi-Messenger Constraints on Supermassive Black Hole Binaries*. Invited Talk. Yale University, New Haven, Connecticut.

[5] **Casey-Clyde, J. Andrew**. Jan. 2024. *Quasars Can Signpost Supermassive Black Hole Binaries*. Talk. New Orleans Ernest N. Morial Convention Center, New Orleans, Louisiana.

[6] **Casey-Clyde, J. Andrew**. Dec. 2023. *Multi-Messenger Constraints on Supermassive Black Hole Binaries*. Invited Talk. University of Pittsburgh, Pittsburgh, Pennsylvania.

[7] **Casey-Clyde, J. Andrew**. Dec. 2023. *Quasars Can Signpost Supermassive Black Hole Binaries*. Talk. University of Miami, Miami, Florida.

[8] **Casey-Clyde, J. Andrew**. Oct. 2023. *Interpreting Power-Law Excursions in Nanohertz Gravitational-Wave Background Spectra*. Talk. University of British Colombia, Vancouver, British Colombia, Canada.

[9] **Casey-Clyde, J. Andrew**. July 2023. *How Many Quasars Host Supermassive Black Hole Binary Systems?* Talk. Virtual.

[10] **Casey-Clyde, J. Andrew**. June 2023. *How Many Quasars Host SMBHB Systems?* Talk. Pullman Resort, Port Douglas, Queensland, Australia.

[11] **Casey-Clyde, J. Andrew**. Mar. 2023. *How Many Quasars Host Supermassive Black Hole Binary Systems?* Talk. Virtual.

[12] **Casey-Clyde, J. Andrew**. Mar. 2023. *Interpreting Nanohertz Gravitational-Wave Background Spectra*. Talk. Oregon State University, Corvallis, Oregon.

[13] **Casey-Clyde, J. Andrew**. Feb. 2023. *How Many Quasars Host Supermassive Black Hole Binaries?* Invited Talk. University of Connecticut, Storrs, Connecticut.

[14] **Casey-Clyde, J. Andrew**. Jan. 2023. *How Many Quasars Host Supermassive Black Hole Binaries?* Talk. Seattle Convention Center, Seattle, Washington.

[15] **Casey-Clyde, J. Andrew**. Oct. 2022. *How Many Quasars Host Supermassive Black Hole Binaries?* Talk. University of Wisconsin - Milwaukee, Milwaukee, Wisconsin.

[16] **Casey-Clyde, J. Andrew**. July 2022. *Quantifying the Relationship Between Supermassive Black Hole Binaries and Quasars Using Pulsar Timing Arrays*. Talk. Vanderbilt University, Nashville, Tennessee.

[17] **Casey-Clyde, J. Andrew**. July 2022. *Quantifying the Relationship Between Supermassive Black Hole Binaries and Quasars Using Pulsar Timing Arrays*. Talk. Virtual.

[18] **Casey-Clyde, J. Andrew**. June 2022. *A Quasar-Based Supermassive Black Hole Binary Population Model: Implications for the Gravitational-Wave Background*. Talk. Pasadena Convention Center, Pasadena, California.

[19] **Casey-Clyde, J. Andrew**. June 2022. *Quantifying the Relationship Between Supermassive Black Hole Binaries and Quasars Using Pulsar Timing Arrays*. Talk. Virtual.

[20] **Casey-Clyde, J. Andrew**. Apr. 2022. *A Quasar-Based Supermassive Black Hole Binary Population Model: Implications for the Gravitational-Wave Background*. Talk. New York Marriott Marquis, New York, New York.

[21] **Casey-Clyde, J. Andrew**. Mar. 2022. *Quantifying the Relationship Between Supermassive Black Hole Binaries and Quasars Using Pulsar Timing Arrays*. Talk. Flatiron Institute, New York, New York.

[22] **Casey-Clyde, J. Andrew**. Dec. 2021. *An AGN-based Supermassive Black Hole Binary Population Model: Implications for the Gravitational-Wave Background*. Talk. Courtyard Marriott Machsee Hotel, Hannover, Germany.

[23] **Casey-Clyde, J. Andrew**. Nov. 2021. *A Quasar-Based Model of Supermassive Black Hole Binaries*. Poster. New England Air Museum, Windsor Locks, Connecticut.

[24] **Casey-Clyde, J. Andrew**. Sept. 2021. *Anchoring Supermassive Black Hole Binaries to Quasars with the Gravitational-Wave Background*. Talk. Flatiron Institute, New York, New York.

[25] **Casey-Clyde, J. Andrew**. July 2021. *Anchoring Supermassive Black Hole Binaries to Active Galactic Nuclei with the Gravitational-Wave Background*. Poster. Virtual.

[26] **Casey-Clyde, J. Andrew**. July 2021. *Anchoring Supermassive Black Hole Binaries to Active Galactic Nuclei with the Gravitational-Wave Background*. Talk. Virtual.
[27] **Casey-Clyde, J. Andrew**. June 2021. *Anchoring Supermassive Black Hole Binaries to Active Galactic Nuclei with the Gravitational Wave Background*. Talk. Virtual.
[28] **Casey-Clyde, J. Andrew**. Apr. 2021. *Interpreting the Gravitational Wave Background in Terms of Supermassive Black Hole Binary Populations*. Talk. Virtual.
[29] **Casey-Clyde, J. Andrew**. Jan. 2021. *Interpreting the Gravitational-Wave Background in Terms of Supermassive Black Hole Binary Populations*. iPoster. Virtual.
[30] **Casey-Clyde, J. Andrew**. Oct. 2020. *Interpreting the Gravitational-Wave Background in Terms of Supermassive Black Hole Binary Populations*. Talk. Virtual.
[31] **Casey-Clyde, J. Andrew**. Sept. 2020. *Constraining Supermassive Black Hole Binary Populations with PTAs*. Talk. Virtual.
[32] **Casey-Clyde, J. Andrew**. July 2020. *Constraining Supermassive Black Hole Binary Populations with PTAs*. Invited Talk. Virtual.
[33] **Casey-Clyde, J. Andrew**, Thummar, H., and Donet, J. Jan. 2019. *Galaxy Classification with Neural Networks in SDSS*. Poster. Seattle Convention Center, Seattle, Washington.
[34] **Casey-Clyde, J. Andrew**. Jan. 2018. *Mapping Gas Orbits in the Circumnuclear Disk*. Poster. Gaylord National Resort & Convention Center, National Harbor, Maryland.
[35] **Casey-Clyde, J. Andrew**. Aug. 2017. *Kinematics of the Eastern Arm in the Circumnuclear Disk*. Poster. International Center for Interdisciplinary Sciences, Quy Nhon, Vietnam.

Outreach Talks & Events

[1] **Casey-Clyde, J. Andrew**. May 2024. *Low Frequency Gravitational Waves: A New View of the Universe*. Public Talk. Seagrave Memorial Observatory, North Scituate, Rhode Island.
[2] **Casey-Clyde, J. Andrew**. Nov. 2023. *Gravitational Waves and Multi-Messenger Astronomy*. Public Talk. Hops 44, Storrs, Connecticut.
[3] **Casey-Clyde, J. Andrew**. Aug. 2023. *Supermassive Black Holes: A Crash Course on the Biggest Objects in the Universe*. Public Talk. Hops 44, Storrs, Connecticut.
[4] **Casey-Clyde, J. Andrew**. May 2023. *Low Frequency Gravitational Waves: A New View of the Universe*. Public Talk. Ecotarium, Worcester, Massachusetts.
[5] **Casey-Clyde, J. Andrew**. Jan. 2022. *Virtual Inventors Club Panelist*. Panel. Virtual. Offered middle school students constructive feedback on their inventions in two sessions.