John (Jeb) I. BAILEY III, Ph.D.

Instrumentation Systems Architect | Design, Engineering, Operations | Control & Analysis Algorithms | Data

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Summary

Principal engineer and instrumentation scientist with 20 years of experience designing, integrating, and operating complex scientific instruments — from spectrographs and robotic telescopes to hyperspectral cameras — in challenging environments. Lead architect of $30M-class observatory systems and Co-PI on NSF-funded instruments totaling $2.8M. Known for bridging rigorous scientific goals with robust engineering execution, with deep expertise in systems architecture, cross-domain integration, and multidisciplinary and multinational team leadership. Proficient in Python, C/C++, FPGA-based systems, and control electronics. Author of 70+ publications; builder of seven major instruments deployed on 6-10 m class telescopes.

Education

University of Michigan, Ann Arbor - Ph.D. Astronomy & Astrophysics, 2015

Dissertation: *Multiplexed High-Precision Radial Velocities: Searching for Hot Jupiters in Southern Open Star Clusters.* Ford Scholar.

University of Alabama in Huntsville - B.S. Physics, Mathematics, *summa cum laude*, 2008

Honors Thesis: *A Novel Method for Finding Young Planets.* Space Grant, Hillman, and Foundation Platinum Scholar.

Professional Experience

California Institute of Technology - Pasadena, CA

Senior Instrument Engineer, Caltech Optical Observatories (2024-present)

- Instrument Architect for ZShooter, a $30M UV-nIR high-resolution spectrograph for the Keck 10 m telescope.
- Cognizant Engineer for HISPEC's fiber subsystem, leading optomechanical design, integration, and controls.
- Provide domain expertise in precision instrumentation, systems engineering, and lifecycle planning.

Independent Consultant - International

Instrumentation Consultant (2019-present)

- Co-I for IFUM ($1.7M NSF MRI), leading controls, electronics, and electromechanics from concept through commissioning.
- Co-manager of M2FS & IFUM operations at Las Campanas Observatory, Chile — sustaining programs for ~30 PIs during extended day/night shifts exceeding 17 hours.
- Advised on control systems and data pipelines bridging science and engineering.

University of California, Santa Barbara - Santa Barbara, CA

Assistant Project Scientist (2018-2022)*; Associate Project Scientist* (2022-2024)

- Co-led a 10-person interdisciplinary team developing MKID detectors, instruments, and software.
- Co-PI of the MKID Multi-Object Echelle Testbench ($1.1M NSF ATI), overseeing optical and mechanical design, calibration, and analysis algorithms
- Architect of the 3rd-generation MKID RF Readout (4 GHz, 1.2 Tb/s).
- Integrated MKID spectrographs (MEC, XKID) with AO systems on 6.5-8 m telescopes.
- Advised multiple Ph.D. theses.

Leiden University - Leiden, The Netherlands

JWST Postdoctoral Fellow, Sterrewacht Leiden (2016-2018)

- Calibration scientist for JWST MIRI Spectrograph.
- Led controls engineering for the bRING β Pictoris b Transit Monitor.
- Supported JWST OTIS AIV testing during Hurricane Harvey.

University of Michigan - Ann Arbor, MI

Doctoral Candidate (2009-2015)

- Core designer of the Michigan/Magellan Fiber System (M2FS).
- Invented a novel fiber slit mechanism enabling high-precision RV science.

- Built robotic fiber polishers and authored planning/reduction software.

Teaching & Mentorship

Ph.D. Students (UCSB, advised/co-advised):

- Jennifer Smith – MKID Detector Readout
- Noah Swimmer – XKID Integral Field Spectrograph for MagAO-X
- Sarah Steiger – MKID Science Data Pipeline
- Isabel Lipartito – RV Binaries in NGC 2516 & 2422

M.Sci. Students:

- Patrick Dorval (Leiden) – bRing telescopes
- Blain Lomberg (Cape Town) – bRing telescopes

Early Education & Outreach:

- Planetarium instructor
- US Space Camp instructor (ages 9-13)
- Undergraduate physics lab instructor

Service & Leadership in the Scientific Community

Instrument & Observatory Roles:

- Co-I and support astronomer for IFUM (2019-present)
- Operations manager and support astronomer for M2FS (2013-present)
- bRing instrument team (2016-2018)

Community & Collaboration:

- Member, JWST MIRI calibration & exoplanet working groups (2016-2018)
- Member, IceAge ERS JWST team (2018-2024)
- Coordinator, Leiden/ESA Summer Program (2017)

Invited Talks:

- Caltech (2022): *Instrumenting Astronomy: Messy, Multi-Disciplinary, and Fun*
- Cal State LA (2019): *Instrumenting Astronomy: Messy, Multi-Disciplinary, and Fun*

Funding, Facilities, and Instrumentation

Competitive Grants & Awards:

- $1.1M – NSF ATI (Co-PI), MKID Echelle Testbench (2021-2024)
- $1.7M – NSF MRI (Co-PI), IFUM (2019-2021)
- Multiple travel and research grants

Telescope Facilities:

- 17 nights, Magellan/Clay 6.5 m (2013-2016) for dissertation program (~$1M USD equivalent)

Major Instruments Built or Delivered:

- **ZShooter** (Keck I, first light 2029) — Lead architect, $30M UV–nIR spectrograph and imager.
- **HISPEC** (Keck II, first light 2026) — Fiber subsystem engineer; electro-optomechanics and controls.
- **MKID Echelle** (UCSB, 2024) — Co-PI; optical & mechanical design, analysis algorithms.
- **XKID** (Magellan, first light 2023) — Optical design, controls architecture, thesis supervision.
- **IFUM** (Magellan, first light 2022) — Co-PI; controls, electronics, electromechanics.
- **MKID Exoplanet Camera** (Subaru, 2019) — Hardware upgrades, control software, data pipeline.
- **bRing Observatory** (South Africa & Australia, first light 2017) — Autonomous control and data.
- **M2FS** (Magellan/Clay, first light 2013) — Core designer; electronics, controls, mechanical systems.

Publications

Refereed Papers

1. Vargas-Salazar, I., Oey, M. S., Eldridge, J. J., Weisserman, D., Januszewski, H. C., Becker, J. C., Zazzera, S., Castro, N., Kim, Y., Kratter, K. M., Mateo, M., **Bailey, J. I.** New Field OB and OBe Binaries of the SMC Wing: Observational Properties and Population Modeling 2025, ApJ, 988, 146
2. Kim, C. S., **Bailey, J. I.**, López, R. A., Clay, W. H., Mazin, B. A. MOMOS: The Multi-Object MKID Optical Spectrometer Simulator and Data Reduction Package 2025, AJ, 169, 176
3. Smith, J. P., **Bailey, J. I.**, Cuda, A., Zobrist, N., Mazin, B. A. MKIDGen3: Energy-resolving, single-photon-counting microwave kinetic inductance detector readout on a radio frequency system-on-chip 2024, RScI, 95, 114705
4. Cristofari, P. I., Dupree, A. K., Milone, A. P., Walker, M. G., Mateo, M., Dotter, A., **Bailey, J. I.** Rotation and Hα Emission in a Young SMC Cluster: A Spectroscopic View of NGC 330 2024, ApJ, 972, 72
5. Cabrera Garcia, J., Sakari, C. M., Roederer, I. U., Evans, D. W., Silva, P., Mateo, M., Song, Y.-Y., Kremin, A., **Bailey, J. I.**, Walker, M. G. Abundances of Neutron-capture Elements in 62 Stars in the Globular Cluster Messier 15 2024, ApJ, 967, 101.
6. Billi, A., Ferraro, F. R., Mucciarelli, A., Lanzoni, B., Cadelano, M., Monaco, L., Mateo, M., **Bailey, J. I., III**, Reiter, M., Olszewski, E. W. Fast rotating Blue Straggler Stars in the Globular Cluster NGC3201, 2023, ApJ, 956, 124
7. Walker, M. G., Caldwell, N., Mateo, M., Olszewski, E. W., Pace, A. B., **Bailey, J. I., III**, Koposov, S. E., Roederer, I. U. Magellan/M2FS and MMT/Hectochelle Spectroscopy of Dwarf Galaxies and Faint Star Clusters within the Galactic Halo, 2023, ApJS, 268, 19
8. Pace, A. B., Koposov, Sergey E., Walker, M. G., Caldwell, N., Mateo, M., Olszewski, E. W., Roederer, I. U., **Bailey, J. I., III**, Belokurov, V., Kuehn, K., Li, T. S., Zucker, D. B. The kinematics, metallicities, and orbits of six recently discovered Galactic star clusters with Magellan/M2FS spectroscopy, 2023, MNRAS, 526, 1
9. Ji, A. P., Simon, J. D., Roederer, I. U., Magg, E., Frebel, A., Johnson, C. J., Klessen, R. S., Magg, M., Cescutti, G., Mateo, M. Bergemann, M., **Bailey, J. I., III** Metal Mixing in the R-Process Enhanced Ultra-Faint Dwarf Galaxy Reticulum II, 2023, ApJ, 165, 100
10. Swimmer, N., Currie, T., Steiger, S., Brandt, G. M., Brandt, T. D., Guyon, O., Kuzuhara, M., Chilcote, Tobin, T., Groff, T. D., Lozi, J., **Bailey, J. I., III**, Walter, A. B., Fruitwala, N., Zobrist, N., Smith, J. P., Coiffard, G., Dodkins, R., Davis, K. K., Daal, M., Bumble, B., Vievard, S., Skaf, N., Deo, V., Jovanovic, N., Martinache, F., Tamura, M., Kasdin, N. J., Mazin, B. A. SCExAO and Keck Direct Imaging Discovery of a Low-Mass Companion Around the Accelerating F5 Star HIP 5319, 2022, AJ, 164, 152
11. Smith, J. P., **Bailey, J. I., III**, Mazin, B. A. Highly-Multiplexed Superconducting Detector Readout: Approachable High-Speed FPGA Design, 2022, IEEE 30th Annual International Symposium on Field-Programmable Custom Computing Machines (FCCM), pp. 1-2
12. **Bailey, J. I., III**, Steiger, S., Zobrist, N., Swimmer, N., Dodkins, R., Davis, K. K., Mazin, B. A. The MKID Pipeline: A Data Reduction and Analysis Pipeline for UVOIR MKID Data, 2022, AJ, 163, 193
13. Dumont, A., Seth, A. C., Strader, J., Sand, D. J., Hughes, A. K., Voggel, K., Caldwell, N., Cronjević, D., Mateo, M., **Bailey, J. I., III**, Forbes, D. A. A population of luminous globular clusters and stripped nuclei with elevated mass to light ratios around NGC 5128, 2022, ApJ, 929, 147
14. Pace, A. B., Walker, M. G., Koposov, S. E., Caldwell, N., Mateo, M., Olszewski, E. W., **Bailey, J. I., III**, Wang, M. Spectroscopic Confirmation of the Sixth Globular Cluster in the Fornax Dwarf Spheroidal Galaxy, 2021, ApJ, 923, 77
15. Lipartito, I., **Bailey, J. I., III**, Brandt, T. D., Mazin, B. A. Orbital Parameters and Binary Properties of 37 FGK Stars in the Cores of Open Clusters NGC 2516 and NGC 2422, 2021, AJ, 162, 285
16. Kenworthy, M. A., Mellon, S. N., **Bailey, J. I., III**, Stuik, R., Dorval, P., Talens, G. J. J., Crawford, S. R., Mamajek, E. E., Laginja, I., Ireland, M., Lomberg, B., Kuhn, R. B., Snellen, I., Zwintz, K., Kuschnig, R., Kennedy, G. M., Abe, L., Agabi, A., Mekarnia, D., Guillot, T. search by orcid Schmider, F., Stee, P., de Pra, Y., Buttu, M., Crouzet, N., Kalas, P., Wang, J. J., Stevenson, K., de Mooij, E., Lagrange, A. -M., Lacour, S., Lecavelier des Etangs, A., Nowak, M., Strøm, P. A., Hui, Z., Wang, L. The β Pictoris b Hill sphere transit campaign. I. Photometric limits to dust and rings, 2021, AA, 648, A15

17. Lim, D., Lee, Y.-W., Koch, A., Hong, S., Johnson, C. I., Kim, J., Chung, C., Mateo, M., Bailey, J. I., III Difference in Chemical Composition between the Bright and Faint Red Clump Stars in the Milky Way Bulge, 2021, ApJ, 907, 47
18. Fruitwala, N., Walter, A. B., **Bailey, J. I., III**, Dodkins, R. Mazin, B. A. End-to-end deep learning pipeline for microwave kinetic inductance detector resonator identification and tuning, 2021, JATIS, 7, 028003
19. Smith, J. P., **Bailey, J. I., III**, Tuthill, J., Stefanazzi, L., Cancelo, G., Treptow, K., Mazin B. A., A High-Throughput Oversampled Polyphase Filterbank using Vivado HLS and PYNQ on a RFSoC, 2021, IEEE OJCAS, 2, 241
20. Song, Y., Mateo, M., **Bailey, J. I., III**, Walker, M. G., Roederer, I. U., Olszewski, E. W., Reiter, M, Kremin, A. Dynamical masses and mass-to-light ratios of resolved massive star clusters - II. Results for 26 star clusters in the Magellanic Clouds, 2021, MNRAS, 504, 4160
21. Steiger, S., Currie, T., Brandt, T. D., Guyon, O., Kuzuhara, M., Chilcote, J., Groff, T. D., Lozi, J., Walter, A. B., Fruitwala, N., **Bailey, J. I., III**, Zobrist, N., Swimmer, N., Lipartito, I., Smith, J. P., Bockstiegel, C., Meeker, S. R., Coiffard, G., Dodkins, R., Szypryt, P., Davis, K. K., Daal, M., Bumble, B., Vievard, S., Sahoo, A., Deo, V., Jovanovic, N., Martinache, F., Doppmann, G., Tamura, M., Kasdin, N. J., Mazin, B. A. SCExAO/MEC and CHARIS Discovery of a Low-mass, 6 au Separation Companion to HIP 109427 Using Stochastic Speckle Discrimination and High-contrast Spectroscopy, 2021, AJ, 162, 44
22. Walter, A., Fruitwala, N., Steiger, S., **Bailey, J. I., III**, Zobrist, N., Swimmer, N., Lipartito, I., Smith, J. P., Meeker, S. R., Bockstiegel, C., Coiffard, G., Dodkins, R., Szypryt, P., Davis, K. K., Daal, M., Bumble, B., Collura, G., Guyon, O., Lozi, J., Vievard, S., Jovanovic, N., Martinache, F., Currie, T. Mazin, B. A. The MKID Exoplanet Camera for Subaru SCExAO, 2020, PASP, 132
23. Fruitwala, N., Strader, P., Cancelo, G., Zmuda, T. Treptow, K., Wilcer, N. Stoughton, C., Walter, A., Zobrist, N., Collura, G., Lipartito, I., **Bailey, J. I., III**, Mazin, B. Second Generation Readout For Large Format Photon Counting Microwave Kinetic Inductance Detectors 2020, Review of Scientific Instruments, 91, 124705
24. Smith, J. P., Mazin, B. A., Walter, A. B., Daal, M., **Bailey, J. I., III**, Bockstiegel, Clinton, Zobrist, N., Swimmer, N., Steiger, S., Fruitwala, N. Flexible Coaxial Ribbon Cable for High-Density Superconducting Microwave Device Arrays, 2020, IEEE TASC, 31, 2500105
25. Johnson, C. I., Dupree, A. K., Mateo, M., **Bailey, J. I., III**, Olszewski, E. O., Walker, M. G. The Most Metal-poor Stars in Omega Centauri (NGC 5139), 2020, AJ, 159, 254
26. Mellon, S. N. , Mamajek, E. E. , Stuik, R., Zwintz, K., Kenworthy, M. A. , Talens, G. J. J. , Burggraaff, O., **Bailey, J. I., III**, Dorval, P., Lomberg, B. B. D., Kuhn, R. B., Ireland, M. J. Bright Southern Variable Stars in the bRing Survey, 2019, ApJS, 244, 15
27. Dorval, P., Talens, G. J. J., Otten, G. P. P. L., Brahm, R., Jordán, A., Vanzi, L., Zapata, A., Henry, T., Paredes, L., Jao, W. C., James, H., Hinojosa, R., Bakos, G. A., Csubry, Z., Bhatti, W., Suc, V., Osip, D., Mamajek, E. E., Mellon, S. N., Wyttenbach, A., Stuik, R., Kenworthy, M., **Bailey, J. I., III**, Ireland, M., Crawford, S., Lomberg, B., Kuhn, R., Snellen, I. MASCARA-4 b/bRing-1b - A retrograde hot Jupiter around the bright A3V star HD 85628 2019, AA, 635, A60
28. Song, Y. Y., Mateo M., Mackey A. D., Olszewski E. W., Roederer I. U., Walker M. G., **Bailey J. I., III** Dynamical masses and mass-to-light ratios of resolved massive star clusters - I. NGC 419 and NGC 1846 2019, MNRAS, 490, 385
29. Zwintz, K., Reese, D. R., Neiner, C., Pigulski, A., Kuschnig, R., Müllner, M., Zieba, S., Abe, L., Guillot, T., Handler, G., Kenworthy, M., Stuik, R., Moffat, A. F. J., Popowicz, A., Rucinski, S. M., Wade, G. A., Weiss, W. W., **Bailey, J. I., III**, Crawford, S., Ireland, M., Lomberg, B., Mamajek, E. E., Mellon, S. N., Talens, G. J. Revisiting the pulsational characteristics of the exoplanet host star β Pictoris 2019, AA, 627, A28
30. Johnson, C. I., Caldwell, N., Rich, R. M., Mateo, M., **Bailey, J. I., III** Light element discontinuities suggest an early termination of star formation in the globular cluster NGC 6402 (M14) 2019, MNRAS, 485, 4311
31. Briceño, C., Calvet, N., Hernández, J., Vivas, A. K., Mateu, C., Downes, J. J., Loerincs, J., Pérez-Blanco, A., Berlind, P., Espaillat, C., Allen, L., Hartmann, L., Mateo, M., **Bailey, J. I., III** The CIDA Variability Survey of Orion OB1. II. Demographics of the Young, Low-mass Stellar Populations 2019, AJ, 157, 85
32. Mellon, S. N., Mamajek, E. E., Zwintz, K., David, T. J., Stuik, R., Talens, G. J. J., Dorval, P., Burggraaff, O., Kenworthy, M. A., **Bailey, J. I., III**, Lomberg, B. B. D., Kuhn, R. B., Ireland, M. J., Crawford, S. M. Discovery of δ Scuti Pulsations in the Young Hybrid Debris Disk Star HD 156623 2019, AJ, 870, 36
33. **Bailey, J. I., III**, Mateo, M., White, R. J., Shectman, S. A., & Crane, J. RV Variability and Stellar Properties of FGK Stars in the Cores of NGC 2516 and NGC 2422 2018, MNRAS, 475, 1609

34. Jiang, L., Wu, J., Bian, F., Chiang, Y., Ho, L. C., Shen, Y., Zheng, Z., **Bailey, J. I., III**, Blanc, G. A., Crane, J. D., Fan, X., Mateo, M., Olszewski, E. W., Oyarzún, G. A., Wang, R., Wu, X. A Giant Protocluster of Galaxies at Redshift 5.70 2018, NatAs, 2, 962
35. Koposov, S. E., Walker, M. G., Belokurov, V., Casey, A. R., Geringer-Sameth, A., Mackey, D., Da Costa, G., Erkal, D., Jethwa, P., Mateo, M., Olszewski, E. W., **Bailey, J. I., III** Snake in the Clouds: a new nearby dwarf galaxy in the Magellanic bridge* 2018, MNRAS, 479, 5343
36. Talens, G. J. J., Deul, E. R., Stuik, R., Burggraaff, O., Lesage, A. L., Spronck, J. F. P., Mellon, S. N., **Bailey, J. I., III**, Mamajek, E. E., Kenworthy, M. A., Snellen, I. A. G. Data calibration for the MASCARA and bRing instruments 2018, AA, 619, A154
37. Chiti, A., Simon, J. D., Frebel, A., Thompson, I. B., Shectman, S. A., Mateo, M., **Bailey, J. I., III**, Crane, J. D., Walker, M. Detection of a Population of Carbon-enhanced Metal-poor Stars in the Sculptor Dwarf Spheroidal Galaxy 2018, ApJ, 856, 142
38. Johnson, C. I., Rich, R. M., Caldwell, N., Mateo, M., **Bailey, J. I., III**, Olszewski, E. W., Walker, M. G. Exploring the Chemical Composition and Double Horizontal Branch of the Bulge Globular Cluster NGC 6569 2018, AJ, 155, 71
39. Stuik, R., **Bailey, J. I., III**, Dorval, P., Talens, G. J. J., Laginja, I., Mellon, S. N, Lomberg, B. B. D., Crawford, S. M., Ireland, M. J., Mamejek, E. E., Kenworthy, M. A. bRing: An observatory dedicated to monitoring the β Pictoris b Hill sphere transit 2017, AA, 607, A45
40. Dupree, A. K., Dotter, A., Johnson, C. I., Marino, A. F., Milone, A. P., **Bailey, J. I., III**, Crane, J. D., Mateo, M., Olszewski, E. W. NGC 1866: First Spectroscopic Detection of Fast-rotating Stars in a Young LMC Cluster 2017, ApJL, 846, L1
41. Jiang, L., Shen, Y., Bian, F., Zheng, Z., Wu, J., Oyarzún, G. A., Blanc, G. A., Fan, X., Ho, L. C., Infante, L., Wang, R., Wu, X., Mateo, M., **Bailey, J. I., III**, Crane, J. D., Olszewski, E. W., Shectman, S., Thompson, I., Walker, M. G. A Magellan M2FS Spectroscopic Survey of Galaxies at $5.5 < z < 6.8$: Program Overview and a Sample of the Brightest Ly α Emitters, 2017, ApJ, 846, 134
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43. Kounkel, M., Hartmann, L., Mateo, M., **Bailey, J. I. III** Kinematics of the Optically Visible YSOs Toward the Orion B Molecular Cloud 2017, ApJ, 844, 138
44. Oyarzún, G. A., Blanc, G. A., González, V., Mateo, M., **Bailey, J. I., III** A Comprehensive Study of Ly α Emission in the High-redshift Galaxy Population 2017, ApJ, 843, 133
45. Johnson, C. I., Caldwell, N., Rich, R. M., Mateo, M., **Bailey, J. I., III**, Olszewski, E. W., Walker, M. G. Chemical Complexity in the EU-Enhanced Monometallic Globular NGC 5896 2017, ApJ, 842, 24
46. Johnson, C. I., Caldwell, N., Rich, R. M., Mateo, M., **Bailey, J. I., III**, Clarkson, W. I., Olszewski, E., Walker, M. G. A Chemical Composition Survey of the Iron-Complex Globular Cluster NGC 6273 (M 19), 2017, ApJ, 836, 138
47. **Bailey, J. I., III**, Mateo, M., White, R. J., Shectman, S. A., Crane, J., & Olszewski, E. Multiplexing Precision RVs: Searching for Close-in Gas Giants in Open Clusters 2016, AJ, 152, 9
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49. Oyarzún, G. A., Blanc, G. A., González, V., Mateo, M., **Bailey, J.I., III**, Finkelstein, S. L., Lira, P., Crane, J. D., & Olszewski, E. W. How Lyman Alpha Emission Depends on Galaxy Stellar Mass, 2016, ApJL, 821, L14
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