RYAN F. TRAINOR

Assistant Professor of Physics & Astronomy
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Contact:

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Research Focus:

- Multi-wavelength imaging and spectroscopic observations with a focus on optical/infrared
- Interactions of stars, gas, black holes, and dark matter in galaxy formation
- Lyman-alpha emission as a probe of astrophysics and cosmology

Education:

California Institute of Technology

- PhD in Astrophysics (Defended August 2014, Conferred June 2015)
  Thesis: *Faint Galaxies in the Mpc-scale Environments of Hyperluminous QSOs at 2<z<3*
  Advisor: Charles Steidel
- MS in Astrophysics (June 2010)

University of California, Irvine

- BS in Physics (Honors, Phi Beta Kappa, *magna cum laude*)
  Honors Thesis: *Improving Galaxy Mass Estimates by Accounting for Binary Systems*
  Advisors: Manoj Kaplinghat & James Bullock

Academic Positions:

Assistant Professor, Franklin & Marshall College (2017-present)

- Tenure-track faculty position in the F&M Physics & Astronomy Department
- Parental leave Fall 2019, junior faculty research leave Spring 2021

Visiting Scientist, Johns Hopkins University (2021-present)

- Remote visiting scientist position in the department of physics and astronomy

Postdoctoral Research Fellow, Miller Institute for Basic Research in Science (2014-2017)

- Postdoctoral fellowship in astronomy funded by the interdisciplinary Miller Institute at the University of California, Berkeley

Peer-Reviewed Publications:

27. Strom, Allison et al. including RFT [4 authors]; *Chemical abundance scaling relations for multiple elements in z~2-3 star-forming galaxies*; accepted to ApJ; arxiv: 2111.06410 (2021)
26. Chen, Yuguang et al. including RFT *and F&M student Noah Lamb* [12 authors]; *The KBSS-KCWI Survey: The connection between extended Lyα halos and galaxy azimuthal angle at z~2–3*; MNRAS 508, 19 (2021)
25. Chen, Yuguang et al. including RFT [16 authors]; *The Keck Baryonic Structure Survey: using foreground/background galaxy pairs to trace the structure and kinematics of circumgalactic neutral hydrogen at z ~ 2*; MNRAS 499, 1721 (2020)
24. Trainor, Ryan. F. et al. [6 authors]; *Predicting Lyα Emission From Galaxies Via Empirical Markers Of Production And Escape*. ApJ 887, 85 (2019)
23. Rudie, Gwen C. et al. including RFT [8 authors]; *The Column Density, Kinematics, and Thermal State of Metal-Bearing Gas within the Virial Radius of z~2 Star-Forming Galaxies in the Keck Baryonic Structure Survey*. ApJ 885, 61 (2019)

22. Martin, D. Christopher et al. including RFT [16 authors]; *Multi-filament gas inflows fuelling young star-forming galaxies*, Nature Astronomy, July 2019 Issue
21. Hill, Ryley et al. including RFT [15 authors]; *The SCUBA-2 web survey: I. Observations of CO(3-2) in hyper-luminous QSO field*, MNRAS 485, 753 (2019)
20. Theios, Rachel L. et al. including RFT [6 authors]; *Dust Attenuation, Star Formation, and Metallicity in z ~2–3 Galaxies from KBSS-MOSFIRE*, ApJ 871, 128 (2019)
19. Steidel, Charles C et al. including RFT [8 authors]; *The Keck Lyman Continuum Spectroscopic Survey (KLCS): The Emergent Ionizing Spectrum of Galaxies at z ~ 3*, ApJ 869, 123 (2018)
18. Law, David R et al. including RFT [6 authors]; *Imaging Spectroscopy of Ionized Gaseous Nebulae around Optically Faint AGN at Redshift z ~ 2*, ApJ 866, 119 (2018)
17. Strom, Allison L. et al. including RFT [5 authors]; *Measuring the Physical Conditions in High-redshift Star-forming Galaxies: Insights from KBSS-MOSFIRE*, 868, 117 (2018)
16. Strom, Allison L. et al. including RFT [6 authors]; *Nebular Emission Line Ratios in z~2-3 Star-Forming Galaxies with KBSS-MOSFIRE: Exploring the Impact of Ionization, Excitation, and Nitrogen-to-Oxygen Ratio*, ApJ 836, 164 (2017)
15. Trainor, R. F. et al. [4 authors]; *The Rest-Frame Optical Spectroscopic Properties of Lyα-emitters at z ∼ 2.5*, ApJ 832, 171 (2016)
14. Erb, D. K. et al. including RFT [8 authors]; *A High Fraction of Ly-alpha-Emitters Among Galaxies with Extreme Emission Line Ratios at z ~ 2*, ApJ 830, 52 (2016)
13. Steidel, C. C. et al. including RFT [6 authors]; *Reconciling the Stellar and Nebular Spectra of High Redshift Galaxies*, ApJ 826, 159 (2016)
12. Martin, D. C. et al. including RFT [7 authors]; *A Newly Forming Cold Flow Protogalactic Disk, a Signature of Cold Accretion from the Cosmic Web*, ApJ 824, L5 (2016)
11. Mostardi, R. E. et al. including RFT [6 authors]; *A High-Resolution Hubble Space Telescope Study of Apparent Lyman Continuum Leakers at z~3*, ApJ 810, 107 (2015)
10. Trainor, R. F. et al. [4 authors]; *The Spectroscopic Properties of Lyα-Emitters at Z ≈ 2.7: Escaping Gas and Photons from Faint Galaxies*, ApJ 809, 89 (2015)
9. Steidel, C.C. et al. including RFT [14 authors]; *Strong Nebular Line Ratios in the Spectra of z ~ 2-3 Star Forming Galaxies: First Results from KBSS-MOSFIRE*, ApJ 795, 165 (2014)
8. Erb, D. K. et al. including RFT [16 authors]; *The Ly-alpha Properties of Faint Galaxies at z~2-3 with Systemic Redshifts and Velocity Dispersions from Keck-MOSFIRE*, ApJ 795, 33 (2014)
7. Mostardi, R. E. et al. including RFT [6 authors]; *Narrowband Lyman-Continuum Imaging of Galaxies at z ~ 2.85*, ApJ 779, 65 (2013)
6. Kulas, K. R. et al. including RFT [10 authors]; *The Mass-Metallicity Relation Of A Z~2 Protocluster With MOSFIRE*, ApJ 774, 130 (2013)
5. Trainor, R. F., Steidel, C. C., *Constraints on Hyperluminous QSO Lifetimes via Fluorescent Lya Emitters at Z~2.7*, ApJ 775, L3 (2013)
4. McLean, I. S. et al. including RFT [20 authors]; *MOSFIRE, the multi-object spectrometer for infra-red exploration at the Keck Observatory*, SPIE 8446, 0J (2012)
3. Trainor, R. F., Steidel, C. C., *The Halo Masses and Galaxy Environments of Hyperluminous QSOs at Z~2.7 in the Keck Baryonic Structure Survey*, ApJ 752, 39 (2012)
2. Rudie, G. C. et al. including RFT [10 authors]; *The Gaseous Environment of High-z Galaxies: Precision Measurements of Neutral Hydrogen in the Circumgalactic Medium of z ~ 2-3 Galaxies in the Keck Baryonic Structure Survey*, ApJ 750, 67 (2012)
1. Minor, Q. E. et al. including RFT [5 authors]; *Correcting Velocity Dispersions of Dwarf Spheroidal Galaxies for Binary Orbital Motion*, ApJ 721, 1142 (2010)

Total citations: 2320; H-index: 21 (via the Astrophysical Data System, 22 November 2021)

Student Papers in Preparation:

1. Lamb, N.; Trainor, R. F., Trenholm, E., et al.; *Lyman-alpha Halos around Faint Galaxies*
2. McClain, R; Trainor, R. F.; *Mapping the Ionization Conditions in Mariposa*

Student Mentoring and Collaboration:

Franklin & Marshall College

- Ojima Abraham (2021-present)
- Issac Lin (2020-present)
- Rebecca McClain (2019-present)
- Rafael Silva (2020)
- Ayana Stuart (2020)
- Brandon Perezous (2020)
- Conor Larison (2019-2021, post-bac researcher, now PhD student at Rutgers University)
- Christopher Chapman (2019-2021, working in computer engineering)
- Erik Garcia (2019, accepted for MSc in Computer Science at UCF)
- Donald Fasce (2019, applying for PhD programs)
- Noah Lamb (2017-2019, post-bac researcher, now PhD student at Drexel University)
- Sandra Chilson (2017-2018, now teaching high school physics)

UC Berkeley

- Anna de Graaf (2015-2016, now PhD student at Leiden Observatory)
- Shanon Oden (2014-2016)
- Elizabeth Trenholm (2016, now MSc student in Data Science at Kings College London)
- Jose Zamora Zeledon (2016, now PhD student in ChemE at Stanford University)
- Duncan Rocha (2016, *local HS student*, now undergrad at Harvey Mudd College)
- Elijah Wilensky (2016, *local HS student*)

Invited Research Talks:

- *Colloquium*, Astronomy Department at University of British Columbia (March 2021)
- *Colloquium*, Physics & Astronomy Department at Williams College (March 2021)
- *Colloquium*, Physics Department at University of Wisconsin, Milwaukee (December 2017)
- *Colloquium*, Physics Department at Millersville University (October 2017)
- *Colloquium*, Astronomy Department at Penn State University, State College (October 2017)
- *The Snowbird Cosmic Lyman-Alpha Workshop*, University of Utah (March 2017)
- *Colloquium*, Physics & Astronomy Department at Pomona College (February 2017)
- *Colloquium*, Physics & Astronomy Department at Oberlin College (February 2017)
- *Colloquium*, Physics & Astronomy Department at Franklin & Marshall College (January 2017)
- *Colloquium*, Physics Department at CSU East Bay (January 2017)
- *Near-Far Galaxy Workshop (Review Talk),* Sonoma, CA (December 2016)
- *Colloquium*, University of Hawaii, Hilo (October 2016)
- *Cosmology Seminar*, UC Davis (November 2015)
- *IMPS Seminar*, UC Santa Cruz (September 2015)
- *Astrophysics Seminar*, UC Irvine (May 2014)
- *ITC Seminar,* Harvard/CfA (December 2013)
- *Theoretical Astrophysics Center Seminar*; UC Berkeley (October 2013)
- *Lyman Alpha as an Astrophysical Tool*; Stockholm, Sweden (September 2013)

Contributed Research Talks:

- *Central Pennsylvania Astronomer's Consortium* (June 2020) – *presented with two students*
- *AAS Meeting*; Seattle, WA (January 2019) – *Two presentations, one with student*
- *Escape of Lyman radiation from galactic labyrinths II*; Kolymbari, Greece (September 2018)
- *Cosmic dawn of galaxy formation: linking observations and theory with new-generation spectral models*; Paris, France (June 2016)
- *The Escape of Lyman radiation from galactic labyrinths*; Kolymbari, Greece (April 2016)
- *The Physical Link between Galaxies and their Halos*; Garching, Germany (June 2013)
- *Keck Science Meeting*; San Diego, CA (September 2012)

- *AAS Meeting*; Austin, TX (January 2012)
- *New Horizons for High Redshifts*; Cambridge, UK (July 2011)
- *Galaxy Formation*; Durham, UK (July 2011)

Funding Awarded & Proposed (Post-PhD):

- **PI**, Pittsburgh Foundation Award (2021-2023) **$95,230 budget awarded to F&M**
- **PI**, RCSA Cottrell Scholar Award (pending; $100,00 budget)
- Co-I, James Webb Space Telescope Cycle 1 GO ($374,172, 2022-2024, PI: Strom, Princeton)
- Co-I, NASA Keck Observatory allocation (2021B), $13,650 total budget awarded
- **PI**, Hubble Space Telescope Cycle 24 (2017-2020), **$91,956 awarded to F&M**
- NSF Astronomy & Astrophysics Postdoctoral Fellowship (2017-2020, declined), $300,000
- Postdoctoral Fellowship awarded by the Miller Institute for Basic Research in Science (2014-2017), $276,757 estimated total funding

Telescope Time Awarded (Post-PhD):

- **PI**, IRAM NOEMA interferometer (5 hours; observations completed Summer 2021)
- Co-I, Keck Observatory 2021B (NASA TAC; 2n awarded)
- Co-I, James Webb Space Telescope Cycle 1 GO (40 hours awarded)
- **PI**, Hubble Space Telescope Cycle 24 (20 orbits awarded)
- Co-I (lead observer, PI Eliot Quataert): Keck Observatory 2017B (2n)
- Co-I (lead observer, PI Eliot Quataert): Keck Observatory 2016B (2n)
- Co-I (lead observer, PI Eliot Quataert): Keck Observatory 2015B (2n)
- Co-I (lead observer, PI Eliot Quataert): Keck Observatory 2015A (1.5n)
- Co-I (PI Alicia Lanz): Las Campanas Observatory 2021B (4n)
- Co-I (PI Gwen Rudie): Las Campanas Observatory 2017B (3n)
- Co-I (PI Gwen Rudie): Las Campanas Observatory 2017A (3n)
- Co-I (PI Gwen Rudie): Las Campanas Observatory 2016B (3n)

Courses Taught:

Franklin & Marshall College

- PHY333, Electric and Magnetic Fields (3x)
- PHY111, Fundamental Physics 1 (4x)
- PHY112, Fundamental Physics 2
- PHY111 Lab (3x)
- AST121, Introduction to Astrophysics (3x)
- AST100, Survey of Astronomy (2x)
- AST100 Lab (3x)
- Independent study in physics or astronomy (23x)

Previous Teaching Experience

- UC Berkeley: Introduction to Astronomy (Instructor of Record, 2015)
- Caltech: Galaxies & Cosmology (Head TA for MOOC with 28K students, 2013)
- Caltech: Introduction to Astronomy (TA with teaching responsibilities, 2010)

Service:

Scientific Field

- Scientific referee for *The Astrophysical Journal* and *Monthly Notices of the Royal Astronomical Society*
- Panel member, Early Career Astronomers meeting with Thomas Zurbuchen, acting director for NASA's Science Mission Directorate
- Panel member, NSF Astronomy & Astrophysics Research Grants
- Panel member, JWST Time Allocation Committee

College
- Secretary of the Faculty (2021-2022)
- Accelerated DEI Curricular Working Group, Subcommittee Co-Chair (2020)
- Inclusivity in Sciences Working Group (2020)
- Committee on Enrollment (Fall 2020)
- Common Hour Committee (Spring 2020)
- Working Group on Bias Response System (2019)
- Quality of Campus Life Committee (2018-2019)
- Provost's Advisory Committee for Faculty Inclusion and Diversity (2018-2019)
- First year advisor (16 students)
- Club advisor: Black Student Union (2019-present)

Department
- Member of departmental search committee for two visitors and one TT hire
- Scribe for department meetings
- Major advisor: Astrophysics class of 2021, 2023
- Club advisor: Sigma Pi Sigma (Physics Honor Society)

Professional Development

Teaching
- Participant, AAPT New Faculty Workshop
- Participant, NASA Center for Astronomy Education *Teaching Excellence* Workshop
- Co-founder, Caltech *Workgroup for Educational Science and Technology*

Diversity, Equity, and Inclusion
- Member, Faculty-Staff Disability Alliance
- Unproductive Thinking Workshop (Jennifer Stollman, PhD, January 2020)
- SACNAS Annual Meeting (Honolulu, Hawai'i, September 2019)
- Implicit Bias Workshop (Dr. Julie Ancis, August 2019)
- HHMI Diversity, Equity, and Inclusion Workshop (Saundra McGuire, PhD, May 2019)
- F&M directed reading groups (*Dear America: Notes of an Undocumented Citizen* by Jose Antonio Vargas; *Hip Hop Beats, Indigenous Rhymes: Modernity and Hip Hop in Indigenous North America* by Dr. Kyle T. Mays; *White Fragility* by Robin DiAngelo)