Viraj Pandya, Ph.D.

Department of Astronomy, Columbia University
Mail Code 5246, 550 West 120th Street, New York, NY 10027
(201) 427-0479 || viraj.pandya@gmail.com

RESEARCH INTERESTS

Modeling galaxies as complex dynamical systems in a cosmological context, subgrid physics in hydrodynamical simulations, galactic atmospheres, stellar populations, intermediate-mass black holes, satellite galaxies, galaxy morphology and geometry, differentiable and probabilistic programming

ACADEMIC POSITIONS HELD

2021–2024 NASA Hubble Postdoctoral Fellow, Columbia University, New York City
2020 Research Analyst / Pre-Doctoral Fellow, Flatiron Institute, New York City
2019 Summer Research Associate, Flatiron Institute, New York City
2018 Summer Research Associate, Flatiron Institute, New York City
2018 Teaching Assistant, University of California, Santa Cruz
2017-2020 NSF Graduate Research Fellow, Astrophysics, University of California, Santa Cruz
2017 Graduate Student Researcher, University of California, Santa Cruz
2017 Teaching Assistant, University of California, Santa Cruz
2014–2016 Post-Baccalaureate Student in Astrophysics, Princeton University, NJ
2013–2014 Research Assistant in Astronomy, Rutgers University, New Brunswick, NJ

EDUCATION

Ph.D. Astrophysics, September 2016 – August 2021
Department of Astronomy & Astrophysics, University of California, Santa Cruz
Advisors: Prof. Kevin Bundy and Dr. Rachel Somerville

M.A. Astrophysics, December 2018
Department of Astronomy & Astrophysics, University of California, Santa Cruz
Advisors: Prof. Joel Primack and Prof. Jean Brodie

Post-Baccalaureate Program Astrophysics, September 2014 – June 2016
Department of Astrophysical Sciences, Princeton University, Princeton, NJ
Advisor: Prof. Jenny Greene

B.A. Mathematics & Economics (Minor: Astronomy), May 2013
Rutgers, The State University of New Jersey, New Brunswick, NJ

AWARDS AND HONORS *(Over $1.1 million in research grants as an early-career PI)*

2023: NSF Astronomy & Astrophysics Grant ($596K), Columbia University, NYC
2021: NASA Hubble Postdoctoral Fellowship ($370K), Columbia University, NYC
2020: Pre-Doctoral Fellowship, Center for Computational Astrophysics, Flatiron Institute, NYC
2016: NSF Graduate Research Fellowship ($138K), University of California, Santa Cruz
2016: Osterbrock Leadership Fellowship, University of California, Santa Cruz
2016: Regents Fellowship, University of California, Santa Cruz
2014: Full Fellowship, Post-Baccalaureate Program in Astrophysics, Princeton University
2014: Full Scholarship, La Serena School for Data Science: Applied Tools for Astronomy, Chile

OBSERVING PROPOSALS

7. Kassin, S et al. (including **Pandya, V.**). Galaxy angular momentum alignment with filaments at $z \sim 3$: The effect of large scale structure on galaxies. *James Webb Space Telescope* Cycle 2, 2023, 66 hours, ID 4291.

6. Finkelstein, S. et al. (including **Pandya, V.**). The Cosmic Evolution Early Release Science (CEERS) Survey. *James Webb Space Telescope* Early Release Science, 2018, 64 hours, ID ERS-1345.

5. Romanowsky, A., Laine, S., **Pandya, V.**, et al. A Survey of Stellar Populations in Ultra-Diffuse Galaxies. *Spitzer Space Telescope*, 2018, 50 hours, ID 14114.

4. **Pandya, V.**, Greene, J., and Mulchaey, J. A Systematic Radio Search for Central Black Holes in Ultracompact Dwarf Galaxies. *Jansky Very Large Array*, 2016, 7 hours, ID 16B-315.

3. **Pandya, V.**, Mulchaey, J., and Greene, J. The JVLA View of Central Accreting Black Holes in Ultracompact Dwarf Galaxies. *Jansky Very Large Array*, 2016, 3 hours, ID 16A-382.

2. Nyland, K., et al. (including **Pandya, V.**). A Complete Census of Nuclear Activity Among the Most Massive Nearby Galaxies. *Jansky Very Large Array*, 2016, 16 hours, ID 16A-291.

1. Davis, T., et al. (including **Pandya, V.**). Gas in MASSIVE Galaxies: Dynamical IMF measurements with molecular gas. *IRAM/NOEMA*, 2016, 15 hours, ID W15BT.

OBSERVING EXPERIENCE

04/2017 Keck DEIMOS, Waimea, Hawaii
Spectroscopy of ultra-diffuse galaxies, globular clusters and early-type galaxies
01/2017 Keck DEIMOS, Waimea, Hawaii
Spectroscopy of ultra-diffuse galaxies, globular clusters and early-type galaxies
03/2015 IRAM 30 meter radio telescope, Granada, Spain
Molecular gas radio observations for local massive elliptical galaxies

ADVISING EXPERIENCE

Austen Gabrielpillai, City University of New York – Bridge Student, 2023-present
Next-generation semi-analytic modeling and inference of satellites around Milky Way analogs
Chris Carr, Columbia University – Graduate Student Research Project, 2023-present
Comparing galactic wind properties in small-scale vs. large-scale hydrodynamical simulations
Meng Lin, Columbia University – Undergraduate Researcher, 2023-present
Predicting synthetic X-ray emission map observations from galactic wind simulations
Cody Carr, University of Minnesota – Remote Flatiron Pre-Doc Project, 2021-present
Predicting synthetic spectral absorption line observations from galactic wind simulations
Austen Gabrielpillai, Flatiron Institute – Research Analyst, 2019-2020
Comparing semi-analytic models and hydrodynamical simulations of galaxy formation
Patrick Ward, UC Santa Cruz – Senior Thesis, 2019-2020
Testing mock predictions for intrinsic alignments of high-redshift elongated galaxies
Sahar Ahmadi, Leah George, Norhan Osman, Joy Velasquez UC Santa Cruz, 2018-2019
Intro to Research class (AY9): The relationship between galaxy size and dark matter halo age
Elliot Eckholm, UC Santa Cruz, 2018
Visualizing backward lightcones and alignments of elongated galaxies in 2D and 3D

B. Cavins, C. Bolanos, K. Alibrio, L. Waldschmidt, S. Balaji UC Santa Cruz, 2017-2018
Intro to Research class (AY9): Fitting isochrones to Milky Way globular clusters

Graham Vanbenthuysen UC Santa Cruz – Senior Thesis, 2017-2018
Correlations between environment, dark matter halo properties, and sizes of galaxies

Yssavo Camacho Rutgers University – Research Experiences for Undergraduates, Summer 2013
Supernova spectroscopy, spectroscopic data reduction, co-authored two papers and two posters

TEACHING

Spring 2018 Astronomy 3, UC Santa Cruz
Created review worksheets and led recitations for ~ 100 *undergraduates*

Winter 2017 Astronomy 5, UC Santa Cruz
Created review worksheets and led recitations for ~ 100 *undergraduates*

Spring 2015 Physics 121, Princeton Prison Teaching Initiative, East Jersey State Prison
Taught and graded multiple astrophysics labs for a class with $\sim$*30 students*

PROFESSIONAL SERVICE AND OUTREACH

– Co-mentor for National Osterbrock Leadership Program at Columbia University (2021–present)
– Referee, *The Astrophysical Journal* (2017–present)
– Referee, *Monthly Notices of the Royal Astronomical Society* (2020–present)
– As an Osterbrock Leadership Fellow at UC Santa Cruz, I co-founded and directed the Osterbrock Mini-Grants Program in 2017. The program has so far awarded more than $15,000 to 11 different proposals led by astronomy graduate students interested in enhancing their leadership skills.
– As the Founder of the Rutgers Astronomical Society, I secured more than $6,500 in funding for new telescopes and numerous astronomy outreach programs in 2011-2012.

REFERENCES

Prof. Greg Bryan, Columbia University, gbryan@astro.columbia.edu
Prof. Kevin Bundy, UC Santa Cruz, kbundy@ucolick.org
Prof. Sandra Faber, UC Santa Cruz, faber@ucolick.org
Prof. Jenny Greene, Princeton University, jgreene@astro.princeton.edu
Prof. Joel Primack, UC Santa Cruz, joel@ucsc.edu
Dr. Rachel Somerville, Flatiron Institute, rsomerville@flatironinstitute.org

PUBLICATIONS *(49 total, 10 as first author, over 2200 refereed citations, h-index=29)*

49. **Pandya, V.** et al. Galaxies Going Bananas: Inferring the 3D Shapes of High-Redshift Galaxies with JWST-CEERS. *Submitted to ApJ* (2023).

48. **Pandya, V.** et al. A unified model for the co-evolution of galaxies and their circumgalactic medium: the relative roles of turbulence and atomic cooling physics. *ApJ in press* (2023).

47. Vega-Ferrero, J. et al. (incl. **Pandya, V.**). On the nature of disks at high redshift seen by JWST/CEERS with contrastive learning and cosmological simulations. *Submitted to ApJ* (2023).

46. Camacho-Neves, Y. et al. (incl. **Pandya, V.**). Over 500 Days in the Life of the Photosphere of the Type Iax Supernova SN 2014dt. *ApJ*, 951(1):67 (2023).

45. Carr, C., et al. (incl. **Pandya, V.**). Regulation of Star Formation by a Hot Circumgalactic Medium. *ApJ*, 949(1):21 (2023).

44. Forbes, J., et al. (incl. **Pandya, V.**). Gas Accretion Can Drive Turbulence in Galaxies. *ApJ*, 948(2):107 (2023).

43. Wetzel, A. et al. (incl. **Pandya, V.**). Public Data Release of the FIRE-2 Cosmological Zoom-in Simulations of Galaxy Formation. *ApJS*, 265(2):44 (2023).

42. Kartaltepe, J. et al. (incl. **Pandya, V.**). CEERS Key Paper. III. The Diversity of Galaxy Structure and Morphology at z = 3-9 with JWST. *ApJL*, 946(1):L15 (2023).

41. Finkelstein, S. et al. (incl. **Pandya, V.**). CEERS Key Paper. I. An Early Look into the First 500 Myr of Galaxy Formation with JWST. *ApJL*, 946(1):L13 (2023).

40. Guo, Y. et al. (incl. **Pandya, V.**). First Look at $z > 1$ Bars in the Rest-frame Near-infrared with JWST Early CEERS Imaging. *ApJL*, 945(1):L10 (2023).

39. Pacifici, C. et al. (incl. **Pandya, V.**). The Art of Measuring Physical Parameters in Galaxies: A Critical Assessment of Spectral Energy Distribution Fitting Techniques. *ApJ*, 944(2):141 (2023).

38. Zavala, J. et al. (incl. **Pandya, V.**). Dusty Starbursts Masquerading as Ultra-high Redshift Galaxies in JWST CEERS Observations. *ApJL*, 943(2):L9 (2023).

37. Finkelstein, S. et al. (incl. **Pandya, V.**). A Long Time Ago in a Galaxy Far, Far Away: A Candidate z 12 Galaxy in Early JWST CEERS Imaging. *ApJ*, 940(2):L55 (2022).

36. Kwok, L., et al. (incl. **Pandya, V.**). Ultraviolet Spectroscopy and TARDIS Models of the Broad-lined Type Ic Supernova 2014ad. *ApJ*, 937(1):40 (2022).

35. Gabrielpillai, A., et al. (incl. **Pandya, V.**). Galaxy Formation in the Santa Cruz semi-analytic model compared with IllustrisTNG – I. Galaxy scaling relations, dispersions, and residuals at z=0. *MNRAS*, 517(4):6091-6111 (2022).

34. Faerman, Y., **Pandya, V.**, Somerville, R. and Sternberg, A. Exploring the Milky Way Circumgalactic Medium in a Cosmological Context with a Semi-Analytic Model. *ApJ*, 928(1):37 (2022).

33. Motwani, B., et al. (incl. **Pandya, V.**). First results from SMAUG: Insights into star formation conditions from spatially-resolved ISM properties in TNG50. *ApJ*, 926(2):139 (2022).

32. **Pandya, V.** et al. Characterizing mass, momentum, energy, and metal outflow rates of multiphase galactic winds in the FIRE-2 cosmological simulations. *MNRAS*, 508(2):2979-3008 (2021).

31. Somerville, R., et al. (incl. **Pandya, V.**). Mock light-cones and theory friendly catalogues for the CANDELS survey. *MNRAS*, 502(4):4858-4876 (2021).

30. **Pandya, V.**, Somerville, R., Anglés-Alcázar, D., et al. First results from SMAUG: The need for preventative stellar feedback and improved baryon cycling in semi-analytic models of galaxy formation. *ApJ*, 905(1):4 (2020).

29. Kim, C.-G., et al. (incl. **Pandya, V.**). First results from SMAUG: Characterization of Multiphase Galactic Outflows from a Suite of Local Star-Forming Galactic Disk Simulations. *ApJ*, 900(1):61 (2020).

28. Lin, L., et al. (incl. **Pandya, V.**). The SFR-radius connection: data and implications for wind strength and halo concentration. *ApJ*, 899(2):93 (2020).

27. Chen, Z., Faber, S., et al. (incl. **Pandya, V.**). Quenching as a Contest between Galaxy Halos and their Central Black Holes. *ApJ*, 897(1):102 (2020).

26. Luo, Y., et al. (incl. **Pandya, V.**). Structural and stellar-population properties versus bulge types in Sloan Digital Sky Survey central galaxies. *MNRAS*, 493(2):1686-1707 (2020).

25. **Pandya, V.**, Primack, J., et al. Can intrinsic alignments of elongated low-mass galaxies be used to map the cosmic web at high redshift? *MNRAS*, 488(4):5580-5593 (2019).

24. Barro, G., et al. (incl. **Pandya, V.**). The CANDELS/SHARDS Multiwavelength Catalog in GOODS-N: Photometry, Photometric Redshifts, Stellar Masses, Emission-line Fluxes, and Star Formation Rates. *ApJS*, 243(2):22 (2019).

23. Davis, T., et al. (incl. **Pandya, V.**). The MASSIVE survey - XI. What drives the molecular gas properties of early-type galaxies. *MNRAS*, 486(1) (2019).

22. Martin-Navarro, I., et al. (incl. **Pandya, V.**). Extreme chemical abundance ratio suggesting an exotic origin for an ultradiffuse galaxy. *MNRAS*, 484(3) (2019).

21. Hahn, C., et al. (incl. **Pandya, V.**). IQ-Collaboratory 1.1: The Star-forming Sequence of Simulated Central Galaxies. *ApJ*, 872(2):160 (2019).

20. Jones, M., Papastergis, E., **Pandya, V.**, et al. Contribution of HI-bearing ultra-diffuse galaxies to the cosmic number density of galaxies. *A&A*, 614:A21 (2018).

19. **Pandya, V.**, Romanowsky, A., Laine, S., et al. The Stellar Populations of Two Ultra-Diffuse Galaxies from Optical and Near-infrared Photometry. *ApJ*, 858(1):29 (2018).

18. Ferre-Mateu, A., et al. (incl. **Pandya, V.**). Origins of ultradiffuse galaxies in the Coma cluster - II. Constraints from their stellar populations. *MNRAS*, 479(4) (2018).

17. Alabi, A., et al. (incl. **Pandya, V.**). Origins of ultradiffuse galaxies in the Coma cluster - I. Constraints from velocity phase space. *MNRAS*, 479(3) (2018).

16. Hovey, L., et al. (incl. **Pandya, V.**). Constraints on Cosmic-ray Acceleration Efficiency in Balmer Shocks of Two Young Type Ia Supernova Remnants in the Large Magellanic Cloud. *ApJ*, 862(2):148 (2018).

15. Bellstedt, S. et al. (incl. **Pandya, V.**). The SLUGGS survey: a comparison of total-mass profiles of early-type galaxies from observations and cosmological simulations, to ~ 4 effective radii. *MNRAS*, 476(4) (2018).

14. Fang, J. et al. (incl. **Pandya, V.**). Demographics of Star-forming Galaxies since $z \sim 2.5$. I. The UVJ Diagram in CANDELS. *ApJ*, 858(2):100 (2018).

13. Voit, M. et al. (incl. **Pandya, V.**). A General Precipitation-Limited $L_X - T - R$ Relation Among Early-Type Galaxies. *ApJ*, 853(1):78 (2018).

12. Somerville, R., Behroozi, P., **Pandya, V.**, et al. The relationship between galaxy and dark matter halo size from $z \sim 3$ to the present. *MNRAS*, 473(2):2714-2736 (2017).

11. **Pandya, V.**, Brennan, R., Somerville, R., et al.The nature of massive transition galaxies in CANDELS, GAMA and cosmological simulations. *MNRAS*, 472(2):2054-2084 (2017).

10. **Pandya, V.**, Greene, J., et al. The MASSIVE Survey. VI. The Spatial Distribution and Kinematics of Warm Ionized Gas in the Most Massive Local Early-type Galaxies. *ApJ*, 837(1):40 (2017).

9. Brennan, R., **Pandya, V.**, Somerville, R., et al. The relationship between star formation activity and galaxy structural properties in CANDELS and a semi-analytic model *MNRAS*, 465(1):619-640 (2017).

8. Kirkpatrick, A. et al. (incl. **Pandya, V.**). The AGN–Star Formation Connection: Future Prospects with JWST. *ApJ*, 849(2):111 (2017).

7. **Pandya, V.**, Mulchaey, J. and Greene, J. A Comprehensive Archival Chandra Search for X-ray Emission from Ultracompact Dwarf Galaxies. *ApJ*, 819(2):162 (2016).

6. Marion, G. et al. (incl. **Pandya, V.**). SN 2012cg: Evidence for Interaction Between a Normal Type Ia Supernova and a Non-Degenerate Binary Companion. *ApJ*, 820(2):92 (2016).

5. Brennan, R., **Pandya, V.**, Somerville, R., et al. Quenching and morphological transformation in semi-analytic models and CANDELS. *MNRAS*, 451(3):2933-2956 (2015).

4. Davis, T. et al. (incl. **Pandya, V.**). The MASSIVE survey - III. Molecular gas and a broken Tully-Fisher relation in the most massive early-type galaxies. *MNRAS*, 455(1):214-226 (2015).

3. Childress, M. et al. (incl. **Pandya, V.**). Measuring nickel masses in Type Ia supernovae using cobalt emission in nebular phase spectra. *MNRAS*, 454(4):3816-3842 (2015).

2. Stritzinger, M. et al. (incl. **Pandya, V.**). Comprehensive observations of the bright and energetic Type Iax SN 2012Z: Interpretation as a Chandrasekhar mass white dwarf explosion. *A&A*, 573:A2 (2015).

1. **Pandya, V.** and Tumulka, R. Spin and the Thermal Equilibrium Distribution of Wave Functions. *Journal of Statistical Physics*, 154(1):491-502 (2014).