Dr. Joseph A. Barranco

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Professional Preparation

Harvard University	Physics, Astronomy & Astrophysics	B.A. 1993
University of California, Berkeley	Astrophysics	Ph.D. 2004
Kavli Institute for Theoretical Physics	NSF A&A Postdoctoral Fellow	01/2004 – 06/2005
Harvard-Smithsonian Center for Astrophysics	NSF A&A Postdoctoral Fellow	08/2005 – 07/2007

Appointments

San Francisco State University	Dept. of Physics & Astronomy	Department Chair	08/2018 – present
		Professor	08/2019 – present
		Associate Professor	08/2013 – 07/2019
		Assistant Professor	08/2007 – 07/2013

Honors & Awards

- NASA Group Achievement Award, SIM Planet Finding Capability Study Team (Team leader: Dr. Debra Fischer), May 2010: "For successful completion of the study of the detection capability of an astronomical mission searching for terrestrial planets in habitable zones of nearby stars."
- San Francisco State University Presidential Award for Faculty Scholarship, Spring 2010
- American Physical Society Nicholas Metropolis Award
  for Outstanding Doctoral Thesis Work in Computational Physics, 2006
- U.C. Berkeley Outstanding Graduate Student Instructor Award, 1998

Research Grants & Fellowships

Monetary Grants

- NSF EAGER (Early-Concept Grants for Exploratory Research), **$38,349**, 2015-2017, "Collaborative EAGER Proposal: The Dead Zones of Protoplanetary Disks are Not Dead – How Zombie Turbulence Transports Angular Momentum and Forms Planetesimals"
- NSF Astronomy & Astrophysics Research Grants, **$425,881**, 2010–2015, "RUI & Collaborative Research: Planet Embryos in Vortex Wombs: Simulations of Gas, Dust, and Magnetic Fields in Protoplanetary Disks and the Formation of Planets"
- NSF Astronomy & Astrophysics Postdoctoral Fellowship, **$194,000**, 2004–2007, "Planet Embryos in Vortex Wombs: Protoplanetary Disks and the Formation of Planetesimals"
- U.C. Berkeley Center for Integrative Planetary Studies Mini-Grant, **$17,500**, 2001–2002
- NSF Graduate Student Fellowship, approx. **$60,000**, 1996–1999

Grants of Computer Resources

Note: The "estimated value" of resources is not money directly awarded to PI/Co-PI or their institutions, but is an approximate valuation of the worth of resources.

- XSEDE, "The Zombie Vortex Instability in Protoplanetary Disks and Vortex Dynamics & Zonal Flows in Planetary Atmospheres," PI: Philip Marcus (U.C. Berkeley), CoPI: Joseph Barranco (SFSU), 2,500,000 compute hours on SDSC Comet Supercomputer, 04/2018 – 03/2019, estimated value of resources $83,375
- XSEDE, "The Zombie Vortex Instability in Protoplanetary Disks and the Role it Plays in Star and Planet Formation," PI: Philip Marcus (U.C. Berkeley), CoPI: Joseph Barranco (SFSU), 2,842,690 compute hours on SDSC Comet Supercomputer, 10/2016 – 03/2018, estimated value of resources $94,382
- XSEDE, "The Zombie Vortex Instability and Its Role in Star, Planet, and Meteorite Formation," PI: Philip Marcus (U.C. Berkeley), CoPI: Joseph Barranco (SFSU), 1,173,958 compute hours on SDSC Comet Supercomputer & 2,344,894 compute hours on TACC Stampede Supercomputer, 07/2015 – 09/2016, estimated value of resources $141,202
- XSEDE, "Vortices, Inertio-Gravity Waves, Critical Layers, and Acoustic Waves in Protoplanetary Disks and their Roles in Star and Planet Formation," PI: Philip Marcus (U.C. Berkeley), CoPI: Joseph Barranco (SFSU), 1,301,087 compute hours on TACC Stampede Supercomputer, 04/2014 – 06/2015, estimated value of resources $46,819

Professional Leadership

- Active membership in the American Physical Society (Divisions of Astrophysics, Fluid Dynamics, Computational Physics) and the American Astronomical Society (Division of Planetary Sciences).
- **Cal-Bridge**, 08/2016 – present. Steering committee and local mentor. The mission of the Cal-Bridge program is to increase the number of California State University (CSU) students (especially women, African-Americans, Hispanic, and Native Americans, and first-generation students) completing their bachelor's degree and successfully entering a PhD program to study physics, astronomy, or a closely related field. Program consists of scholarships, mentorship from both CSU and UC faculty, summer research opportunities, and professional development workshops throughout the academic year.
  See: `http://www.cpp.edu/~sci/physics-astronomy/research/cal-bridge.shtml`
- **American Astronomical Society Committee on the Status of Minorities in Astronomy (CSMA)**, 07/2012 – 06/2015. This committee works to increase the number of historically under-represented minorities, notably African-Americans, Hispanic, and Native Americans, who earn degrees in astronomy and pursue successful careers in astronomy in the United States. I helped write a NSF proposal to fund underrepresented minority (URM) students to attend national conferences. See: `http://csma.aas.org/`.
- **American Physical Society Committee on Minorities (COM)**, 01/2012 – 12/2014. This committee works to increase the number of historically under-represented minorities, notably African-Americans, Hispanic, and Native Americans, who earn degrees in physics and pursue successful careers in physics in the United States. COM conducts site visits and offers a minority scholarship for undergraduate physics majors. Other programs include the annual Edward A. Bouchet Award, travel grants, and the Roster, which lists names and qualifications of several hundred women and minorities in physics to facilitate them being invited as speakers. See: `http://www.aps.org/about/governance/committees/commin/index.cfm`.
- Creator and moderator of Facebook page for LGBT (Lesbian, Gay, Bisexual, Transgendered) Physicists, Astrophysicists, Astronomers and Friends. See: `http://www.facebook.com/groups/89586472053.`
- Peer-reviewer for scientific articles and grant proposals for The Astrophysical Journal, Cambridge University Press, Journal of Computational & Applied Mathematics, Monthly Notices of the Royal Astronomical Society, NASA, National Science Foundation, Physics of Plasma, Theoretical & Computational Fluid Dynamics

Student Advisees

Current M.S. Students

- Wendy Crumrine, M.S. Physics/Astro expected August 2020. Project: Numerical Simulation of Dust Interaction with the Zombie Vortex Instability
- Nicole Rider, M.S. Physics/Astro expected August 2020. Project: Streaming Instability with a Semi-Lagrangian Advection Algorithm

Previous M.S. Students

- Richard McWhirter, M.S. Physics/Astro, December 2018. Thesis: *Application of Thermal Wind Equation to the Jovian Troposphere & Stratosphere.* Now: Software Engineer with The Boeing Company in St. Louis, MO.
- M. Quinn Parkinson, M.S. Physics/Astro, May 2015. Thesis: *Protoplanet-Planetesimal Interactions in Circumbinary Disks.* Now: Head Brewer at Black Hammer Brewing.
- Diana Madera, M.S. Physics, May 2015. Thesis: *Dust Trapping in Protoplanetary Disk Vortices with a Two-Fluid Terminal Velocity Approach.* Ph.D. Aeronautics & Astronautics, Stanford University, June 2020. Now: Engineer with Lockheed Martin Corporation in Denver, CO.
- Colleen Twitty, M.S. Physics, May 2015. Thesis: *Dust Trapping in Protoplanetary Disk Vortices with a Lagrangian Super-Particle Approach.* Now: Software Engineer with Peloton Technology.
- Andrew Fittingoff, M.S. Physics, August 2011. Thesis: *Light Curves of Kuiper Belt Objects and a Search for Kuiper Belt Binaries.* Now: Adjunct Instructor of Physics with the University of San Francisco, College of Alameda & Laney College.
- Samy Kamal, M.S. Physics, August 2011. Thesis: *The Dynamics of Three-Dimensional Vortices in Rotating, Stratified Shear Flows.* Ph.D. Aerospace Engineering, Arizona State University, May 2015. Now: Atmospheric Scientist with Saildrone, Inc. in Alameda, CA.
- Michael Ryan, M.S. Physics, August 2010. Thesis: *Faint Moons Orbiting Kuiper Belt Objects.* High school teacher with Sacred Heart Cathedral Preparatory School in San Francisco, CA.

Previous B.S. Students

- Michael Shadchin, B.S. Physics/Astro, December 2018. Project: Numerical simulation of orbits of moons of Uranus with time dependent obliquity.

- David Robinson, B.S. Physics/Astro, May 2015. Project: Numerical simulation of gravitational collapse of dust particles with REBOUND. Now Ph.D. candidate in Computational Science at Florida State University.
- Connor Poland, B.S. Physics/Astro, May 2015. Project: Numerical simulation of gravitational collapse of dust particles with REBOUND. Now a M.S. candidate in Computational Science at U.C. San Diego.
- Seth Gossage, B.S. Physics/Astro, May 2014. Project: Numerical simulation of protoplanet collisions with Uranus with GADGET2. Now a Ph.D. candidate in Astronomy at Harvard University.
- M. Quinn Parkinson, B.S. Physics/Astro, May 2012. Project: Numerical simulation of dust settling in protoplanetary disks. Enrolled in M.S. program immediately after. M.S. Physics/Astro awarded May 2015.
- Howard Nguyen, B.S. Physics/Astro, May 2013.

Publications

- **Barranco, J.**, Marcus, P., Pei, S., Glassgold, A, 2018, "Zombie Vortex Instability. III. The Effects of Non-Uniform Stratification and Radiative Damping." The Astrophysical Journal, **869**:127–152. arXiv:1810.06588.
- Marcus, P.S., Pei, S., Jiang, C.H., **Barranco, J.A.**, 2016, "Zombie Vortex Instability. II. Thresholds to Trigger Instability and the Properties of Zombie Turbulence in the Dead Zones of Protoplanetary Disks." The Astrophysical Journal, **833**:148–161. arXiv:1605.07635.
- Marcus, P.S., Pei, S., Jiang, C.H., **Barranco, J.A.**, Hassanzadeh, P., Lecoanet, D., 2015, "Zombie Vortex Instability. I. A Purely Hydrodynamic Instability to Resurrect the Dead Zones of Protoplanetary Disks." The Astrophysical Journal, **808**:87–102. arXiv:1410.8143.
- Penev, K., **Barranco, J.A.**, Sasselov, D.D. 2011, "Three-dimensional Spectral Simulations of Anelastic Turbulent Convection." The Astrophysical Journal, **734**:118. arXiv:0810.5151.
- Lee, A.T., Chiang, E., Asay-Davis, X., **Barranco, J.A.**, 2010, "Forming Planetesimals by Gravitational Instability: II. How Dust Settles to its Marginally Stable State." The Astrophysical Journal, **725**: 1938–1954. arXiv:1010.0250.
- Lee, A.T., Chiang, E., Asay-Davis, X., **Barranco, J.A.**, 2010, "Forming Planetesimals by Gravitational Instability: I. The Role of the Richardson Number in Triggering the Kelvin-Helmholtz Instability." The Astrophysical Journal, **718**: 1367–1377. arXiv:1010.0248.
- Penev, K., **Barranco, J.A.**, Sasselov, D.D. 2009, "Direct Calculation of the Turbulent Dissipation Efficiency in Anelastic Convection." The Astrophysical Journal, **705**: 285–297. arXiv:0810.5370.
- **Barranco, J.A.** 2009, "Three-Dimensional Simulations of Kelvin-Helmholtz Instability in Settled Dust Layers in Protoplanetary Disks." The Astrophysical Journal, **691**: 907–921. arXiv:0711.4410.
- Hartman, J. D., Gaudi, B. S., Holman, M. J., McLeod, B. A., Stanek, K. Z., **Barranco, J. A.**, Pinsonneault, M. H., Meibom, S., Kalirai, J. S., 2009, "Deep MMT Transit Survey of the Open Cluster M37. IV. Limit on the Fraction of Stars With Planets as Small as 0.3 R_J." The Astrophysical Journal, **695**:336–356. arXiv:0809.3807.
- Hartman, J.D., Gaudi, B.S., Pinsonneault, M.H., Stanek, K.Z., Holman, M.J., McLeod, B.A., Meibom, S., **Barranco, J.A.**, Kalirai, J.S., 2009, "Deep MMT Transit Survey of the Open Cluster M37. III. Stellar Rotation at 550 Myr." The Astrophysical Journal, **691**: 342–364. arXiv:0803.1488.
- Hartman, J.D., Gaudi, B.S., Holman, M.J., McLeod, B.A., Stanek, K.Z., **Barranco, J.A.**, Pinsonneault, M.H., Kalirai, J.S., 2008, "Deep MMT Transit Survey of the Open Cluster M37. II. Variable Stars." The Astrophysical Journal, **675**: 1254–1277. arXiv:0709.3484.
- Hartman, J.D., Gaudi, B.S., Holman, M.J., McLeod, B.A., Stanek, K.Z., **Barranco, J.A.**, Pinsonneault, M.H., Meibom, S., Kalirai, J.S., 2008, "Deep MMT Transit Survey of the Open Cluster M37. I. Observations and Cluster Parameters." The Astrophysical Journal, **675**: 1233-1254. arXiv:0709.3063.
- **Barranco, J.A.** & Marcus, P.S. 2006 "A 3D Spectral Anelastic Hydrodynamic Code for Shearing, Stratified Flows," Journal of Computational Physics, **219**:21–46. arXiv:astro-ph/0509063
- **Barranco, J.A.** & Marcus, P.S. 2005, "Three-Dimensional Vortices in Stratified Protoplanetary Disks," The Astrophysical Journal, **623**:1157-1170. arXiv:astro-ph/0501267
- **Barranco, J.A.**, Marcus, P.S., & Umurhan, O.M. 2000, "Scalings and Asymptotics of Coherent Vortices in Protoplanetary Disks," in *Studying Turbulence Using Numerical Simulation Databases – VIII, Proceedings of the 2000 Summer Program*, Stanford University/NASA–Ames Center for Turbulence Research, p.85–95.
- **Barranco, J.A.** & Marcus, P.S. 2000, "Vortices in Protoplanetary Disks and the Formation of Planetesimals," in *Studying Turbulence Using Numerical Simulation Databases – VIII, Proceedings of the 2000 Summer Program*, Stanford University/NASA–Ames Center for Turbulence Research, p.97–108.
- **Barranco, J.A.** & Goodman, A.A. 1998, "Coherent Dense Cores. I. NH_3 Observations," The Astrophysical Journal, **504**:207-222.
- Goodman, A.A., **Barranco, J.A.**, Wilner, D.J., & Heyer, M.H. 1998, "Coherence in Dense Cores. II. The Transition to Coherence," The Astrophysical Journal, **504**:223-246.

Teaching Experience at SFSU, August 2007–December 2019

Semester	Course	Title	Enrollment[1]	Teaching effectiveness[2]	Department average
Fall 2019	Physics 330	Analytic Mechanics I	31 (24)	1.21	1.73
Spring 2019	Physics 712	Physics of Plasmas	19 (15)	1.07	1.94
Fall 2018	Physics 330	Analytic Mechanics I	35 (28)	1.14	1.90
Spring 2018	Physics 440[3]	Computational Physics	4 (2)	1.00	1.99
	Physics 740[3]	Computational Physics	19 (16)	1.31	
Fall 2017	Physics 330	Analytic Mechanics I	19 (17)	1.12	2.04
	Astronomy 400[3]	Stellar Astrophysics	4 (4)	1.00	
	Astronomy 700[3]	Stellar Astrophysics	4 (3)	1.33	
Spring 2017	Physics 220	General Physics w/ Calculus I	72 (50)	2.36	2.00
	Physics 220	General Physics w/ Calculus I	72 (53)	2.21	
Fall 2016	Physics 330	Analytic Mechanics I	33 (25)	1.24	2.02
Spring 2016	Physics 220	General Physics w/ Calculus I	165 (120)	2.00	1.91
	Physics 440[3]	Computational Physics	14 (11)	1.36	
	Physics 740[3]	Computational Physics	13 (10)	1.10	
Fall 2015	Physics 220	General Physics w/ Calculus I	167 (130)	2.42	1.98
	Physics 330	Analytic Mechanics I	33 (24)	1.29	
Spring 2015		*Sabbatical*			
Fall 2014	Physics 220	General Physics w/ Calculus I	162 (121)	2.06	2.04
	Physics 330	Analytic Mechanics I	34 (27)	1.59	
Spring 2014	Physics 220	General Physics w/ Calculus I	127 (99)	2.00	2.10
	Physics 440[3]	Computational Physics	9 (5)	1.20	
	Physics 740[3]	Computational Physics	12 (6)	2.33	
Fall 2013	Physics 330	Analytic Mechanics I	28 (19)	1.53	1.99
Spring 2013	Astronomy 400[3]	Stellar Astrophysics	5 (2)	1.00	NR
	Astronomy 700[3]	Stellar Astrophysics	5 (5)	1.00	
	Physics 712	Physics of Plasmas	8 (8)	1.75	
Fall 2012	Physics 330	Analytic Mechanics I	29 (24)	1.50	NR
	Physics 440[3]	Computational Physics	7 (6)	1.50	
	Physics 740[3]	Computational Physics	13 (10)	1.70	
Spring 2012	Physics 220	General Physics w/ Calculus I	98 (89)	1.62	NR
	Astronomy 400[3]	Stellar Astrophysics	5 (4)	1.00	
	Astronomy 700[3]	Stellar Astrophysics	1 (1)	1.00	
Fall 2011	Physics 220	General Physics w/ Calculus I	140 (121)	1.88	NR
	Physics 330	Analytic Mechanics I	29 (25)	1.28	
Spring 2011	Astronomy 400[3]	Stellar Astrophysics	7 (7)	1.43	NR
	Astronomy 700[3]	Stellar Astrophysics	7 (6)	1.50	
	Physics 712	Physics of Plasmas	9 (7)	1.43	
Fall 2010	Physics 220	General Physics w/ Calculus I	114 (90)	1.56	NR
	Physics 330	Analytic Mechanics I	20 (17)	2.12	
Spring 2010		*Presidential Award Sabbatical*			
Fall 2009	Physics 220	General Physics w/ Calculus I	111 (91)	1.60	NR
	Physics 330	Analytic Mechanics I	20 (18)	1.67	
Spring 2009	Physics 220	General Physics w/ Calculus I	87 (73)	1.27	NR
	Physics 712	Physics of Plasmas	9 (7)	1.14	
Fall 2008	Physics 220	General Physics w/ Calculus I	107 (78)	1.64	NR
	Physics 330	Analytic Mechanics I	23 (19)	1.53	
Spring 2008	Physics 722	Astrophysics	9 (8)	2.25	NR
Fall 2007	Physics 220	General Physics w/ Calculus I	68 (50)	1.50	NR

[1] Enrollment figures are for census date. The number of student evaluations is in parentheses.

[2] Teaching effectiveness is based on Item 6 of the Student Evaluation of Teaching Effectiveness survey: "Please rate the overall effectiveness of your instructor on a scale ranging from the most positive response (highly effective) to the least positive response (ineffective)." Mean scores are reported on a scale from 1 ("highly effective") to 5 ("ineffective").

[3] Paired course. Joint lectures with differentiated assignments; graduate assignments are longer and more complex.