

Ruth Murray-Clay

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EDUCATION

University of California, Berkeley, M.A. (2004) & Ph.D. (2008)

Field: Astrophysics, Advisor: Eugene Chiang

Harvard University, A.B. *magna cum laude* (2001)

Field: Physics and Astronomy & Astrophysics, Advisor: Josh Grindlay

POSITIONS

University of California, Santa Barbara, Assistant Professor of Physics, 2014–present

Harvard University, Lecturer on Astronomy, 2010–present

Smithsonian Astrophysical Observatory, Astrophysicist, 2010–2014

Harvard University, Affiliate of the Department of Astronomy, 2013–2014

Harvard University, Institute for Theory and Computation (ITC) Postdoctoral Fellow, 2008–10

HONORS AND AWARDS (SELECTED)

2013 **Harvard University Certificate of Teaching Excellence**

2012 **Kavli Fellow, National Academy of Sciences**

2008 **Mary Elizabeth Uhl Prize for outstanding dissertation**

2008 ITC Fellowship (accepted); Hubble Fellowship, NSF Postdoctoral Fellowship, Caltech Prize Fellowship (Theory), MIT Pappalardo Fellowship, Princeton Lyman Spitzer, Jr. Fellowship, IAS Membership, CITA Postdoctoral Fellowship (all declined)

2007–08 American Association of University Women American Fellowship

2006–07 Berkeley Atmospheric Sciences Center Fellowship

2004–07 National Science Foundation Graduate Research Fellowship

2005 AAS Division on Dynamical Astronomy Student Stipend Award

STUDENTS

- Graduate advisor: Harvard graduate students

Rebekah Dawson: 5 published papers + 1 submitted from thesis; **Fireman Prize** for best Ph.D. dissertation in Astrophysics at Harvard; Currently a **Miller Fellow** at UC Berkeley

Ana-Maria Piso: 1 submitted paper; **Anjali Tripathi**

- Undergraduate advisor:

Natania Wolansky: Harvard senior thesis; **Goldberg Prize** for best senior thesis in Astronomy and Astrophysics; university-wide **Hoopes Prize** for outstanding senior thesis

Schuyler Wolff: Smithsonian Astrophysical Observatory REU; 1 published paper

Jonathan Jackson: Harvard junior project; **Harriet Lau**: visiting student

Eric Mukherjee: Caltech SURF; **Matthew Alpert**: Harvard undergrad

- Member of research exam and thesis advisory committees at Harvard (local), MIT (external)

TEACHING

- 2013 **Co-Instructor, Exoplanet Systems (Astronomy 189), Harvard**
- 2011–13 Speaker, Research Tutorial in Astrophysics (Astronomy 98), Harvard
- 2011 Organizer, summer informal order-of-magnitude practice sessions (~5 students, twice per week) and statistics book club (~10 regular participants)
- 2009 **Co-Instructor, Solar System Dynamics (Astronomy 224), Harvard**
- 2003 Graduate Student Instructor, Intro. to Astrophysics (Astronomy 7b), UC Berkeley
- 2002 Graduate Student Instructor, Intro. to General Astronomy (Astronomy 10), UC Berkeley
- 2002 Teaching Fellow, Statistical Mechanics and Thermodynamics (Physics 181), Harvard
- 2001 Teaching Fellow, Introduction to Computer Science I (Computer Science 50), Harvard

PROFESSIONAL ACTIVITIES (SELECTED)

- Invited Talks** >30 invited colloquia, seminars, and conference talks since 2006 including: Kavli Frontiers of Science (National Academy of Sciences); New Horizons in Science (joint meeting of the US, Mexican, and Canadian National Academies of Science); Caltech; Princeton; Wesleyan; JPL; MIT; IAS; Harvard CfA; Yale; UCLA; Columbia; Ohio State; U. of Arizona; Boulder; Penn State
- Committees** Annual Reviews of Astronomy and Astrophysics guest editor (2014); AAS Division on Dynamical Astronomy Committee Member (elected; 2011-2013)
- SOC** IAU Symposium 299: “Exploring the formation and evolution of planetary systems” (2013); Aspen Center for Physics Meeting: “Exoplanets in Multi-body Systems in the Kepler Era” (2013); 2012 Sagan Summer Workshop; “Signposts of Planets” Conference (2011)
- Panelist** NSF astronomy proposal review panel (2013); Hubble Fellowship selection committee (2013); NASA ROSES Origins of Solar Systems review panel (2011)
- Referee** ApJ, ApJL, A&A, MNRAS, Icarus, AJ, NASA, NSERC, CFHT
- Local Service** Harvard Astronomy Department Committee on Academic Studies; CfA Fellowship Selection Committee (2 years); ITC Fellowship Selection Committee (3 years); Harvard Graduate Admissions Committee (3 years); CfA Colloquium Committee (2 years); CfA Telescope Time Allocation Committee; ITC Visitor Committee
- Mentoring** Co-founder of a new graduate student mentoring program at Harvard; Formal mentor for undergraduate and graduate students at Berkeley and Harvard (2003-present); Talk tutorial for Harvard Graduate Women in Science and Engineering (2010)
- Outreach** Public talk “Jupiter and Mars: Gas giants, terrestrial planets, and the origins of planetary systems” at CfA Observatory Night (April 2014); Volunteer teacher in fifth-grade classrooms for Project ASTRO (2007–2008); Presenter for Compass, a program for incoming UC Berkeley undergraduates in underrepresented minorities (2007); Writer of public articles for the *Berkeley Science Review* (2004–2006); Workshop presenter for Expanding Your Horizons, a science enrichment program for middle school girls (2005, 2006)

Submitted Papers

- 2) **“The photo eccentric effect and proto-hot Jupiters III: a paucity of proto-hot Jupiters on super-eccentric orbits.”** R.I. Dawson, **R.A. Murray-Clay**, & J.A. Johnson, *Astrophys. J.*, submitted, arXiv:1211.0554
- 1) **“Minimum Core Masses for Giant Planet Formation: Understanding Equaiton of State and Opacity Effects.”** A.A. Piso, A.N. Youdin, & **R.A. Murray-Clay**, *Astrophys. J.*, submitted

Refereed Papers

- 26) **“Large Eccentricity, Low Mutual Inclination: The Three-Dimensional Architecture of a Hierarchical System of Giant Planets.”** R.I. Dawson, J.A. Johnson, D.C. Fabrycky, D. Foreman-Mackey, **R.A. Murray-Clay**, L.A. Buchave, P.A. Cargile, K.I. Clubb, B.J. Fulton, L. Hebb, A.W. Howard, D. Huber, A. Shporer, & J.A. Valenti, *Astrophys. J.*, 791, 89, 19pp. (2014)
- 25) **“A Combined Very Large Telescope and Gemini Study of the Atmosphere of the Directly Imaged Planet, β Pictoris b.”** T. Currie, A. Burrows, N. Madhusudhan, M. Fukagawa, J.H. Girard, R. Dawson, **R. Murray-Clay**, S. Kenyon, M. Kuchner, S. Matsumura, R. Jayawardhana, J. Chambers, & B. Bromley, *Astrophys. J.*, 776, 15, 19pp (2013)
- 24) **“Giant Planets Orbiting Metal-rich Stars Show Signatures of Planet-Planet Interactions.”** R.I. Dawson & **R.A. Murray-Clay**, *Astrophys. J. Letters*, 767, L24, 6pp (2013)
- 23) **“A Thermal Infrared Imaging Study of Very Low Mass, Wide-separation Brown Dwarf Companions to Upper Scorpius Stars: Constraining Circumstellar Environments.”** V. Bailey, P.M. Hinz, T. Currie, K.Y.L. Su, S. Esposito, J.M. Hill, W.F. Hoffmann, T. Jones, J. Kim, J. Leisenring, M. Meyer, **R. Murray-Clay**, M.J. Nelson, E. Pinna, A. Puglisi, G. Rieke, T. Rodigas, A. Skemer, M.F. Skrutskie, V. Vaitheeswaran, & J.C. Wilson, *Astrophys. J.*, 767, 31, 13pp (2013)
- 22) **“The Photoeccentric Effect and Proto Hot Jupiters II. KOI-1474.01, a Candidate Eccentric Planet Perturbed by an Unseen Companion.”** R.I. Dawson, J.A. Johnson, T.D. Morton, J.R. Crepp, D.C. Fabrycky, **R.A. Murray-Clay**, & A.W. Howard, *Astrophys. J.*, 761, 163, 16pp (2012)
- 21) **“Disruption of a Proto-Planetary Disk by the Black Hole at the Milky Way Centre.”** **R.A. Murray-Clay** & A. Loeb, *Nature Communications*, 3, 1049 (2012)
- 20) **“Neptune’s Wild Days: Constraints from the Eccentricity Distribution of the Classical Kuiper Belt.”** R.I. Dawson & **R.A. Murray-Clay**, *Astrophys. J.*, 750, 43, 29pp (2012)
- 19) **“Neptune on Tiptoes: Dynamical Histories that Preserve the Cold Classical Kuiper Belt.”** S. Wolff, R.I. Dawson, & **R.A. Murray-Clay**, *Astrophys. J.*, 746, 171, 16pp (2012)
- 18) **“On the Misalignment of the Directly Imaged Planet β Pictoris b with the System’s Warped Inner Disk.”** R.I. Dawson, **R.A. Murray-Clay**, & D.C. Fabrycky, *Astrophys. J. Letters*, 743, L17, 6pp (2011)

- 17) **“The Effects of Snowlines on C/O in Planetary Atmospheres.”** K.I. Öberg, **R.A. Murray-Clay**, & E.A. Bergin, *Astrophys. J. Letters*, 743, L16, 5pp (2011)
- 16) **“Resolved Submillimeter Observations of the HR 8799 and HD 107146 Debris Disks.”** A.M. Hughes, D.J. Wilner, S.M. Andrews, J.P. Williams, K.Y.L. Su, **R.A. Murray-Clay**, & C. Qi, *Astrophys. J.*, 740, 38, 9pp (2011)
- 15) **“Fragment Production and Survival in Irradiated Disks: A Comprehensive Cooling Criterion.”** K.M. Kratter & **R.A. Murray-Clay**, *Astrophys. J.*, 740, 1, 12pp (2011)
- 14) **“Wind-shearing in gaseous protoplanetary disks and the evolution of binary planetesimals.”** H.B. Perets & **R.A. Murray-Clay**, *Astrophys. J.*, 733, 56, 9pp (2011)
- 13) **“Identifying Collisional Families in the Kuiper Belt.”** R.A. Marcus, D. Ragozzine, **R.A. Murray-Clay**, & M.J. Holman, *Astrophys. J.*, 733, 40, 15pp (2011)
- 12) **“Using Kuiper Belt Binaries to Constrain Neptune’s Migration History.”** **R.A. Murray-Clay** & H.E. Schlichting, *Astrophys. J.*, 730, 132, 14pp (2011)
- 11) **“High-Contrast 3.8 Micron Imaging of the Brown Dwarf/Planet-Mass Companion to GJ 758.”** T. Currie, V. Bailey, D. Fabrycky, **R. Murray-Clay**, T. Rodigas, & P. Hinz, *Astrophys. J. Letters*, 721, L177–L181 (2010)
- 10) **“The Runts of the Litter: Why planets formed through gravitational instability can only be failed binary stars.”** K.M. Kratter, **R.A. Murray-Clay**, & A.N. Youdin, *Astrophys. J.*, 710, 1375–1386 (2010)
- 9) **“Stability of the Directly Imaged Multiplanet System HR 8799: Resonance and Masses.”** D.C. Fabrycky & **R.A. Murray-Clay**, *Astrophys. J.*, 710, 1408–1421 (2010)
- 8) **“A Super-Earth Transiting a Nearby Low-Mass Star.”** D. Charbonneau, Z.K. Berta, J. Irwin, C.J. Burke, P. Nutzman, L.A. Buchhave, C. Lovis, X. Bonfils, D.W. Latham, S. Udry, **R.A. Murray-Clay**, M.J. Holman, E.E. Falco, J.N. Winn, D. Queloz, F. Pepe, M. Mayor, X. Delfosse & T. Forveille, *Nature*, 462, 891-894 (2009)
- 7) **“Atmospheric Escape from Hot Jupiters.”** **R.A. Murray-Clay**, E.I. Chiang, & N. Murray, *Astrophys. J.*, 693, 23–42 (2009)
- 6) **“Inside-Out Evacuation of Transitional Protoplanetary Disks by the Magneto-Rotational Instability.”** E. Chiang & **R. Murray-Clay**, *Nature Physics*, 3, 604–608 (2007)
- 5) **“The Origin of the Young Stars in the Nucleus of M31.”** P. Chang, **R. Murray-Clay**, E. Chiang, & E. Quataert, *Astrophys. J.*, 668, 236–244 (2007)
- 4) **“Brownian Motion in Planetary Migration.”** **R.A. Murray-Clay** & E.I. Chiang, *Astrophys. J.*, 651, 1194–1208 (2006)
- 3) **“A Brief History of Trans-Neptunian Space.”** E. Chiang, Y. Lithwick, **R. Murray-Clay**, M. Buie, W. Grundy, & M. Holman, peer-reviewed review chapter in *Protostars and Planets V*, eds. B. Reipurth, K. Keil, & D. Jewitt (Tucson: Univ. Arizona Press), 895–909 (2006)
- 2) **“A Signature of Planetary Migration: The Origin of Asymmetric Capture in the 2:1 Resonance.”** **R.A. Murray-Clay** & E.I. Chiang, *Astrophys. J.*, 619, 623–638 (2005)

- 1) **“The Circumbinary Ring of KH 15D.”** E.I. Chiang & **R.A. Murray-Clay**, *Astrophys. J.*, 607, 913–920 (2004)

Other Publications

- 4) **“NIMBUS: the Near-infrared Multi-Band Ultraprecise Spectroimager for SOFIA.”** M.W. McElwain, A. Mandell, B. Woodgate, D.S. Spiegel, N. Madhusudhan, E. Amatucci, C. Blake, J. Budinoff, A. Burgasser, A. Burrows, M. Clampin, C. Conroy, L.D. Deming, E. Dunham, R. Foltz, Q. Gong, H. Knutson, T. Muench, **R. Murray-Clay**, H. Peabody, B. Rauscher, S. Rinehart, G. Villanueva, *Proc. SPIE*, 8446, 84467B, 14pp (2012)
- 3) **“Frontier Planets: Wide Separation Giants and Planet Formation.”** **R.A. Murray-Clay**, in *New Horizons in Astronomy: Frank N. Bash Symposium 2009*, eds. L. Stanford, J.D. Green, L. Hao, & Y. Mao, *ASP Conference Series*, 432, 98–115 (2010)
- 2) **“Balloon flight background measurement with actively-shielded planar and imaging CZT detectors.”** P.F. Bloser, T. Narita, J.A. Jenkins, M. Perrin, **R. Murray**, & J.E. Grindlay, in *X-Ray and Gamma-Ray Instrumentation for Astronomy XII*, eds. K.A. Flanagan & O.H. Siegmund, *Proc. SPIE*, 4497, 88–99 (2002)
- 1) **“Design and preliminary tests of a prototype CZT imaging array.”** T. Narita, J.E. Grindlay, J.A. Jenkins, M. Perrin, D. Marrone, **R. Murray**, & B. Connell, in *X-Ray and Gamma-Ray Instrumentation for Astronomy XII*, eds. K.A. Flanagan & O.H. Siegmund, *Proc. SPIE*, 4497, 79–87 (2002)