

# Cameron B. Hummels

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## RESEARCH INTERESTS

Galaxy formation and evolution, circumgalactic medium, stellar feedback, synthetic observations, high performance computing, visualization, open-source software

## EDUCATION

**Ph.D. Astronomy**, Columbia University, July 2012

*Thesis*: “Comparing Simulations and Observations of Galaxy Evolution: Methods for Constraining the Nature of Stellar Feedback”

*Advisors*: Dr. Greg Bryan, Dr. David Schiminovich

**M.A. Astronomy**, Wesleyan University, 2005

*Thesis*: “Effects of Dynamical Friction on the Sagittarius Dwarf Galaxy”

*Advisor*: Dr. Kathryn Johnston

**B.A. Computer Science**, Pomona College, 2001

## RESEARCH EXPERIENCE

**National Science Foundation Postdoctoral Fellow**, Caltech, 2015 - present

*Sponsor*: Phil Hopkins

**Postdoctoral Researcher**, University of Arizona, 2012 - 2015

*Sponsor*: Brant Robertson

**Graduate Research Fellow**, Columbia University 2005 - 2012

**Graduate Research Fellow**, Wesleyan University 2003 - 2005

**Research Assistant**, University of Virginia, 2001 - 2003

*Supervisor*: Steve Majewski

## GRANTS AND AWARDS

**Astronomy and Astrophysics Postdoctoral Fellowship**, NSF, 2015 - 2018

**Caltech Astronomy Citizenship Award**, 2016

**Principle Investigator**, Hubble Space Telescope Theory Grant, 2014

“The COS Cold Absorber Puzzle: Understanding the Metallicity and Phase of the Circumgalactic Medium”, Cycle 22, AR 13917, \$112,000

**Co-Investigator (Funded)**, Hubble Space Telescope Theory Grant, 2014

“MAST Interface to Synthetic Telescopes with yt MISTY: Observing Simulations of the Intergalactic Medium”, Cycle 22, AR 13919, *PI*: Molly Peeples, \$115,000

**Principle Investigator**, XSEDE Allocation, 2013 - present

“The Effects of Stellar Feedback and Gas Accretion on the Evolution of Galaxies”, TG-AST140018, 1,700,000 SUs

**Co-Investigator**, Blue Waters Allocation, 2015 - present

“Petascale adaptive mesh simulations of Milky Way-type galaxies and their environments”, 100,000,000 SUs, *PI*: Brian O’Shea

**Awardee**, Columbia Astronomy APPLAUSE Award (best public talk), 2009

**Astronomy Ambassador to New York City & State**, NASA IYA, 2009

- COMPUTING**
- Core Developer**, TRIDENT Synthetic Observation Generator, 2014 - present  
Primary developer; focus on creating core infrastructure
  - Core Developer**, YT Analysis Suite, 2010 - present  
Designed volume rendering infrastructure; halo tracking and analysis; synthetic observation generation; documentation; long-term planning and community
  - Developer**, ENZO Hydrodynamics Code, 2007 - present  
Designed/modified feedback models; refinement criteria; performance modules
  - High Performance Computing**, NCSA, TACC, NICS, 2007 - present  
Coding, operating, optimizing on NCSA BlueWaters; TACC Stampede & Ranch; NICS Kraken & Nautilus; & NERSC Edison
- OBSERVING**
- Observer**, GALEX Arecibo SDSS Survey, 2009 - 2012  
Over 100 hours of observation and reduction of Arecibo HI data
  - Designer & Observer**, TLP Synoptic Survey, 2007 - 2008  
Constructed and remotely operated TLP optical telescope at Cerro Tololo
  - Observer**, Kitt Peak 36", 2005  
Over 30 hours of photometric observation on KPNO 36" telescope of SN Ia
  - Observer**, Grid Giant Star Survey, 2001 - 2003  
Over 150 hours of observation on Las Campanas Swope optical telescope
- TEACHING & OUTREACH**
- Director, Organizer, & Lecturer**, Public Outreach, Caltech Astro, 2015 - present  
Oversaw all aspects of planning and executing ~40 outreach events (~6000 attendees) / year: stargazing, lectures, Astronomy on Tap, sidewalk astronomy.
  - Organizer**, Week of Astronomy, Pasadena City of Astronomy, 2016  
Oversaw planning and executing city-wide astronomy festival (~2000 attendees) with science demos, observing, and Astronomy on Tap
  - Astronomy Ambassador**, American Astronomical Society, 2014 - present  
AAS Outreach representative at U. Arizona and Caltech
  - Director, Organizer, & Lecturer**, Public Outreach, Columbia Astro, 2005 - 2012  
Oversaw all aspects of planning and executing ~40 outreach events (~5000 attendees) / year: stargazing, lectures, Astronomy on Tap, sidewalk astronomy.
  - Mentor & Organizer**, Rooftop Variables, Columbia University, 2008 - 2012  
Mentored Scott Misner, 8th grade teacher at Isaac Young Middle School, and his class in astronomy education, telescope and CCD usage
  - Founder & Organizer**, Astrophoto Exhibition, Columbia University, 2009  
Planned and hosted *From Earth to the Universe* photography exhibit on Columbia's campus for two weeks with 10,000+ attendees
  - Organizer**, 365 Days of Astronomy Podcast Submission, 2009  
Planned and recorded 16 5-10 minute educational podcasts for 365DOA
  - Lab Instructor**, Columbia University, 2005 - 2008
    - Astronomy 1403: "Earth, Moon & Planets"
    - Astronomy 1404: "Beyond the Solar System"
  - Mentor**, Project ASTRO, Middletown, CT, 2004 - 2005  
Partnered with local teachers to facilitate an Astronomy curriculum for 5th and 6th grade classes

**SELECTED  
RESEARCH  
TALKS**

- Colloquium, UC-San Diego, November 2017, *Invited Talk*
- Colloquium, Carnegie Institute, October 2017, *Invited Talk*
- ExSoCal, Caltech, September 2017, *Invited Talk*
- Galaxies and their Halos, Caltech, September 2017, *Co-Organizer*
- Galaxy Workshop, UC-Santa Cruz, August 2017, *Contributed Talk*
- What Matters in Galaxies, Durham UK, June 2017, *Contributed Talk*
- Colloquium, New Mexico State University, April 2017, *Invited Talk*
- AAS and NSF Symposium, Grapevine Texas, January 2017, *Contributed Talk*
- Center for Computational Astrophysics Seminar, December 2016, *Invited Talk*
- Harvard ITC Seminar, May 2016
- Astronomy Seminar, Carnegie Institute, May 2016, *Invited Talk*
- Python in Astronomy Workshop, U. Washington, March 2016, *Contributed Talk*
- IMPS Workshop, UC Santa Cruz, February 2016, *Contributed Talk*
- CCAPP Seminar, Ohio State, December 2015, *Invited Talk*
- Colloquium, Pomona College, November 2015, *Invited Talk*
- Mocking the Universe, STSci, July 2015, *Contributed Talk*
- Theory Colloquium, U. Arizona, February 2015, *Invited Talk*
- IMPS Seminar, UC Santa Cruz, January 2015, *Invited Talk*
- Santa Cruz Galaxy Workshop, UC Santa Cruz, August 2014
- KITP Stellar Feedback Program, UC Santa Barbara, May 2014, *Invited Talk*
- Circumgalactic Medium Workshop, Notre Dame, January 2014, *Invited Talk*
- IMPS Talk, UC Santa Cruz, March 2013, *Invited Talk*
- Jerusalem Winter School in Theoretical Physics, Hebrew Univ., January 2013
- Astrophysics Seminar, Georgia Tech, February 2012, *Invited Talk*
- yt Users Workshop, U. Chicago, January 2012, *SOC*
- Astrophysics Seminar, U. Chicago, January 2012
- Astronomy Seminar, McMaster, Canada, January 2012, *Invited Talk*
- AAS Meeting, Austin, January 2012, Dissertation Talk
- Enzo Developers Workshop, Columbia, October 2011, *Contributed Talk*
- Enzo Users & Developers Workshop, UC San Diego, June 2010, *Contributed Talk*
- Communicating Astronomy with the Public, South Africa, March 2010, *Contributed Talk*
- AAS Meeting, Washington DC, January 2010, *Contributed Talk*
- Astronomy Society of New York Meeting, Hofstra, April 2007, *Contributed Talk*

**SELECTED  
PUBLIC  
TALKS**

“Understanding the Sun, Moon, and the Great American Eclipse”, Caltech Outreach, August 2017  
“Simulating the Universe on a Supercomputer”, Caltech Outreach, July 2016  
“How the universe is trying to kill us”, Caltech Reel Science, Feb 2016  
“The Moon: Formation, Exploration, and Habitation”, Pima CC, March 2015  
“The Moon: Formation, Exploration, and Habitation”, U. Arizona, February 2014  
“Adventures in Astronomy: From our Galaxy to the Edge of the Universe”, Phoenix ComicCon, May 2013  
“The Immortal Quantum: Following Energy in the Universe”, Columbia, May 2012  
“Will the World End in 2012?”, Amateur Astronomers Inc., January 2010  
“Will the World End in 2012?”, Columbia, December 2009  
“Will the World End in 2012?”, NY Skies, July 2009  
“Moon Miscellany: An intro to our closest companion”, Columbia, February 2008

**STUDENTS  
CO-ADVISED  
W/ PHIL  
HOPKINS**

**2017:** Brandon Dimas (Pasadena HS)  
Creation of James Webb Space Telescope color palette and images from FIRE sims  
**2016:** Charles Watson (VURP), Gefei Dang (SURF), Rafael Fueyo-Gomez (SURF)  
Visualization of simulated datasets with automated construction of camera paths

**GUEST  
TEACHING**

“LSST Data Science Fellowship Program”, Lecturer, 7 hours, NOAO, April 2017  
“Evolution and Dynamics of CGM and IGM”, Caltech, G. Djorgovsky, March 2017  
“Holograms and Nonlinear Optics”, Caltech, P. Hopkins, November 2016  
“The Inter- and Circum-Galactic Media”, Caltech, S. Kulkarni, March 2016  
“Transients on the Lunar Surface”, U. Arizona, E. Olszewski, April 2015  
“Preparing and Writing Winning Proposals”, U. Arizona, G. Besla, April 2015  
“How do Galaxies Evolve”, Tohono O’odham CC, K. Garmany, November 2014  
“How do Galaxies Evolve”, Dalton School, April 2012

**SUMMER &  
WINTER  
SCHOOLS**

“*Gravity’s Loyal Opposition, The Physics of Star Formation and Feedback*”, KITP, Santa Barbara, May-June 2014  
*Winter School on Galaxy Evolution*, Hebrew University, Jerusalem, 2013  
*Scicoder Workshop*, NYU, New York, June, 2011  
*Local Group Cosmology*, Tenerife, Spain, November, 2008  
*Scientific Writing and Speaking* Columbia University, New York, July, 2007  
*MODEST School on Numerical N-Body Dynamics*, Strasbourg, France, March 2004

**ACADEMIC  
SERVICE &  
MEMBERSHIP**

**Co-chair and SOC**, Galaxies and their Halos Conference, Caltech, September 2017  
**Review Panel Member**, NASA, 2016 - present  
**Review Panel Member**, National Science Foundation, 2014 - present  
**Referee**, Monthly Notices of the Royal Astronomical Society, 2013 - present  
**Member**, American Astronomical Society, 2003 - present

## PUBLICATIONS

1. “TRIDENT: a universal tool for generating synthetic absorption spectra from astrophysical simulations”,  
**Hummels, C.**; Smith, B.; Silvia, D.; *The Astrophysical Journal*, 847, 59 (2017)
2. “GRACKLE: a Chemistry and Cooling Library for Astrophysics”,  
Smith, B. et al. (including **Hummels, C.**), *Monthly Notices of the Royal Astronomical Society*, 466, 2217 (2017)
3. “FIRE-2 Simulations: Physics versus Numerics in Galaxy Formation”,  
Hopkins, P. et al. (including **Hummels, C.**), *eprint arXiv:1702.06148* (2017)
4. “The AGORA High-Resolution Galaxy Simulations Comparison Project. II: Isolated Disk Test”  
Kim, J. et al. (including **Hummels, C.**), *The Astrophysical Journal*, 833, 202 (2016)
5. “The *Astropy* Problem”  
Muna, D. et al. (including **Hummels, C.**), *eprint arXiv:1610.03159* (2016)
6. “Kinetic energy from supernova feedback in high-resolution galaxy simulations”,  
Simpson, C., Bryan, G., **Hummels, C.**, & Ostriker, J., *The Astrophysical Journal*, 809, 69 (2015)
7. “Cosmological simulations of galaxy formation with cosmic rays”,  
Salem, M., Bryan, G. L., & **Hummels, C.**, *The Astrophysical Journal Letters*, 797, L18 (2014)
8. “ENZO: an adaptive mesh refinement code for astrophysics”,  
Bryan, G. et al. (including **Hummels, C.**), *Astrophysical Journal Supplements*, 211, 19 (2014)
9. “The AGORA high-resolution galaxy simulations comparison project”,  
Kim, J. et al. (including **Hummels, C.**), *Astrophysical Journal Supplements*, 210, 14 (2014)
10. “The GALEX Arecibo SDSS Survey - VIII. Final data release. The effect of group environment on the gas content of massive galaxies”,  
Catinella, B.; Schiminovich, D.; Cortese, L.; Fabello, S.; **Hummels, C.**; et al., *Monthly Notices of the Royal Astronomical Society*, 436, 34 (2014)
11. “Constraints on hydrodynamical subgrid models from quasar absorption line studies of the simulated circumgalactic medium”,  
**Hummels, C.**; Bryan, G.; Smith, B.; and Turk, M., *Monthly Notices of the Royal Astronomical Society*, 430, 1548 (2013)
12. “The GALEX Arecibo SDSS Survey. VI. Second data release and updated gas fraction scaling relations”,  
Catinella, B.; Schiminovich, D.; Kauffmann, G.; Fabello, S.; **Hummels, C.**; et al., *Astronomy & Astrophysics*, 544, A65 (2012)
13. “Adaptive mesh refinement simulations of galaxy formation: exploring numerical and physical parameters”,  
**Hummels, C.**; Bryan, G., *Astrophysical Journal*, 749, 140 (2012)
14. “The GALEX Arecibo SDSS Survey - IV. Baryonic mass-velocity-size relations of massive galaxies”,  
Catinella, B. et al. (including **Hummels, C.**), *Monthly Notices of the Royal Astronomical Society*, 420, 1959 (2012)

**PUBLICATIONS  
(CONTINUED)**

15. "The GALEX Arecibo SDSS Survey. V. The Relation between the H I Content of Galaxies and Metal Enrichment at Their Outskirts",  
Moran, S. et al. (including **Hummels, C.**), *Astrophysical Journal*, 745, 66 (2012)
16. "The GALEX Arecibo SDSS Survey - II. The star formation efficiency of massive galaxies",  
Schiminovich, D. et al. (including **Hummels, C.**), *Monthly Notices of the Royal Astronomical Society*, 408, 919 (2010)
17. "The GALEX Arecibo SDSS Survey - I. Gas fraction scaling relations of massive galaxies and first data release",  
Catinella, B. et al. (including **Hummels, C.**), *Monthly Notices of the Royal Astronomical Society*, 403, 683 (2010)
18. "Lunar outgassing, transient phenomena, and the return to the moon. II. predictions and tests for outgassing/regolith interactions",  
Crotts, A. & **Hummels, C.**, *Astrophysical Journal*, 707, 1506 (2009)
19. "A two micron all sky survey view of the Sagittarius Dwarf Galaxy. II. Swope Telescope spectroscopy of M giant stars in the dynamically cold Sagittarius Tidal Stream",  
Majewski, S. et al. (including **Hummels, C.**), *Astronomical Journal*, 128, 245 (2004)
20. "Exploring halo substructure with giant stars. III. first results from the Grid Giant Star Survey and discovery of a possible nearby Sagittarius tidal structure in Virgo",  
Kundu, A. et al. (including **Hummels, C.**), *Astrophysical Journal Letters*, 576, L125 (2002)

**REFERENCES**

**Dr. Phil Hopkins**

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California Institute of Technology  
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**Dr. Jason X. Prochaska**

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