

## Charles W. Danforth

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### Education

- Ph.D. 2003    **Johns Hopkins University**  
Dept. of Physics and Astronomy, Baltimore, MD  
Thesis: “*Interstellar Matter Kinematics in the Magellanic Clouds*”  
Advisor: Dr. William P. Blair
- M.A. 2000    **Johns Hopkins University**  
Dept. of Physics and Astronomy, Baltimore, MD
- B.A. 1995    **Swarthmore College** Swarthmore, PA.  
Major: Astrophysics

### Astrophysical Research

#### Postdoctoral and Senior Research Associate (2003-present)

Center for Astrophysics and Space Astronomy, University of Colorado

Astrophysical research on observational cosmology, quasar absorption-line systems, the “missing baryon problem”, structure and physics of active galaxies, the ionizing metagalactic radiation field, and the connection between galaxies/large scale structure and the gaseous intergalactic medium. Member of the Hubble Space Telescope Cosmic Origins Spectrograph Science Team. Extensive collaboration with numerical cosmologists and X-ray astronomers. Research mentor for several graduate and undergraduate students on related research projects.

### Science Education

#### Instructor (2012–present)

Dept. of Astrophysics & Planetary Science, University of Colorado

Instructor for a full spectrum of introductory, university-level, non-majors astronomy courses on solar system and planetary science, stellar and galactic astronomy, and cosmology. Continuously ranked 5/6 in Course Overall and 5.4/6 in Instructor Overall student course evaluations.

“*The Solar System*” ASTR1000/1010; Fall semesters 2014-2016.

Two sections of 150-200 students, 3-4 credit hours. Observational astronomy, the scientific method, solar system dynamics, and other phenomena. The course is a core science curriculum class designed as the first in a sequence of astronomy classes for non-majors and stresses critical thinking skills, peer instruction, and hands-on experience in the planetarium and at the campus observatory. Extensive lab planning and coordination of graduate and undergraduate teaching assistants.

“*Stars and Galaxies*” ASTR1020/1200; Spring semesters 2015-2017.

Two sections of 100-200 students, 3-4 credit hours. The second half of the introductory astronomy sequence: the Sun, stellar structure, processes, and life cycle; galactic structure and dynamics; large-scale structure, cosmology, and the Big Bang. Utilized extensive peer-instruction, hands-on experience in the planetarium and at the campus observatory, independent projects.

“*Modern Cosmology*” Astro2010; Spring 2012 & Spring 2014.

Introduction to Cosmology, scientific reasoning, and the frontiers of astrophysics. Astro-2010 is a 3-credit-hour Undergraduate Core Curriculum class with a typical enrollment of ~ 75 undergraduate non-majors.

**Undergraduate Research Advisor**, University of Colorado (2006–present)

- Cameron Pratt (2016–2017).  
Spread of metals into the Low-redshift Intergalactic Medium (honors thesis)  
Pratt et al. 2018, ApJ, submitted.
- Shannon Osborne (2016–2017).  
Determining the temperatures of HI+OVI IGM absorption systems (honors thesis)
- Julie Davis (2013–2015, now U. Wisconsin, Madison, graduate student).  
Analysis of absorption and galaxy populations along blazar sight lines (honors thesis)  
Publications: Davis et al. 2015 ApJ, 810, 92
- Matthew Stevans (2009–2013, now University of Texas graduate student).  
Ionization and metallicity of high-velocity clouds; composite spectrum of UV-bright active galactic nuclei. Publications: Shull et al. 2010, 2012; Stevans et al. 2014
- Teresa Ross (2008–2009, Ph.D. from New Mexico State University 2015).  
Quasar absorption line survey of metal absorbers in the intergalactic medium.

**Graduate Research Advisor**, University of Colorado (2011–present)

- Evan Tilton (2011–2016).  
Creating a consensus catalog of intergalactic absorption systems in HST and FUSE spectra.  
Supermassive black hole mass measurements using emission line properties of active galaxies.  
Publications: Tilton et al. 2012, ApJ, 759, 112.; Danforth et al. 2016, ApJ 817, 111
- Brennan Gantner (2011–2012).  
A detailed study of absorber-galaxy statistics in the Great Wall. Publications: Gantner Ph.D. thesis

**Notable Grants, Collaborations, & Observational Experience**

- PI: “*Resolving the Circum-Nuclear Structure of the Canonical Radio Galaxy M87*”, **Hubble Space Telescope** guest observer program (2016, \$75k)
- Co-PI: “*Hot Gas in Spiral-Rich Galaxy Groups*” HST guest observer program (2015, \$250k)
- Co-PI: “*Accretion Physics in Nearby FRI Galaxies*” HST guest observer program (2013, \$50k)
- Co-PI: “*Probing Weak Intergalactic Absorption with Flaring Blazar Spectra*” HST target-of-opportunity programs (2011, \$90k; 2012, \$120k)
- PI: “*Exploring the Galactic Damped Ly $\alpha$  Absorber with Antipodal Sight Lines*” HST Archival program (2011, \$120k).
- Co-PI: “*Probing the WHIM using Weak, Distributed Metal Absorption*” HST Cy19 Archival program (2011, \$37k)
- PI of three **Far Ultraviolet Spectroscopic Explorer** programs (2003-2008, \$100k in total). Co-I on numerous others
- PI of two successful **Spitzer Space Telescope** imaging proposals (2007-2009, \$158k in total)
- Co-I on three **Chandra X-ray Observatory** programs (2009-2011)
- **Cosmic Origins Spectrograph Science Team** (2009-2013)
- HST / Servicing Mission 4 Early Release Observations Team (2009-2010)
- Ground-based observing experience at Kitt Peak National Observatory and Cerro Tololo Inter-American Observatory and numerous university-level telescopes

## Professional Service & Recognition

### Invited Colloquia

- University of Massachusetts, Lowell (2015)
- Ohio University (2013)
- Texas A&M University (2013)
- Harvard/CfA Center for Theory and Computation (2011)
- KIPAC/Stanford University (2010)

### Invited Conference Talks

- *Results from a Large IGM Survey with HST*, U. Notre Dame (2014)
- *Nearfield Cosmology from HST/COS*, Intergalactic Interactions, Edinburgh, UK (2013)
- *What are IGM Absorbers?*, Summer CGM-Galaxy Interface Workshop, Leiden, NL (2013)
- *Tracing WHIM with HST/COS*, Cosmic Odyssey of the Baryons, Marseille, FR (2011)
- *Actually Detecting the WHIM with UV Absorbers*, HEAD, Waikalua, HI (2010)
- *Metals in the Low-z IGM*, Chemical Enrichment Across Cosmic Time, Leiden, NL (2009)
- *Finding the Missing Baryons*, Future of UV Spectroscopy, Annapolis, MD (2008)

### Professional Service & Public Outreach Activities

- Interim Director of Sommers-Bausch Observatory, Boulder, CO (Fall 2017)
- Committee Member for six U. Colorado grad students' Comprehensive exams
- Panel Member on several NASA proposal reviews
- Referee for numerous articles in ApJ, MNRAS, A&A, PASP.
- American Astronomical Society oral session chair at numerous general meetings
- *Should I Go to Grad School?*, Beyond Boulder (STEM Career Development Series)
- *A Diet in the Details?* Secular Students and Skeptics Society
- Friday Night Open Houses, Sommers-Bauch Observatory, Colorado

## Professional References

- **J. Michael Shull**, University of Colorado,  
Boulder, CO 80309, [mshull@casa.colorado.edu](mailto:mshull@casa.colorado.edu)
- **John T. Stocke**, University of Colorado,  
Boulder, CO 80309, [stocke@casa.colorado.edu](mailto:stocke@casa.colorado.edu)
- **Crystal Martin**, University of California Santa Barbara,  
Santa Barbara, CA 93106, [cmartin@physics.ucsb.edu](mailto:cmartin@physics.ucsb.edu)
- **James C. Green**, University of Colorado  
Boulder, CO 80303, [james.green@colorado.edu](mailto:james.green@colorado.edu)
- **Eric Perlman**, Florida Institute of Technology  
Melbourne, FL 32901, [eperlman@fit.edu](mailto:eperlman@fit.edu)

## Publications

First-author papers (refereed): 15	H-index: 13
Total papers (refereed): 72	H-index: 27

### First-author Publications

- *Far-UV Emission Properties of FRI Radio Galaxies*  
Danforth, Stocke, France, Begelman, & Perlman 2016 ApJ, 832, 76
- *An HST/COS Survey of the Low-redshift IGM. I. Survey, Methodology, and Overall Results*  
Danforth, Keeney, Tilton, Shull, Stocke, Stevans, et al. 2016 ApJ, 817, 111
- *A Fast Flare and Direct Redshift Constraint in Far-UV Spectra of the Blazar S5 0716+714*  
Danforth, Nalewajko, France, & Keeney 2013 ApJ, 764, 57
- *An HST/COS Search for Warm-Hot Baryons in the Mrk 421 Sight Line*  
Danforth, Stocke, Keeney, Penton, Shull, Yao, & Green 2011 ApJ, 743, 18
- *Hubble/COS Observations of the Ly $\alpha$  Forest Toward the BL Lac Object IES 1553+113*  
Danforth, Keeney, Stocke, Shull, & Yao 2010 ApJ, 720, 976
- *Broad HI Absorbers as Metallicity-independent Tracers of the Warm-Hot IGM*  
Danforth, Stocke, & Shull 2010 ApJ, 710, 613
- *The Low-redshift Intergalactic Medium. III. H I and Metal Absorbers at  $z < 0.4$*   
Danforth & Shull 2008 ApJ, 679, 194
- *Possible Detection of OVI from the LMC Superbubble N70*  
Danforth & Blair 2006 ApJ, 646, 205
- *The Low-redshift Intergalactic Medium. II. Ly $\beta$ , O VI, and C III Forest*  
Danforth, Shull, Rosenberg, & Stocke 2006 ApJ, 640, 716
- *The Low-redshift Intergalactic Medium. I. O VI Baryon Census*  
Danforth & Shull 2005 ApJ, 624, 555
- *Far-UV and Ha Spectroscopy of SNR 0057–7226 in the SMC H II Region N66*  
Danforth, Sankrit, Blair, Howk, & Chu 2003 ApJ, 586, 1179
- *An Atlas of Far Ultraviolet Spectroscopic Explorer Sight Lines toward the Magellanic Clouds*  
Danforth, Howk, Fullerton, Blair, & Sembach 2002 ApJS, 139, 81
- *A Detailed Analysis of a Cygnus Loop Shock-Cloud Interaction*  
Danforth, Blair, & Raymond 2001 AJ, 122, 938
- *The ISM Interactions of a Runaway Luminous Blue Variable Nebula in the LMC*  
Danforth & Chu 2001 ApJ, 552, L155
- *A Comparison of UV, Optical, and X-Ray Imagery of Selected Fields in the Cygnus Loop*  
Danforth, Cornett, Levenson, Blair, & Stecher 2000 AJ, 119, 2319
- *Acoustic Applications of Phased Array Technology*  
Danforth 2000 Bulletin of the Royal Acoustical Society, 25:6, 9

## Co-author Publications

- *The Dispersion of Fast Radio Bursts from a Structured IGM at  $z < 1.5$*   
Shull & **Danforth** 2018, ApJ, in press (arXiv:1712.01280)
- *The Spread of Metals into the Low-Redshift Intergalactic Medium*  
Pratt, Stocke, Keeney, & **Danforth** 2018, ApJ, submitted (arXiv:1706.05103)
- *Agnostic Stacking of Intergalactic Doublet Absorption: Measuring the Ne VIII Population*  
Frank, Pieri, Mathur, **Danforth**, & Shull 2017, arXiv:1710.05023
- *An Ultraviolet Survey of Low-redshift Partial Lyman-limit Systems with HST/COS*  
Shull, **Danforth**, Tilton, Moloney, & Stevans 2017, ApJ, 849, 106
- *Characterizing the Circumgalactic Medium of Nearby Galaxies with HST/COS and HST/STIS Absorption-line Spectroscopy: II. Methods and Models*  
Keeney, Stocke, **Danforth**, Shull, Pratt, Froning, Green, Penton, & Savage 2017 ApJS, submitted
- *The Warm Circum-Galactic Medium:  $10^{5-6}$  K Gas Associated with a Single Galaxy Halo or with an Entire Group of Galaxies?*  
Stocke, Keeney, **Danforth**, Oppenheimer, Pratt, & Berlind 2017 ApJ, accepted (arXiv:1702.08554)
- *HST/COS Observations of AGNs. III. Spectral Constraints in the Lyman Continuum from Composite COS/G140L Data*  
Tilton, Stevans, Shull, & **Danforth** 2016 ApJ, 817, 56
- *The Metagalactic Ionizing Background: A Crisis in UV Photon Production or Incorrect Galaxy Escape Fractions?*  
Shull, Moloney, **Danforth**, & Tilton 2015 ApJ, 811, 3
- *On the Size and Mass of Photoionized Clouds in Extended Spiral Galaxy Halos*  
Davis, Keeney, **Danforth**, & Stocke 2015 ApJ, 810, 92
- *A Detection of Gas Associated with the M31 Stellar Stream*  
Koch, **Danforth**, Rich, Ibata, & Keeney 2015 ApJ, 807, 153
- *Ultraviolet ISM Diagnostics for Star-forming Galaxies. I. Tracers of Metallicity and Extinction*  
Zetterlund, Levesque, Leitherer, & **Danforth** 2015 ApJ, 805, 151
- *The Ly $\alpha$  Line Profiles of Ultraluminous Infrared Galaxies: Fast Winds and Lyman Continuum Leakage*, Martin, Dijkstra, Henry, Soto, **Danforth**, & Wong 2015 ApJ, 803, 6
- *Tracing the Cosmic Metal Evolution in the Low-redshift Intergalactic Medium*  
Shull, **Danforth**, & Tilton 2014 ApJ, 796, 49
- *An HST/COS Observation of Broad Ly $\alpha$  Emission and Associated Absorption Lines of the BL Lacertae Object H 2356–309*  
Fang, **Danforth**, Buote, Stocke, Shull, Canizares, & Gastaldello 2014 ApJ, 795, 57
- *Updated Models for the Creation of a Low- $z$  QSO Absorber by a Dwarf Galaxy Wind*  
Keeney, Joeris, Stocke, **Danforth**, & Levesque 2014 AJ, 148, 103
- *HST/COS Observations of AGN. II. Extended Survey of UV Composite Spectra from 159 AGN*  
Stevans, Shull, **Danforth**, & Tilton 2014 ApJ, 794, 75

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- *Absorption-line Detections of  $10^5$ - $10^6$ K Gas in Spiral-rich Groups of Galaxies*  
Stocke, Keeney, **Danforth**, Syphers, Yamamoto, Shull, Green, Froning, Savage, Wakker, Kim, Ryan-Weber, & Kacprzak 2014 ApJ, 791, 128
  - *The Photon Underproduction Crisis*  
Kollmeier, Weinberg, Oppenheimer, Haardt, Katz, Dav' e, Fardal, Madau, **Danforth**, Ford, Peebles, & McEwen 2014 ApJ, 789, L32
  - *UV characteristics, outflow properties and variability of AGN Mrk 1513*  
Tofany, Winter, Borguet, Edmonds, **Danforth**, Green, & Arav 2014 MNRAS, 439, 3649
  - *Quasar outflows and AGN feedback in the EUV: COS observations of HE 0238–1904*  
Arav, Borguet, Chamberlain, Edmonds, & **Danforth** 2013 MNRAS, 436, 3286
  - *Chandra View of the Warm-Hot IGM toward IES 1553+113: Absorption-line Detections*  
Nicastro, Elvis, Krongold, Mathur, Gupta, **Danforth**, Barcons, Borgani, Branchini, Cen, Dav' e, Kaastra, Paerels, Piro, Shull, Takei, & Zappacosta 2013 ApJ, 769, 90
  - *The Firm Redshift Lower Limit of the Most Distant TeV-detected Blazar PKS 1424+240*  
Furniss, Williams, **Danforth**, Fumagalli, Prochaska, Primack, Urry, Stocke, Filippenko, & Neely 2013 ApJ, 768, L31
  - *On the Redshift of the Very High Energy Blazar 3C 66A*  
Furniss, Fumagalli, **Danforth**, Williams, & Prochaska 2013 ApJ, 766, 35
  - *HST/COS Spectra of Three QSOs That Probe the CGM of a Single Spiral Galaxy: Evidence for Gas Recycling*, Keeney, Stocke, Rosenberg, **Danforth**, Ryan-Weber, Shull, Savage, & Green 2013 ApJ, 765, 27
  - *Characterizing the Circumgalactic Medium of Nearby Galaxies with HST Absorption Spectra*  
Stocke, Keeney, **Danforth**, Shull, Froning, Green, Penton, & Savage 2013 ApJ, 763, 148
  - *The Low-z IGM as Seen in Archival Legacy HST/STIS and FUSE Data*  
Tilton, **Danforth**, Shull, & Ross 2012 ApJ, 759, 112
  - *The Baryon Census in a Multiphase IGM: 30% of the Baryons May Still be Missing*  
Shull, Smith, & **Danforth** 2012 ApJ, 759, 23
  - *On the Significance of Absorption Features in HST/COS Data*  
Keeney, **Danforth**, Stocke, France, & Green 2012 PASP, 124, 830
  - *Identifying the Baryons in a Multiphase Intergalactic Medium*  
Shull & **Danforth** 2012 arXiv:1208.3249
  - *HST/COS AGNs. I. UV Composite Spectra of the Ionizing Continuum and Emission Lines*  
Shull, Stevans, & **Danforth** 2012 ApJ, 752, 162
  - *The Cosmic Origins Spectrograph*  
Green, Froning, Osterman, Ebbets, Heap, Leitherer, Linsky, Savage, Sembach, Shull, Siegmund, Snow, Spencer, Stern, Stocke, Welsh, B' eland, Burgh, **Danforth**, France, Keeney, McPhate, Penton, Andrews, Brownsberger, Morse, & Wilkinson 2012 ApJ, 744, 60
  - *Multiwavelength Observations of A0620–00 in Quiescence*  
Froning, Cantrell, Maccarone, France, Khargharia, Winter, Robinson, Hynes, Broderick, Markoff, Torres, Garcia, Bailyn, Prochaska, Werk, Thom, Beland, **Danforth**, Keeney, & Green 2011 ApJ, 743, 26

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- *HST/COS Observations of Galactic HVCs: Four AGN Sight Lines through Complex C*  
Shull, Stevans, **Danforth**, Penton, Lockman, & Arav 2011 ApJ, 739, 105
  - *Broad Ly $\alpha$  Emission from Three Nearby BL Lacertae Objects*  
Stoche, **Danforth**, & Perlman 2011 ApJ, 732, 113
  - *Multiple Absorption-line Spectroscopy of the Intergalactic Medium. I. Model*  
Yao, Shull, **Danforth**, Keeney, & Stoche 2011 ApJ, 730, 143
  - *HST/COS Detection of Ne VIII Tracing Warm-Hot Gas Toward PKS 0405–123*  
Narayanan, Savage, Wakker, **Danforth**, Yao, Keeney, Shull, Sembach, Froning, & Green 2011 ApJ, 730, 15
  - *A High-metallicity, HVC Along the Mrk421 Sight Line: A Tracer of Complex M?*  
Yao, Shull, & **Danforth** 2011 ApJ, 728, L16
  - *Ultraviolet and X-ray Variability of the Seyfert 1.5 Galaxy Mrk 817*  
Winter, **Danforth**, Vasudevan, Brandt, Scott, Froning, Keeney, Shull, Penton, Mushotzky, Schneider, & Arav 2011 ApJ, 728, 28
  - *The Quasar/Galaxy Pair PKS 1327–206/ESO 1327–2041: Absorption Associated with a Recent Galaxy Merger*  
Keeney, Stoche, **Danforth**, & Carilli 2011 AJ, 141, 66
  - *HST/COS Observations of the Quasar HE 2347–4342: Probing the Epoch of He II Patchy Reionization at Redshifts  $z=2.4-2.9$*   
Shull, France, **Danforth**, Smith, & Tumlinson 2010 ApJ, 722, 1312
  - *Cosmic Origins Spectrograph Observations of Translucent Clouds: Cyg OB2 8A*  
Snow, Destree, Burgh, Ferguson, **Danforth**, & Cordiner 2010 ApJ, 720, L190
  - *A Direct Detection of Gas Accretion: The Lyman Limit System in 3C 232*  
Stoche, Keeney, & **Danforth** 2010 PASA, 27, 256
  - *FUSE observations in Magellanic Clouds*, Blair, Oliveira, Lamassa, Gutman, Danforth, Fullerton, Sankrit, & Gruendl 2010 yCat, 612, 10634
  - *Cosmic Origins Spectrograph Observations of the Chemical Composition of SNR LMC N132D*  
France, Beasley, Keeney, **Danforth**, Froning, Green, & Shull 2009 ApJ, 707, L27
  - *A Large Reservoir of Ionized Gas in the Galactic Halo: Ionized Silicon in High-Velocity and Intermediate-Velocity Clouds*  
Shull, Jones, **Danforth**, & Collins 2009 ApJ, 699, 754
  - *The FUSE Legacy in the Magellanic Clouds: An Online Stellar Sight Line Atlas*, Blair, Oliveira, Lamassa, Gutman, **Danforth**, Fullerton, Sankrit, & Gruendl 2009 PASP, 121, 634
  - *X-raying the Intergalactic O VI Absorbers*  
Yao, Tripp, Wang, **Danforth**, Canizares, Shull, Marshall, & Song 2009 ApJ, 697, 1784
  - *The Magellanic Clouds Legacy Project: A New Resource for Magellanic Clouds Researchers*  
Blair, Oliveira, Lamassa, Gutman, **Danforth**, Fullerton, Sankrit, Gruendl, & Levay 2009 AIPC, 1135, 43
  - *FUSE Observations of OVI Absorption in the Large Magellanic Cloud*  
Blair, Oliveira, Lamassa, Sankrit, & **Danforth** 2009 AIPC, 1135, 40
  - *FUSE Observations of KPD 2055+3111, a Star behind the Cygnus Loop*  
Blair, Sankrit, Torres, Chayer, & **Danforth** 2009 ApJ, 692, 335

- *The Metallicity of Intergalactic Gas in Cosmic Voids*  
Stoche, **Danforth**, Shull, Penton, & Giroux 2007 ApJ, 671, 146
- *Baryonic Content of the Warm-Hot Intergalactic Medium at Low Redshift*  
Sonneborn, Shull, **Danforth**, & Moos 2007 NCimB, 122, 1307
- *FUSE Survey of Magellanic Cloud Supernova Remnants*  
Blair, Ghavamian, Sankrit, & **Danforth** 2006 ApJS, 165, 480
- *Does the Milky Way Produce a Nuclear Galactic Wind?*  
Keeney, **Danforth**, Stoche, Penton, Shull, & Sembach 2006 ApJ, 646, 951
- *An ATCA radio-continuum study of the SMC. IV. Multifrequency analysis of the N66 region*  
Reid, Payne, Filipovic, **Danforth**, Jones, White, & Staveley-Smith 2006 MNRAS, 367, 1379
- *The Galaxy Environment of O VI Absorption Systems*  
Stoche, Penton, **Danforth**, Shull, Tumlinson, & McLin 2006 ApJ, 641, 217
- *A FUSE Survey of Interstellar Molecular Hydrogen toward High-Latitude AGNs*  
Gillmon, Shull, Tumlinson, & **Danforth** 2006 ApJ, 636, 891
- *An ATCA radio-continuum study of the SMC, III. SNRs and their environments*  
Filipović, Payne, Reid, **Danforth**, Staveley-Smith, Jones, & White 2005 MNRAS, 364, 217
- *An Unbiased Far Ultraviolet Survey of Magellanic Cloud Supernova Remnants*  
Ghavamian, Blair, Sankrit, **Danforth**, & Sembach 2004 astro, arXiv:astro-ph/0410271
- *The Wind of the B[e] Supergiant Henize S22 Viewed through a Reflection Nebula in DEML106*  
Chu, Chen, **Danforth**, Dunne, Gruendl, Naz' e, Oey, & Points 2003 AJ, 125, 2098
- *Interstellar Bubbles in Two Young H II Regions*  
Naz' e, Chu, Points, **Danforth**, Rosado, & Chen 2001 AJ, 122, 921