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Cynthia S. Froning

Statement

I am an astronomical observer and instrumentalist. I specialize in the development of ultraviolet, optical, and near-infrared cameras and spectrographs for ground- and space-based telescopes and enabling technologies for future instruments. I use multiwavelength observations to address a number of research questions, with a particular interest in the physics of accretion disks and outflows in X-ray binary systems and the properties of exoplanet systems in the ultraviolet.

Recent Employment History

University Affiliate Research Fellow

2013–present Department of Astronomy
University of Texas, Austin, TX

Associate Director

2011–2013 Center for Astrophysics and Space Astronomy
University of Colorado, Boulder, CO

Assistant Research Professor

2009–2013 Department of Astrophysical and Planetary Sciences,
University of Colorado

Research Associate

2002–2013 Center for Astrophysics and Space Astronomy,
University of Colorado

Postdoctoral Fellow

1999–2002 Space Telescope Science Institute, Baltimore, MD

Education

Ph.D Astronomy

1996–1999 University of Texas, Austin, TX
• Dissertation: *The Near-Infrared Properties of Compact Binary Systems*

MA Astronomy

1993–1996 University of Texas

BS Electrical Engineering, with High Honors

1989–1993 University of Texas

Selected Honors and Awards

- NASA RHG Exceptional Achievement Engineering-Teams award given to the HST Instrument Development for Servicing Mission 4 Team (2009)
- NASA Group Achievement Award to the HST SM4 Servicing Implementation Team (2009)
- University Co-Op Endowment Fellowship (1998–1999)
- David Alan Benfield Memorial Scholarship in Astronomy (1998–1999)
- William S. Livingstone Endowment Fund Fellowship (1997–1998)
- NASA/Texas Space Grant Consortium Fellowship (1997–1998)
- National Science Foundation Graduate Student Fellowship (1993–1996)

Research Highlights

- Project Manager, conceptual design study for GMACS optical spectrograph for the Giant Magellan Telescope (2016–)
- PI, conceptual design study for the Gemini High-resolution Optical Spectrograph (2011–2012).
- HST/Cosmic Origins Spectrograph Project Scientist (2005–2014).
- PI, conceptual design study for a High Resolution Optical Spectrograph for the Thirty Meter Telescope (2005–2006).
- Co-I, development of the first NIR laser comb for ultra high precision calibration to support radial velocity exoplanet searches (2006–present).
- Program Director of the NIC-FPS NIR camera instrument team for the Apache Point Observatory 3.5-m telescope (2004).
- Member of the instrument development team for the CoolSpec NIR spectrograph and the instrument refit team for Rokcam, the NIR imager, both for McDonald Observatory (1996–1999).
- Ongoing programs to characterize the structure and physical properties of accretion disks in compact binaries to: probe the accretion mechanism in disks at variable accretion rates, investigate the link between mass infall and outflows in winds and jets, and place firm limits on accreting black hole and neutron star masses to constrain formation and evolution models.
- Additional research interests in other fields, including probes of the atmospheres of transiting exoplanets using time-resolved UV spectroscopy and characterization of the UV radiation environments of exoplanet hosts.
- Interests in technology development to support future instrumentation, including development of dichroic trees for spectral sorting and multiplexing for cost savings and risk mitigation in large instruments.

Teaching Experience

- Teaching AST 351/392J, Spring 2016, a cross-listed upper level and graduate level astronomical instrumentation course
- Supervised graduate student J. Khargharia (Ph.D completion: Summer 2012).
- Taught ASTR 3520 *Observations and Instrumentation 2*, Spring 2011, an undergraduate major lab course focusing on spectroscopy observations and data analysis.
- Teaching assistant at the University of Texas (1996–1997), including leading discussion sessions and instrument training at McDonald Observatory.

Membership and Service

- Past CASA Associate Director and CASA Fellow. Current CASA Affiliated Fellow. CASA is a research center serving 11 rostered faculty, 25 research scientists, 39 undergraduate and graduate students, and 14 staff. CASA has a \$2.1M yearly budget.
- Member, American Astronomical Society.
- FUSE Observer's Advisory Committee (2003–2008) and various conference SOCs.
- Regular participation in refereeing manuscripts, serving on review and advisory panels for NASA and the NSF, etc.
- Press activities: development of Cosmic Origins Spectrograph Early Release Observations and press release materials for the HST Servicing Mission 4 press conference; press interviews in support of press releases concerning observations of exoplanet atmospheres of WASP-12b and HD209458b.
- Community service including volunteering at the South by Southwest NASA education booth, speaking at University of Denver's Osher Lifelong Learning Institute and Ball seminars, participating in CU Astronomy Day, star party support, etc.

- Invited participant in the Keck Institute for Space Studies workshop “Next Generation UV Instrument Technologies Enabling Missions in Astrophysics, Cosmology and Planetary Sciences.”
- Creation of an atlas of all FUSE observations of cataclysmic variables, available from the HST MAST High Level Science Products archive.

References

- Prof. James Green, University of Colorado, james.green@colorado.edu, (303) 492-7645
- Prof. J. Michael Shull, University of Colorado, michael.shull@colorado.edu, (303) 492-7827
- Prof. David Crampton, NRC Herzberg Institute of Astrophysics, david.crampton@nrc-cnrc.gc.ca, (250) 363-0010
- Dr. Knox S. Long, Space Telescope Science Institute, long@stsci.edu, (410) 338-4862
- Prof. Edward L. Robinson, University of Texas at Austin, elr@astro.as.utexas.edu, (512) 471-3401

Refereed Publications

- Loyd, R.P. et al. 2016, ApJ, submitted, *The MUSCLES Treasury Survey III: X-ray to Infrared Spectra of 11 M and K Stars Hosting Planets*
- Youngblood, A. et al. 2016, ApJ, submitted, *The MUSCLES Treasury Survey II: Intrinsic Lyman Alpha and Extreme Ultraviolet Spectra of K and M Dwarfs with Exoplanets*
- France, K., et al. 2016 ApJ, submitted, *The MUSCLES Treasury Survey I: Motivation and Overview*
- C.W. Danforth, et al. 2016, ApJ, 817, 111, *An HST/COS Survey of the Low-Redshift Intergalactic Medium. I. Survey, Methodology, and Overall Results*
- Zhang, S., et al. 2015, MN, 447, 2671, *Modeling Warm Absorptions in the HST/COS Spectrum of Mrk 290 with XSTAR*
- Stocke, J., et al. 2014, ApJ, 791, 128, *Absorption-line Detections of the Intra-Group Medium in Spiral-Rich Groups of Galaxies*
- Hoard, D., et al. 2014, ApJ, 786, 68, *Nova-Like Cataclysmic Variables in the Infrared*
- Froning, C.S., et al. 2014 ApJ, 780, 48, *Multiwavelength Observations of Swift J1753.5-0127*
- France, K., Froning, C. S., et al. 2013, ApJ, 763, 149, *The Ultraviolet Radiation Environment Around M-Dwarf Exoplanet Host Stars*
- Stocke, J., et al. 2013, ApJ, 763, 148, *Characterizing the Circumgalactic Medium of Nearby Galaxies With HST/COS and /STIS Absorption-Line Spectroscopy*
- Khargharia, J., Froning, C. S., Robinson, E.L., & Gelino, D. 2012, AJ, 145, 21, *The Mass of the Black Hole in XTE J1118+480*
- Haswell, C., et al. 2012, ApJ, 760, 79, *Near-ultraviolet Absorption, Chromospheric Activity, and Star-Planet Interactions in the WASP-12 system*
- France, K., Linsky, J. L., Tian, F., Froning, C.S., & Roberge, A. 2012, ApJ, 750, L32, *Time-Resolved Spectroscopy of the M-dwarf GJ 876 Exoplanetary System*
- Froning, C. S., Long, K. S., Gänsicke., B., & Szkody, P. 2012, ApJS, 199, 7, *A Survey of Far Ultraviolet Spectroscopic Explorer Observations of Cataclysmic Variables*
- Khargharia, J., Stocke, J. T., Froning, C. S., Gopakumar, A. & Joshi, B. C. 2012, ApJ, 744, 183, *PSR J1903+0327: A Unique Milli-Second Pulsar with a Main-Sequence Companion Star*

- Green, J. C., Froning, C. S., et al. 2012, ApJ, 744, 60, *The Cosmic Origins Spectrograph*
- Froning, C.S., et al. 2011, ApJ, 743, 26, *Multiwavelength Observations of A0620-00 in Quiescence*
- Narayanan, A., et al. 2011, ApJ, 730, 14, *Cosmic Origins Spectrograph Detection of Ne VIII Tracing Warm-Hot Gas Towards PKS0405-123*
- Winter, L.M., Danforth, C., Vasudevan, R., Brandt, W.N., Scott, J., Froning, C., Keeney, B., Shull, J.M., Penton, S., Mushotzky, R., Schneider, D.P., & Arav, N. 2011, ApJ, 728, 28, *Ultraviolet and X-ray Variability of the Seyfert 1.5 Galaxy Markarian 817*
- Fossati, L., et al. 2010, ApJ, 720, 872, *A Detailed Spectropolarimetric Analysis of the Planet-hosting star WASP-12*
- Linsky, J.L., Yang, H., France, K., Froning, C.S., Green, J.C., Stocke, J.T., & Osterman, S.N. 2010, ApJ, 717, 1291, *Observations of Mass Loss from the Transiting Exoplanet HD209458b*
- Khargharia, J., Froning, C.S., & Robinson, E.L. 2010, ApJ, 716, 1105, *Near-Infrared Spectroscopy of Low Mass X-ray Binaries: Accretion Disk Contamination and Compact Object Mass Determination in V404 Cyg and Cen X-4*
- France, K., Linsky, J.L., Brown, A., Froning, C.S., & Beland, S. 2010, ApJ, 715, 596, *Metal Depletion and Warm H₂ in the Brown Dwarf 2M1207 Accretion Disk*
- Fossati, L., Haswell, C.A., Froning, C.S., et al. 2010, ApJ, 714, 222, *Metals in the Exosphere of the Highly Irradiated Planet WASP-12b*
- France, K., Stocke, J., Yang, H., Linsky, J., Wolven, B.C., Froning, C.S., Green, J.C., & Osterman, S.N. 2009, ApJ, 712, 1277, *Searching for Far-Ultraviolet Auroral/Dayglow Emission from HD209458b with the Cosmic Origins Spectrograph*
- Cantrell, A.G., Baily, C.D., Orosz, J.A., McClintock, J.E., Remillard, R.A., Froning, C.S., Neilsen, J., & Gelino, D. 2009, ApJ, 710, 1127, *The Inclination of the Soft X-ray Transient A0620-00 and the Mass of its Black Hole*
- France, K., Beasley, M., Keeney, B.A., Danforth, C.W., Froning, C.S., Green, J.C., & Shull, J.M. 2009, ApJ, 707, 27, *Cosmic Origins Spectrograph Observations of the Chemical Composition of SNR LMC N132D*
- Long, K. S., Gansicke, B. T., Knigge, C., & Froning, C.S. 2009, ApJ, 697, 1512, *The Effect of the Superoutburst on the White Dwarf in VW Hydri as Observed with FUSE*
- Hoard, D.W., et al. 2009, ApJ, 693, 236, *Observations of V592 Cassiopeiae with the Spitzer Space Telescope — Dust in the Mid-Infrared*
- Reynolds, M.T., Callanan, P.J., Robinson, E.L., & Froning, C.S., 2008, MNRAS, 387, 788, *IR Contamination in Galactic X-Ray Novae*
- Froning, C.S., Robinson, E.L., & Bitner, M.A., 2007, ApJ, 663, 1215, *Near-Infrared Spectra of the Black Hole X-Ray Binary, A0620-00*
- Long, K.S., Brammer, G., & Froning, C.S. 2006, ApJ, 648, 541, *FUSE Spectroscopy of the White Dwarf in U Geminorum*
- Long, K.S., Froning, C.S., Knigge, C., Blair, W.P., Kallman, T.R., & Ko, Y.-K. 2005, ApJ, 630, 511, *FUV Spectroscopy of the Dwarf Novae SS Cygni and WX Hydri in Quiescence*
- Hartley, L.E., Long, K.S., Froning, C.S., & Drew, J.E. 2005, ApJ, 623, 425, *The Far Ultraviolet Spectrum of Z Cam in Quiescence and Standstill*
- Hoard, D.W., Szkody, P., Froning, C.S., Long, K.S., & Knigge, C. 2003, AJ, 126, 2473, *Observations of the SW Sextantis Star DW Ursae Majoris with the Far Ultraviolet Spectroscopic Explorer*
- Godon, P., Cheng, F., Sion, E.M., Szkody, P., Long, K.S., & Froning, C. S.

2004, ApJ, 612, 429, *Far Ultraviolet Observations of the Dwarf Nova VW Hyi in Quiescence*

- Froning, C.S., Long, K.S., & Baptista, R. 2003, AJ, 126, 964, *Hubble Space Telescope Observations of the Nova-Like Cataclysmic Variable V348 Puppis*
- Prinja, R.K., Long, K.S., Froning, C. S., Knigge, C., Witherick, D. K., Clark, J. S., & Ringwald, F. A. 2002, MNRAS, *FUSE and HST Ultraviolet Observations of the Disc Wind of RW Sextantis*
- Long, K.S., Froning, C.S., Gänsicke, B., Knigge, C., Sion, E. M., & Szkody, P. 2003, ApJ, 591, 1172, *WZ Sge: FUSE Spectroscopy of the 2001 Outburst*
- Froning, C.S., Long, K.S., & Knigge, C. 2002, ApJ, 584, 433, *Accretion and Outflow in Interacting Binary Systems: FUSE Observations of the Novalike Cataclysmic Variable, UX Ursae Majoris*
- Froning, C.S., Long, K.S., Drew, J.E., Knigge, C., & Proga, D. 2001, ApJ, 562, 963, *FUSE Observations of U Geminorum During Outburst and Decline*
- Froning, C. S. & Robinson, E. L. 2001, AJ, 121, 2212, *Near-Infrared Light Curves of the Black Hole Binary A0620—00*
- Froning, C. S., Robinson, E. L., Welsh, W. F., & Wood, J. H. 1999, ApJ, 523, 399, *The Quiescent Accretion Disk in IP Peg at Near-Infrared Wavelengths*
- Barnes, T. G. III, Ivans, I. I., Martin, J., Froning, C. S., & Moffett, T. J., 1999, PASP, 111, 812, *V(RI)_C Photometry of Cepheids in the Magellanic Clouds*
- Lester, D. F., Hill, G. J., Doppmann, G., & Froning, C. S. 2000, PASP, 112, 384, *CoolSpec: A Near-Infrared Long-Slit Spectrometer for McDonald Observatory*

Selected Instrumentation Papers

- Froning, C.S., et al. 2013, Proc. SPIE, 8836, 88360Y *A Conceptual Design for a Cassegrain-mounted high resolution optical spectrograph for large aperture telescopes*
- Froning, C. S. et al. 2012, *Conceptual Design Study for the Gemini High Resolution Optical Spectrograph*, Gemini Documents GHOSD-01 to GHOSD-06, University of Colorado study
- Froning, C. S. 2011, Ap&SS, 335, 267, *Early Science Results from the Cosmic Origins Spectrograph*
- Ghavmanian, P., Froning, C., Osterman, S., Keyes, C.D., & Sahnou, D. 2010, STScI Instrument Science Report COS 2010-09, *COS FUV External Spectroscopic Performance*
- Sahnou, D. J., et al. 2010, SPIE, 7731, 103, *Commissioning of the Cosmic Origins Spectrograph on the Hubble Space Telescope: an Overview of COS Servicing Mission Observatory Verification*
- Froning, C. S. & Green, J. C. 2009, Ap&SS, 320, 181, *The Cosmic Origins Spectrograph: Capabilities and Prelaunch Performance*
- Froning, C.S., Holtzmann, J., Beasley, M., & Burrows, C. 2009, white paper for the Astrophysical Research Consortium, *Apache Point Observatory 3.5-m Telescope Optical Camera Upgrade Options*
- Elias, et. Al. 2009, Astro2010: The Astronomy and Astrophysics Decadal Survey, Position Papers, no. 12, *Developing Future Generations of Instrument Builders*
- Osterman, S., Diddams, S., Beasley, M., Froning, C., et al. 2007, SPIE, 6693, 44, *A Proposed Laser Frequency Comb-Based Wavelength Reference for High-Resolution Spectroscopy*
- Froning, et al., 2006, SPIE, 6269, 61, *Conceptual Design for a High Resolution Optical Spectrograph on the Thirty Meter Telescope: a New Concept for a Ground-Based High-Resolution Optical Spectrograph*
- Osterman, et al., 2006, SPIE, 6269, 95, *A High Resolution Optical*

Spectrograph for the Thirty Meter Telescope: Design and Performance

- Hearty, F., et al. 2004, SPIE, 5492, 1623, *Near-Infrared Camera and Fabry-Perot Spectrograph (NIC-FPS)*

Invited Talks

- Anton Pannekoek Institute for Astronomy, University of Amsterdam, September 2015
- Texas A&M University, October 2014
- Institute for Astronomy, University of Hawaii, January 2012
- University of Wisconsin-Madison, February 2011
- Princeton University, November 2010
- NOAO/Steward Observatory, October 2010
- Science With the Hubble Space Telescope III, Venice, October 2010
- UV Universe 2010, St. Petersburg, June 2010 (Froning 2011)
- Special session, "Science with the New HST," American Astronomical Society, Washington, D.C., January 2010
- University of Wyoming, April 2008
- Science with the New Hubble Space Telescope, Bologna, Italy, January 2008
- University of New Mexico, October 2007
- Space Astronomy: the UV Window to the Universe, El Escorial, Spain, May 2007 (Froning & Green 2009)
- Astrophysics in the Far Ultraviolet: Five Years of Discovery With FUSE, Victoria, B. C., August 2004
- The Astrophysics of Cataclysmic Variables, Strasbourg, France, July 2004
- San Diego State University, May 2004