

MARK G. CONDE, Ph.D.

Professor of Physics

Geophysical Institute, University of Alaska Fairbanks
903 Koyukuk Drive, Fairbanks, AK 99775
mgconde@alaska.edu

PROFESSIONAL PREPARATION:

University of Tasmania (Australia)	Physics	B.Sc. 1981
University of Tasmania (Australia)	Physics, Honors (1 st Class)	B.Sc. 1982
University of Adelaide (Australia)	Physics	Ph.D. 1991
La Trobe University (Australia)	Postdoctoral Research Fellow	1992-1993
University of Alaska Fairbanks	Postdoctoral Research Fellow	1993-1995

APPOINTMENTS:

From 2018: Professor of Physics, University of Alaska Fairbanks.
From 2011: Associate Professor of Physics, University of Alaska Fairbanks.
2006-2011: Assistant Professor of Physics, University of Alaska Fairbanks.
2004-2006: Senior Lecturer in Physics, La Trobe University (Australia.)
2001-2004: Assistant Professor of Physics, University of Alaska Fairbanks.
1999-2001: Research Assistant Professor, University of Alaska Fairbanks.
1995-1999: Research Associate, University of Alaska Fairbanks.
1993-1995: Postdoctoral Research Fellow, University of Alaska Fairbanks.
1992-1993: Postdoctoral Research Fellow, La Trobe University
1990-1992: Computer programmer for marine science, Australian Antarctic Division.
1984-1990: Professional Officer (Physicist), Australian Antarctic Division, and Ph.D. student, University of Adelaide. (Spent 33 months in Antarctica during this period.)

RESEARCH INTERESTS:

Dr. Conde's major area of research interest is fluid dynamics of Earth's atmosphere above ~100 km, involving ground-based optical remote sensing, in-situ sounding rocket measurements, and satellite remote sensing. While his work is primarily experimental, he has also undertaken some first-principles physics-based numerical modeling. The overall theme of these studies is to understand how "space weather" perturbations affect atmospheric conditions in Earth's thermosphere, particularly at heights occupied by satellites in low Earth orbit. Contributions to other scientific disciplines include studies of optical phenomena in the lower atmosphere, physical oceanography, and ground water modeling.

As a result of this work, Dr. Conde has introduced three new experimental methods that have each had *transformational impacts* within the field of thermospheric dynamics:

- Development of all-sky imaging Fabry-Perot instruments capable of measuring thermospheric winds and temperatures with at least an order of magnitude increase in spatio-temporal resolution compared to other techniques in current use.
- Development of a "tailored trajectory" strategy to allow sub-orbital sounding rockets to sample an atmospheric region several hundred kilometers in length at relatively constant altitude.
- Development of sounding rocket systems capable of dispersing up to 24 sub-payloads throughout a sampling volume spanning roughly 100×100 kilometers horizontally, and several hundred km vertically.

Dr. Conde currently has ground-based instruments and ongoing observing programs based in Alaska and Antarctica. In Addition, he has at various times conducted observing campaigns from Norway, Sweden, Svalbard, Australia, and Canada. Current collaborators include groups in the USA, UK, Norway, Australia, Canada, South Africa, and Japan.

RESEARCH FUNDING:

A list of Dr. Conde's research grants since 2001 is provided separately below. Total funds awarded as PI over this 15-year period were US\$9,367,004. Total funding awarded for grants listing Conde a Co-I was US\$2,468,245 which, when pro-rated for the number of Co-Is, totals US\$633,647 of funding for Conde. In total, Conde has averaged around US\$666,710 in research funding awarded per year for the past 15 years.

TEACHING EXPERIENCE:

Dr. Conde has been teaching undergraduate and graduate physics classes continuously since 2002, with a typical teaching load being around 100 lectures per year plus 30 hours of labs. Courses taught include:

- Introductory Astronomy (100 level)
- Energy and Society (100 level)
- Modern Physics (200 level)
- Electromagnetism (200 and 300 level)
- Astrophysics (200 and 400 level)
- Solar Physics (400 level)
- Optics (400 level)
- Planetary Atmospheres (400 level)
- Experimental Physics (400 level)
- Aeronomy and Auroral Physics (400 level and Graduate level)
- Space Physics (Graduate Level)

Dr. Conde has supervised four completed PhDs: Matt Krynicki and Manbharat Dhady at the University of Alaska, and Callum Anderson and Shaun Cooper at La Trobe University. He has also supervised one completed Masters student, Jeff Holmes, at the University of Alaska. As of 2017 he has three current PhD students, John Elliott, Carl Andersen, and Kylee Branning, and one Master's student, Joshua Vann. He has also served as an ordinary member of numerous other graduate student's advisory committees.

PROFESSIONAL SERVICE:

- Member of NASA's "Sounding Rocket Working Group" – a steering committee that guides the priorities for NASA's sub-orbital sounding rocket program.
- Member of the "CEDAR Science Steering Committee", which guides the scientific direction of the US National Science Foundation's aeronomy program.
- Member of a Scientific and Technical review panel evaluating "Small Explorer" missions for NASA.
- Convener of sessions at national conferences for the American Geophysical Union and the US National Science Foundation.
- Service on numerous NSF and NASA scientific review panels.
- Member of the University of Alaska Faculty Senate.

- Member and chair of multiple faculty search committees at the University of Alaska and La Trobe University.
- Frequent reviewer for scientific journals.

Refereed Publications

- Greet, P., M. Conde, and F. Jacka, Daytime observation of the sodium layer with a Fabry-Perot spectrometer at Mawson, Antarctica, *Geophys. Res. Lett.*, *16*, 871-874, 1989.
- Conde, M., and F. Jacka, Analysis of day-time observations of the 630 nm thermospheric emission over Mawson, Antarctica, *ANARE Res. Notes*, *69*, 125-138, 1989.
- Conde, M., and H. Beggs (eds.), *ANARE Research Notes, 69: Australian upper atmospheric and space physics research in Antarctica, 1988*, vol. 69, Australian Antarctic Division, Kingston, Tasmania, 1989.
- Conde, M., and F. Jacka, Thermospheric wind and temperature measurements from Mawson, Antarctica, spanning 24 hours of local time, *ANARE Res. Notes*, *80*, 243-261, 1990.
- Conde, M., P. Greet, and F. Jacka, The Ring effect in the sodium D2 Fraunhofer line of day skylight over Mawson, Antarctica, *J. Geophys. Res.*, *97*, 11561-11565, 1992.
- Penrose, J. D., M. Conde, and T. J. Pauly, Acoustic detection of ice crystals in Antarctic waters, *J. Geophys. Res.*, *99*, 12573-12580, 1994.
- Conde, M., and P. L. Dyson, Thermospheric vertical winds above Mawson, Antarctica, *J. Atmos. Terr. Phys.*, *57*, 589-596, 1995.
- Conde, M., and P. L. Dyson, Thermospheric horizontal winds above Mawson, Antarctica, *Adv. Space Res.*, *16*, 41-52, 1995.
- Conde, M., and R. W. Smith, Mapping thermospheric winds in the auroral zone, *Geophys. Res. Lett.*, *22*, 3019-3022, 1995.
- Conde, M., and R. W. Smith, Phase compensation of a separation scanned, all-sky imaging Fabry-Perot spectrometer for auroral studies, *Appl. Opt.*, *36*, 5441-5450, 1997.
- Conde, M., and R. W. Smith, Spatial structure in the thermospheric horizontal wind above Poker Flat, Alaska, during solar minimum, *J. Geophys. Res.*, *103*, 9449-9472, 1998.
- Smith, R. W., G. Hernandez, R. G. Roble, P. L. Dyson, M. Conde, R. Crickmore, and M. Jarvis, Observation and Simulation of Winds and Temperatures in the Antarctic Thermosphere for August 2 - 10, 1992, *J. Geophys. Res.*, *103*, 9473-9480, 1998.
- Conde, M., and R. W. Smith, Simultaneous Observations of the Aurora and of Non-Uniform Thermospheric Winds, from Poker Flat, Alaska, *Proc. NIPR Symp. Upper Atmos. Phys.*, *12*, 30-38, 1998.
- Innis, J. L., P. A. Greet, D. J. Murphy, M. Conde, and P. L. Dyson, A large vertical wind in the thermosphere at the auroral oval/polar cap boundary seen simultaneously from Mawson and Davis, Antarctica, *J. Atmos. Sol-Terr. Phys.*, *61*:1047-1058, 1999.
- Greet, P. A., M. Conde, P. L. Dyson, J. L. Innis, A. M. Breed, and D. J. Murphy, Thermospheric wind field over Mawson and Davis, Antarctica; Simultaneous observations by two Fabry-Perot spectrometers of 630 nm emission, *J. Atmos. Sol-Terr. Phys.*, *61*:1025-1045, 1999.

- Rees, D., M. Conde, A. Steen, and U. Brandstrom, The First Daytime Ground-Based Optical Image of the Aurora, *Geophys. Res. Lett.*, 27:313-316, 2000.
- Conde, M., Analysis of Fabry-Perot spectra of lidar backscatter echoes Morris, R.J., Wilkinson, P.J. (ed.) *ANARE Reports No. 146*. 91–114, 2001.
- Conde, Craven, Immel, Hoch, Stenbaek-Nielsen, Hallinan, Smith, Olson, Wei Sun, Frank, and Sigwarth, Assimilated observations of thermospheric winds, the aurora, and ionospheric currents over Alaska, *J. Geophys. Res.* 106:10493-10508, 2001.
- Ishii, Conde, Smith, Kryriicki, Sagawa, and Watari,. Vertical wind observations with two Fabry-Perot interferometers at Poker Flat, Alaska, *J. Geophys. Res.* 106:10537-10551, 2001.
- Innis, J. L. and M. Conde, Thermospheric vertical wind activity maps derived from Dynamics Explorer-2 WATS observations, *Geophys. Res. Lett.*, 28: 3847-3850, 2001.
- Innis, J. L., and M., Correction to “Thermospheric Vertical Wind Activity Maps Derived from Dynamics Explorer - 2 WATS Observations”, *Geophys. Res. Lett.*, 28(24), 4529-4529, 2001
- Conde, M., Deriving wavelength spectra from fringe images from a fixed-gap single-etalon Fabry-Perot spectrometer, *Appl. Opt.*. 41: 2672-2678, 2002.
- Innis, I. L. and M. Conde, High-latitude thermospheric vertical wind activity from Dynamics Explorer-2 WATS observations: Indications of a source region for polar cap gravity waves, *J. Geophys. Res.* 107, No. A8, 10,1029/2001JA009130, 2002.
- Innis and Conde, Characterization of acoustic-gravity waves in the upper thermosphere using Dynamics Explorer 2 Wind & Temperature Spectrometer (WATS) & Neutral Atmospheric Composition Spectrometer data, *J.Geophys.Res.* 107, A12, 10. 1029/2002JA009370, 2002.
- Conde, M., Airglow Instrumentation, *The Encyclopaedia Of Atmospheric Science*, Eds. J Holton, J Pyle, J Curry. Academic Press Ltd. London, 2003, pp 1576-1583.
- Ishii M., M. Kubota, M. Conde, R. W. Smith, M. Krynicki, Vertical wind distribution in the polar thermosphere during Horizontal E Region Experiment (HEX) campaign, *J. Geophys. Res.*, 109, A12311, doi:10.1029/2004JA010657, 2004.
- Holmes J. M., M. Conde, C. Deehr, D. Lummerzheim, Morphology of evening sector aurorae in $\lambda 557.7$ -nm Doppler temperatures, *Geophys. Res. Lett.*, 32, L02103, 10.1029/2004GL021553, 2005.
- Oyama S., B. J. Watkins, S. Nozawa, S. Maeda, M. Conde, Vertical ion motion observed with incoherent scatter radars in the polar lower ionosphere, *J. Geophys. Res.*, 110, A04302, doi:10.1029/2004JA010705, 2005
- Cooper, S. L. and M. G. Conde, 2006. Origins of horizontal divergence in the auroral thermosphere: A modelling study, *Geophys. Res. Lett.* 33: doi:10.1029/2006GL027601.
- Hecht J.H., D.J. Strickland, and M.G. Conde, The Application of Ground-based Optical Techniques for Inferring Electron Energy Deposition and Composition Change during Auroral Precipitation Events, *Journal of Atmospheric and Solar Terrestrial Physics* 68:1502-1519, 2006.
- Wescott, E. M., H. Stenbaek-Nielsen, M. Conde, M. Larsen, and D. Lummerzheim, 2006, The HEX experiment: Determination of the neutral wind field from 120 to 185 km altitude near a stable premidnight auroral arc by triangulating the drift of rocket-deployed chemical trails, *J. Geophys. Res.*, 111, A09302, doi:10.1029/2005JA011002.
- Hecht, J. H., T. Mulligan, D. J. Strickland, A. J. Kochenash, Y. Murayama, Y.-M. Tanaka, D. S. Evans, M. G. Conde, E. F. Donovan, F. J. Rich, D. Morrison, Satellite and ground-

based observations of auroral energy deposition and the effects on thermospheric composition during large geomagnetic storms: 1. Great geomagnetic storm of 20 November 2003, *J. Geophys. Res.*, 113, A01310, doi:10.1029/2007JA012365, 2008 .

Anderson, C., Conde, M., Dyson, P., Davies, T., and Kosch, M. J.: Thermospheric winds and temperatures above Mawson, Antarctica, observed with an all-sky imaging, Fabry-Perot spectrometer, *Ann. Geophys.*, 27, 2225-2235, 2009.

Cooper, S. L., Conde, M., and Dyson, P.: Numerical simulations of thermospheric dynamics: divergence as a proxy for vertical winds, *Ann. Geophys.*, 27, 2491-2502, 2009.

Kosch, M. J., C. Anderson, R. A. Makarevich, B. A. Carter, R. A. D. Fiori, M. Conde, P. L. Dyson, and T. Davies, First E region observations of mesoscale neutral wind interaction with auroral arcs, *J. Geophys. Res.*, 115, A02303, doi:10.1029/2009JA014697, 2010

Kosch, M. J., C. Anderson, H.-C. I. Yiu, A. C. Kellerman, R. A. Makarevich, A. Aruliah, M. Conde, E. Griffin, T. Davies, I. McWhirter, and P. L. Dyson , First observations of simultaneous interhemispheric conjugate high-latitude thermospheric winds, *J. Geophys. Res.*, 115, A09328, doi:10.1029/2009JA015178, 2010

Conde, M. G., and M. Nicolls (2010), Thermospheric temperatures above Poker Flat, Alaska, during the stratospheric warming event of January and February 2009, *J. Geophys. Res.*, doi:10.1029/2010JD014280.

Anderson, C., T. Davies, M. Conde, P. Dyson, and M. J. Kosch (2011), Spatial sampling of the thermospheric vertical wind field at auroral latitudes, *J. Geophys. Res.*, 116, A06320, doi:10.1029/2011JA016485.

Larsen, M. F., and M. G. Conde (2011), The Horizontal E-region Experiment: Evidence for inertial instability on the evening side of the auroral oval?, *Geophys. Res. Lett.*, 38, L17106, doi:10.1029/2011GL048424.

Kubota, M., M. Conde, M. Ishii, Y. Murayama, and H. Jin (2011), Characteristics of nighttime medium-scale traveling ionospheric disturbances observed over Alaska, *J. Geophys. Res.*, 116, A05307, doi:10.1029/2010JA016212.

Anderson, C., M. Conde, and M. G. McHarg (2012), Neutral thermospheric dynamics observed with two scanning Doppler imagers: 1. Monostatic and bistatic winds, *J. Geophys. Res.*, 117, A03304, doi:10.1029/2011JA017041.

Anderson, C., M. Conde, and M. G. McHarg (2012), Neutral thermospheric dynamics observed with two scanning Doppler imagers: 2. Vertical winds, *J. Geophys. Res.*, 117, A03305, doi:10.1029/2011JA017157.

Anderson, C., M. Conde, and M. G. McHarg (2012), Neutral thermospheric dynamics observed with two scanning Doppler imagers: 3. Horizontal wind gradients, *J. Geophys. Res.*, 117, A05311, doi:10.1029/2011JA017471.

Nicolls, M. J., S. L. Vadas, J. W. Meriwether, M. G. Conde, and D. Hampton (2012), The phases and amplitudes of gravity waves propagating and dissipating in the thermosphere: Application to measurements over Alaska, *J. Geophys. Res.*, 117, A05323, doi:10.1029/2012JA017542.

Hecht, J. H., T. Mulligan, J. T. Correia, J. H. Clemmons, D. J. Strickland, R. L. Walterscheid, and M. G. Conde (2012), A multiyear (2002–2006) climatology of O/N₂ in the lower thermosphere from TIMED GUVI and ground-based photometer observations, *J. Geophys. Res.*, 117, A03302, doi:10.1029/2011JA017146.

- Anderson, C., M.J. Kosch, M.J. Nicolls, M. Conde (2013), Ion–neutral coupling in Earth's thermosphere, estimated from concurrent radar and optical observations above Alaska, *Journal of Atmospheric and Solar-Terrestrial Physics*, 105–106: 313–324, doi: 10.1016/j.jastp.2013.04.005.
- Zettergren, M., K. Lynch, D. Hampton, M. Nicolls, B. Wright, M. Conde, J. Moen, M. Lessard, R. Miceli, and S. Powell (2014), Auroral ionospheric F region density cavity formation and evolution: MICA campaign results, *J. Geophys. Res. Space Physics*, 119, 3162–3178, doi:10.1002/2013JA019583.
- Dhadly, M. S., J. Meriwether, M. Conde, and D. Hampton (2015), First ever cross comparison of thermospheric wind measured by narrow- and wide-field optical Doppler spectroscopy, *J. Geophys. Res. Space Physics*, 120, 9683–9705, doi:10.1002/2015JA021316.
- Lynch, K. A., D. L. Hampton, M. Zettergren, T. A. Bekkeng, M. Conde, P. A. Fernandes, P. Horak, M. Lessard, R. Miceli, R. Michell, J. Moen, M. Nichols, S. P. Powell and M. Samara. (2015), MICA sounding rocket observations of conductivity-gradient-generated auroral ionospheric responses: Small-scale structure with large-scale drivers, *J. Geophys. Res. Space Physics*, 120, 9661–9682, doi:10.1002/2014JA020860.
- Drob, D. P., J. T. Emmert, J. W. Meriwether, J. J. Makela, E. Doornbos, M. Conde, G. Hernandez, J. Noto, K. A. Zawdie, S. E. McDonald, et al. (2015), An update to the Horizontal Wind Model (HWM): The quiet time thermosphere, *Earth and Space Science*, 2, 301–319, doi:10.1002/2014EA000089.
- Liuzzo, L. R., A. J. Ridley, N. J. Perlongo, E. J. Mitchell, M. Conde, D. L. Hampton, W. A. Bristow, and M. J. Nicolls (2015), High-latitude ionospheric drivers and their effects on wind patterns in the thermosphere, *J. Geophys. Res. Space Physics*, 120, 715–735, doi:10.1002/2014JA020553.
- Kaeppler, S. R., D. L. Hampton, M. J. Nicolls, A. Strømme, S. C. Solomon, J. H. Hecht, and M. G. Conde (2015), An investigation comparing ground-based techniques that quantify auroral electron flux and conductance, *J. Geophys. Res. Space Physics*, 120, 9038–9056, doi:10.1002/2015JA021396.
- Dhadly, M.S. and Conde, M., 2016. Distortion of thermospheric air masses by horizontal neutral winds over Poker Flat Alaska measured using an all-sky scanning Doppler imager. *Journal of Geophysical Research: Space Physics*, 121, 854–866, doi:10.1002/2015JA021800.
- Fernandes, P. A., K. A. Lynch, M. Zettergren, D. L. Hampton, T. A. Bekkeng, I. J. Cohen, M. Conde, L. E. Fisher, P. Horak, M. R. Lessard, et al. (2016), Measuring the seeds of ion outflow: Auroral sounding rocket observations of low-altitude ion heating and circulation, *J. Geophys. Res. Space Physics*, 121, 1587–1607, doi:10.1002/2015JA021536.
- Dhadly, M., J. Emmert, D. Drob, M. Conde, E. Doornbos, G. Shepherd, J. Makela, Q. Wu, R. Niecejewski, and A. Ridley (2017), Seasonal dependence of northern high-latitude upper thermospheric winds: A quiet time climatological study based on ground-based and space-based measurements, *J. Geophys. Res. Space Physics*, 122, doi:10.1002/2016JA023688.

Dhadly, M and M. Conde (2017), Trajectories of thermospheric air parcels flowing over Alaska, reconstructed from ground-based wind measurements, *J. Geophys. Res. Space Physics* – Accepted May 23, 2017.

Funded Research Grants (US Dollars, since 2001)

- Conde, Smith, CEDAR/TIMED: Thermospheric Vertical Wind Observations from Three Sites in the Northern Auroral Zone (NASA, \$246,300, 01-Sep-2000 for 4 years.)
- Conde, Near Real-time Imaging of Ionospheric Electron Density Profiles Across the Auroral Zone (US DoD, \$100,000, 01-Oct 2001 for 16 months.)
- Conde, CEDAR: Mapping the Variance of Thermospheric Vertical Winds using Dynamics Explorer-2 WATS Data (NSF, \$63,000, 01-Jan-2001 for 2 years.)
- Conde, Craven, Hawkins, Wescott, Nielsen, Lummerzheim, Smith, Larsen, Mapping the E-region vertical and zonal (horizontal) winds near a stable auroral arc, using a near-horizontal chemical release trail (NASA, \$768,111, 01-Jan-2001 for 3 years.)
- Conde, Craven, Hawkins, Wescott, Nielsen, Lummerzheim, Smith, Larsen, Brown, Experimental techniques for studying the aurora with sounding rockets Companion to parent research proposal: Mapping the E-region vertical and zonal (horizontal) winds near a stable auroral arc using a near-horizontal chemical release trail (NASA, \$36,000, 01-Jan-2001 for 3 years.)
- Conde, Smith, Lower thermospheric composition studies in the auroral zone (Aerospace Corporation, \$37,250, 01-Mar-2001, for 18 months.)
- Collins, Conde, CEDAR: Ground-based optical imaging of sporadic sodium clouds near the summer mesopause, using resonantly scattered sunlight (NSF, \$205,499, 01-Jan-2002 for 3 years.)
- Conde, Craven, Hawkins, Wescott, Nielsen, Lummerzheim, Smith, Larsen, Mapping the E region vertical and zonal (horizontal) winds near a stable auroral arc, using a near horizontal chemical release trail (Supplement) (NASA, \$55,627, 01-Mar-2003 for 1 year.)
- Conde, Lower Thermospheric Composition Studies in the Auroral Zone (Aerospace Corporation, \$75,00, 01-Sep-2001 for 1 year.)
- Conde, Lummerzheim, CEDAR/TIMED: Thermospheric Vertical Wind Observations from Three Sites in the Northern Auroral Zone (Supplement) (NASA, \$122,038, 1-Sep-03 for 2 years.)
- Conde, Dyson, A new instrument to observe the three-dimensional structure of wind and temperature disturbances at and above Earth's polar mesopause (ARC Australia, AU\$347,221], 1-July-2004 for 4 years.)
- Craven, Conde, Lummerzheim, Wescott, Nielsen, Johnson, Hawkins, Brown, Bristow, Thayer, HEX 2: Investigation of mesoscale drivers for vertical and horizontal winds in the high-latitude lower thermosphere (NASA, \$815,441, 01-Jan-2005 for 3 years.)
- Conde, All-Sky Doppler imaging Fabry-Perot Spectrometer (US Air Force, \$374,950, 01-Jan-2008, for 1 year.)
- Conde, Lummerzheim, CEDAR: All-Sky Mapping of E-Region Neutral Winds Above Poker Flat, Alaska (NSF, \$197,350, 01-Jan-2008 for 2 years.)
- Conde, A Comparison of Thermospheric Composition Change Between the Dayside and Nightside as a Function of Auroral Activity Using Satellite and Ground-Based Data (Aerospace Corporation, \$52,456, 1-Jan-2008 for 3 years.)
- Conde, Lummerzheim, MRI: Development of a Thermospheric Wind Imager (NSF, \$684,788, 1-Jan-2009 for 2 years.)
- Conde, Lummerzheim, Nielsen, Development of a New Chemical Release Technique for Measuring Neutral Wind Velocity Gradients in Earth's Auroral thermosphere, (NASA, \$526,055, 1-July-2008 for 3 years.)
- Conde, NASA SMEX Evaluation (SAIC Corporation, \$33,256, 1-Jan-2009 for 4 months.)

Conde, UNIS Daytime Auroral Imager, (The University Center in Svalbard, \$85,587, 1-Oct-2009 for 3.5 years.)

Conde, Collaborative Research: Thermospheric Neutral Wind Observations from the Antarctic Peninsula (NSF, \$124,982, 1-July-2010 for 2 years.)

Conde, Sounding Rocket Payload Systems for In-situ Measurements of Ionosphere-Thermosphere Structure at Small Spatial Scales (NASA, \$373,649, 1-March-2012 for 2 years.)

Conde, Auroral Spatial Structures Probes – University of Alaska Co-I participation (NASA, \$67,630, 1-March-2011 for 3 years.)

Conde, Dynamics of the Coupled Ionosphere-Thermosphere System (U.S. Department of the Air Force, \$44,982, 1-Oct-2011 for 3 years.)

Conde, Ground Based Optical Remote Sensing of Cross-scale Coupling Processes Occurring in Earth's Auroral Thermosphere (NSF, \$583,169, 1-Nov-2012 for 3 years.)

Bristow, Conde, Collins, Smith, Watkins, Collaborative Research: PFISR Ion-Neutral Observations in the Thermosphere (PINOT) (NSF, \$764,469, 1-Oct-2012 for 3 years.)

Conde, Ground Based Optical Remote Sensing of Cross-scale Coupling Processes Occurring in Earth's Auroral Thermosphere – Supplement (NSF, \$14,865, 15-Sep-2012, duration unspecified as this was a supplement to a pre-existing grant.)

Conde, The role of field aligned ion-drag in driving vertical winds and mass density enhancements observed in the cusp region of Earth's upper thermosphere (NASA, \$896,281, 1-Feb-2013 for 3 years.)

Hampton, Conde, Collaborative Research: CEDAR--A Focused Study of Sustained Upward Vertical Winds in the Auroral Zone (NSF, \$223,146, 1-May-2013 for 3 years)

Hampton, Conde, ISINGLASS: Ionospheric Structuring: In Situ and Groundbased Low Altitude – University of Alaska Co-I participation (Dartmouth College, \$189,944, 8-April-2014 for 3 years.)

Conde, Hampton, Bristow, Smith, High-resolution Mapping of Thermospheric Wind and Temperature Fields near the Equatorward Edge of the Antarctic Polar Cap to understand Coupling to Layers both above and below (NSF, \$984,222, 15-July-2014 for 5 years.)

Conde, Ground Based Optical Remote Sensing of Cross-scale Coupling Processes Occurring in Earth's Auroral Thermosphere (NSF, \$14,898, 28-Aug-2014, duration unspecified as this was a supplement to a pre-existing grant.)

Conde, Hampton, Meriwether, CEDAR: High-resolution Multistatic Mapping of Small-Scale Flow Structures in Earth's Auroral Thermosphere (NSF, \$312,892, 21-July-2015 for 3 years.)

Conde, A sounding rocket investigation of neutral jets associated with auroral arcs – University of Alaska Co-I participation (NASA Goddard Space Flight Center, \$60,000, 15-Mar-2016 for 1 year.)

Conde, AZURE: Auroral Zone Upwelling Release Experiment – University of Alaska Co-I participation (Clemson University, \$77,677, 1-April-2016 for 2 years.)

Hampton, Fallen, Conde, CEDAR: Probing the upper E-region and lower F-region neutral winds using ionospheric heating (NSF, \$269,746, 2017 onward, for 3 years)

Conde, Aruliah, Kakinami, Hampton, Larsen, Lynch, Burchill, Ridley, Lessard, In-Situ Measurements of Neutral and Plasma Dynamics Associated with Earth's Cusp-Region Thermospheric Mass Density Anomaly (NASA, \$2,093,574, 2017 onward for 3 years)

Pending Proposals (since 2016)

Bristow, Conde: Atmospheric Expansion Response and Interaction Explorer (AERIE) Mission –
University of Alaska Co-I participation (NASA, \$1,503,948, June 2017 onward for 8 years)