

# CURRICULUM VITAE: Douglas Kevin Duncan

PRESENT ADDRESS Dept. of Astrophysical & Planetary Sciences  
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DATE OF BIRTH February 22, 1951---Glendale, California

EDUCATION B.S. with honor, in Astronomy  
California Institute of Technology, 1973  
Ph.D., Dec. 1980  
University of California at Santa Cruz  
Dissertation: "Li Abundances, Ca II K Line  
Emission, and Ages of Dwarfs in the Solar  
Neighborhood"

PROFESSIONAL BACKGROUND	<u>Position</u>	<u>Institution</u>	<u>Dates</u>
	Director, Fiske Planetarium	Univ. of Colorado	2002-2018
	Senior Instructor	Univ. of Colorado	2002-present
	Nat'l Education Coordinator	American Astron. Soc.	1996-2001
	Assoc. Prof. Astron.	Univ. of Chicago	1992-2001
	Director of Astronomy and Education	Adler Planetarium	1992-1996
	Astronomer	Space Tel. Sci. Institute	1986-1992
	Research Associate	Mt. Wilson & Las Campanas Obs.	1982-1986
	Carnegie Fellow	Mt. Wilson & Las Campanas Obs.	1980-1982
	Research Assist. to Dr. George Herbig and Dr. R.P. Kraft	Univ. of Calif. at Santa Cruz	1975-1980
	Lecturer, Summer Session	Univ. of Calif. at Santa Cruz	Summer 1979 Summer 1978
	Teaching Assistant, The Summer Science Program	NSF program at The Thacher School, Ojai, CA	Summer 1976 Summer 1975 Summer 1974
	Research Assist.	The Carnegie Obs. Big Bear Solar Obs.	1972-1973 Summer 1970

RESEARCH INTERESTS Formal and informal science education; stellar spectroscopy; primordial and early galactic nucleosynthesis as revealed in stellar abundances; stellar chromospheric activity and rotation.

MEMBERSHIPS American Astronomical Society  
Astronomical Society of the Pacific (former Board member)  
American Association of Physics Teachers  
International Astronomical Union  
The Explorers Club (New York)

NATIONAL AWARDS Richard Emmons National Award for Outstanding Astronomy Teaching at the University Level, 2011.

UNIVERSITY OF COLORADO AWARDS The Best Should Teach Gold Award, 2010.

NATIONAL SERVICE	<p>NASA Advisory Committee, Science Subcommittee, 2012-2015, 2015-2017</p> <p>American Astronomical Society Van Biesbrock Award Committee, 2009-11</p> <p>Board of Trustees, Astronomical Society of the Pacific.</p>
GRANTS	<p>Gordon and Betty Moore Foundation, “Enabling 2 Million Americans for the 2017 Total Solar Eclipse,” Co-I.</p> <p>NASA grant. “Enhancement of Astronomy and Earth Science Teaching Using High Resolution Immersive Environments,” 2016-2020, PI.</p> <p>Science Education Improvement Grant, postdoctoral support, 2011-2013.</p> <p>NSF Grant, “Community of Astronomy Teaching Scholars (CATS) National Implementation Program for Learner-Centered Astronomy Teaching,” Co-I, 2008-10</p> <p>NASA Grant, EPO Section of Lunar University Network for Astrophysics Research (LUNAR), 2009-2013.</p> <p>NASA grants for planetarium show production: COS (2012), Solar Astronomy (2008), Hubble Telescope (2006).</p> <p>NOAA grant for “Science on a Sphere (SOS)” and SOS upgrade (2006; 2009)</p> <p>NASA HST Grant, “Experimental Proof of the Neutrino Process in SN from the Boron Isotope Ratio,” (Co-I), 2004-7</p> <p>NASA Space Interferometry Mission, “Anchoring Pop. II Distance Scale,” (Co-I), 2001-</p> <p>NASA HST Grant, “Detection of <math>^{10}\text{B}/^{11}\text{B}</math>: Part II,” 1998</p> <p>NASA HST Grant, “Comparative Analysis of the Sun and <math>\alpha</math> Cen,” 1997</p> <p>NASA HST Grant, “Boron in Be-Deficient Halo Stars,” 1996</p> <p>NASA HST Grant, “Major NLTE Corrections to HST Boron Observations?” 1995</p> <p>NASA HST Grant, “Detection of <math>^{10}\text{B}/^{11}\text{B}</math> and Galactic Chemical Evolution,” 1995</p> <p>NASA HST Grant, “Boron as a Probe of the Formation of the Galactic Halo, and of Primordial Nucleosynthesis,” 1993</p> <p>NASA HST Grant, “Evolution of Boron: Implications for Galactic Evolution,” 1993</p> <p>NASA HST Grant, “Boron as a Probe of Stellar Structure and Mass Loss,” 1992</p> <p>NASA HST Grant, “Be and B as Probes of Cosmic Ray Spallation and Stellar Structure,” 1991</p> <p>NASA HST Grant, “Precision Parallaxes of Cepheid and RR Lyrae Stars,” 1991</p> <p>Four NASA IUE Grants, 1981, 1982, 1985, 1987-88</p> <p>National Science Foundation, “Chromospheric Variations in Late-Type Stars,” 1984</p> <p>National Geographic Society, “Synoptic Observation of Magnetically Induced Chromospheric Variations in Main Sequence Stars,” 1982</p>
SELECTED TECHNICAL CONTRIBUTIONS	<p>Installation and Calibration, Apache Point Observatory 3.5m echelle spectrograph.</p> <p>NOAO 8-meter Telescope Planning Committee.</p> <p>Designed, built (the electronics), and implemented a three-photomultiplier tube spectrometer for use at the focus of the Lick coude camera. Interfaced the device and computer; wrote machine-language programs for operation.</p> <p>Assisted in the design of an echelle spectrometer for the Lick 3-m. coude.</p> <p>Modified the Mount Wilson 100” intensified Reticon to achieve very high resolution for line profile analysis, and the 60” HK spectrometer to observe giant stars.</p>
INVITED TALKS, CONFERENCES, WORKSHOPS 1990-PRESENT	<p>Invited Review Chapter, “<i>Technology and Engagement in the University Classroom</i>,” American Astronomical Society-Institute of Physics, 2019.</p> <p>Invited talk, Univ. of California, Santa Cruz, “Scientific Science Teaching,” fall 2015.</p> <p>Invited talk, 50<sup>th</sup> Anniversary Celebration, Univ. of California, Santa Cruz, “Alumni with Exceptionally Interesting Careers,” spring 2015.</p>

Invited talks, Univ. of Western Ontario, McMaster University (Canada), “Applying the Science Method to University Science Teaching: Remarkable effort, Remarkable success,” 2015.  
 Invited talk, Penn State Univ., “Science Classes for Non-science Students What’s the goal; what’s the approach?” 2015.  
 Invited presentation to State of Colorado and Univ. of Colorado leaders: “Technology and Student Performance,” 2012.  
 Invited talk, 2012 National Clicker Conference, “Technology and Student Performance.”  
 Invited Talk, Univ. of Delaware conference, Retrospective: 6 years of clicker use. 2012.  
 Workshop leader, American Astronomical Society, 2010: “Interactive Teaching.”  
 Keynote talk, Inaugural National Conference on Classroom Response Systems, 2009.  
 “Teaching with Clickers,” Keynote talk and faculty workshop, Univ. of Delaware, 2006.  
 “Clickers and Case Study Teaching,” Keynote talk and workshop, SUNY Buffalo, 2006.  
 “Interactive Teaching” (invited review), Gettysburg, PA, 2005.  
 “Teaching with Technology: Student Response Systems,” Faculty Teaching Excellence Program (FTEP), Univ. of Colorado, 2004-2012, every year.  
 “Science and Engineering Education and the Future of Aerospace” (invited review for NASA,) The James Baker Institute for Public Policy, 2002.  
 “Ten Years of HST Science” (invited review, Baltimore, MD, 2000.  
 Organizing Committee, “Primordial Nuclei and their Galactic Evolution,” Bern, Switzerland, 1997.  
 “Nuclei in the Cosmos IV,” Notre Dame, IN, 1996.  
 American Physical Society Mtg., “Observational Cosmology,” Indianapolis, IN, 1996.  
 Goddard Conference, “Cosmic Abundances,” College Park, MD, 1995.  
 Snowmass Workshop, “Particle and Nuclear Astrophysics and Cosmology,” CO, 1994.  
 Education Advisory Committee, American Astron. Soc., 1993-1996.  
 Yamada Conference XXXVII, “Evolution of the Universe and its Observational Quest,” Tokyo, Japan, 1993.  
 Texas/Pascos '92, “Relativistic Astrophysics and Cosmology,” Berkeley, 1992.  
 Member, Organizing Committee of the first US conference on “Gender Issues in Astronomy,” Baltimore, MD, 1992.  
 National Academy of Science Colloquium on Physical Cosmology, Irvine, CA, 1992.  
 NATO Advanced Research Workshop, “Angular Momentum Evolution of Young Stars,” Noto, Italy, 1990.  
 European Meeting, “The Problem of Lithium,” Frascati, Italy, 1990.  
 Workshop, “Optical Fibres in Astronomy,” Tucson, AZ, 1988.

**PH.D. STUDENTS ADVISED**

Luisa Rebull – tenured at IPAC  
 Francesca Primas – tenured at ESO  
 Colin Wallace – faculty, Univ. of North Carolina

**TEACHING ACTIVITIES**

University of Colorado, Introductory Astronomy; Data Analysis and Computer Programming, 2002-  
 Wrote planetarium script for national distribution, “The Many Faces of the Hubble Telescope (Spanish version - Las Muchas Caras del Telescopio Hubble)” 2007-8.  
 Wrote two planetarium show scripts, “Deep Impact,” and “City of Stars,” 2004-6.  
 Professor in the Core Curriculum, Univ. of Chicago, 1996-2000.  
 Teaching courses, writing planetarium shows, and designing exhibits, Adler Planetarium, 1992-96.  
 Lecturer, Johns Hopkins University School of Continuing Studies, 1988-1990.  
 Visiting Faculty, Occidental College, California, 1985. Team-taught with Dr. Alan Dressler.  
 Summer Session Lecturer in Astronomy, Univ. of California at Santa Cruz, 1978 and 1979.  
 Invited participant, founding meeting for the “Multi-Campus Group for Research and Development in Learning and Teaching,” University of California, Berkeley, 1979.  
 Leader of training sessions for new Graduate Student Teaching Assistants, Univ. of Calif., 1978-79, Univ. of Chicago, 1995-2002, Univ. of Colorado, 2002-2017

Teaching Assistant for three summers at the NSF Summer Science Program Ojai, CA. -  
 Taught celestial mechanics, astronomy, calculus, to a nationally-selected group of  
 high school students.  
 Developed laboratory and observational exercises for courses, UC Santa Cruz.

#### SELECTED EDUCATIONAL GRANTS

NSA Grant, "Enhancement of Astronomy and Earth Science Teaching Using High  
 Resolution Immersive Environments," 2015-2020.  
 NASA Grant, "Planetarium Modules for College Class Use," 2006.  
 NASA Grant, "*Seeing the Invisible* Museum Exhibits," 2005.  
 SIM Grant, "Starlab Inflatable Planetarium," 2004.  
 NSF Grant, "Systemic Reform of Astro 101," (Co-I), 2000.  
 Ameritech Foundation Grant, "Ameritech-Adler Space Information Center," 1996.  
 NASA IDEA GRANT, "Walk Through the Rainbow," 1995.  
 NASA IDEA GRANT, "Hubble Picture Books and HST in the Planetarium," 1994.  
 NSF NSF/Exploratorium Exhibits Grant (Institutional Award), 1993.

#### SELECTED PUBLIC TALKS

Astronomical Society of the Pacific Annual Meeting, Keynote Talk, "Latest Results from  
 the Hubble Space Telescope," 1998(with astronaut Steve Hawley).  
 Abbott Laboratories Annual Dinner, 1995, 1997.  
 U.S. Coast Guard Academy, "Results from the Hubble Space Telescope," 1990.  
 National Meeting of Deans of Continuing Education Programs, "Science as a Liberal Art,"  
 talk: "What is Science?" 1989.  
 Inaugural Lecturer, Space Telescope Science Institute "Open Night at the Institute " series,  
 1988.  
 Guest lecturer, *Ojai Summer Science Program*, 1981, 83, 85, 1990-93.

#### OTHER PUBLIC SCIENCE ACTIVITIES

Colorado Public Radio. Monthly science commentary on "Colorado Matters." 2014-  
*History Channel*, "Life and Death of a Star," 2007.  
 WBEZ (National Public Radio) Chicago. Astronomer-in-residence, co-host of live  
 monthly program, 1995-1999.  
 Leader, Solar Eclipse Expeditions, Bolivia (1994),  
 Galapagos (1998), Africa (2001), Greece, Egypt, Turkey (2006), China (2009)  
 BBC Television Program *Horizon*, 1993.  
 Arctic Odyssey to the N. Magnetic and N. Geographic Poles, 1993.  
 Lecturer, Adler Planetarium, Univ. of Chicago, and UCLA trip to Mexico for the total solar  
 eclipse of July 1991.  
 BBC Television Program *The Sky at Night*, Patrick Moore, interviewer, 1991.  
 Selection Committee for the AAAS/Westinghouse Award for Public Understanding of  
 Science and Technology, 1991-92.  
 National Public Radio Program All Things Considered, "Spectroscopy with the Hubble  
 Space Telescope," Richard Harris, interviewer, 1990.  
 Trip Leader, Arctic Auroral Odyssey to Baffin Island, 1990-1991.  
 Script Consultant, Maryland Public Television Series, "Starfinder," 1990-91.  
 Script Consultant, Maryland Science Center/Davis Planetarium, 1990-~.  
 "Astronomer of the Ship," Sun Line cruise of South America through the Straits of  
 Magellan, 1988.  
 Lecturer and Photography Instructor, Sun Line Halley's Comet Cruise, 1986.  
 National Public Radio Program *All Things Considered*, "Mt. Wilson Observatory and the  
 Solar-Stellar Connection," George Alexander, interviewer, 1985.  
 BBC Television Program *The Sky at Night*, Patrick Moore, interviewer, 1985.

## BIBLIOGRAPHY

DOUGLAS KEVIN DUNCAN

### BOOKS AND BOOK CHAPTER

Clickers in the Classroom, D.K. Duncan, Benjamin Cummings, 2005.

Clickers in the Astronomy Classroom, D.K. Duncan, Benjamin Cummings, 2006.

“Technology and Student Engagement in the University Classroom” chapter in *Astronomy Education: A Practitioner’s Guide to the Research*, Institute of Physics, 2019 (in press).

### REFEREED PUBLICATIONS

A Determination of R from Optical and Radio Observations of Planetary Nebulae, w/Steven A. Hawley, *Publ. Astron. Soc. Pac.*, **88**, 672, 1976.

Photometry of the Reflection Nebulosity Surrounding V1057 Cygni, w/E. A. Harlan and G. H. Herbig, *Astron. J.*, **86**, 1520, 1981.

Lithium Abundances, K Line Emission, and Ages of Nearby Solar-type Stars, *Ap.J.*, **248**, 651, 1981.

Lithium Abundance and Age Spread in the Pleiades, D. K. Duncan and B. F. Jones, *Ap.J.*, **271**, 663, 1983.

Rotation, Convection, and Magnetic Activity in Lower Main Sequence Stars, R. W. Noyes, L. W. Hartmann, S. L. Baliunas, D. K. Duncan, and A. H. Vaughan, *Ap.J.*, **279**, 763, 1984.

A Study of the Dependence of Mg~II Emission on the Rotational Periods of Main-sequence Stars, L. Hartmann, S. L. Baliunas, D. K. Duncan, and R. W. Noyes, *Ap.J.*, **279**, 778, 1984.

A Sample of Solar-Type Stars of Known Age, *Astron.J.*, **89**, 515, 1984.

Chromospheric H and K Emission and Rotation of the Hyades Lower Main Sequence, D. K. Duncan, S. L. Baliunas, R. W. Noyes, A. H. Vaughan, J. Frazer, and H. H. Lanning, *Publ. Astron. Soc. Pac.*, **96**, 707, 1984.

The Photometric Variability of Solar-Type Stars IV: Detection of Rotational Modulation Among Hyades Stars, W. G. Lockwood, D. T. Thompson, R. R. Raddick, W. H. Osborn, W. E. Baggett, D. K. Duncan, and L. W. Hartmann, *Publ. Astron. Soc. Pac.*, **96**, 714, 1984.

Evidence for Global p-Mode Oscillations in the K2 Dwarf  $\epsilon$  Eridani, R. W. Noyes, S. L. Baliunas, E. Belserene, D. K. Duncan, J. Horne, and L. Widrow, *Ap.J.(Letters)*, **285**, L23, 1984.

Time Series Measurement of Chromospheric Ca II H and K Emission in Cool Stars and the Search for Differential Rotation, S. L. Baliunas, J. H. Horne, A. Porter, D. K. Duncan, R. W. Noyes, and A. H. Vaughan, *Ap.J.*, **294**, 310, 1985.

Short Timescale Periodicity in H $\alpha$  Emission from H II 1883, G. W. Marcy, D. K. Duncan, and R. Cohen, *Ap.J.*, **288**, 259, 1985.

Variable Polarization and Activity in Arcturus, J. C. Kemp, G. D. Henson, D. S. Kraus, J. S. Beardsley, L. C. Carroll, and D. K. Duncan, *Ap.J.*, **301**, L35, 1986.

The Pleiades Rapid Rotators: Evidence for an Evolutionary Sequence, R. P. Butler, R. D. Cohen, D. K. Duncan, and G. W. Marcy, *Ap. J.*, **319**, L19, 1987.

Lithium Abundances of Southern F, G, and K Dwarfs and Subgiants, R. Pallavicini, M. Cerruti-Sola, and D. K. Duncan *Astron. and Astrophys.*, **174**, 116, 1987.

The Lithium Abundance in Halo Stars, L. M. Hobbs and D. K. Duncan, *Ap. J.*, **317**, 796, 1987.

Li Production in the Big Bang, D. K. Duncan and L. M. Hobbs, *Indian J. Astr. Astrophys.*, **8**, 83, 1987.

The Activity, Variability, and Rotation of Lower Main Sequence Hyades Stars, R. Radick, D. T. Thompson, G. W. Lockwood, D. K. Duncan, and W. E. Baggett, *Ap. J.*, **321**, 459, 1987.

Emissions from the Outer Atmospheres of M-Dwarfs, R. Rutten, R. Mewe, C. Schreiver, C. Zwaan, and D. Duncan, *Astron. and Astrophys.*, **219**, 239, 1989.

Fast Spectroscopic Variations on Rapidly Rotating Cool Dwarfs: III. Masses of Circumstellar Absorbing Clouds on AB Doradus, A. Collier-Cameron, D. K. Duncan, P. Ehrenfreund, B.H. Foing, K.D. Kuntz, M.V. Penston, R.D. Robinson, and D.R. Soderblom, *M.N.R.A.S.*, **247**, 415, 1990.

Time-Resolved CCD Photometry of an Ensemble of Stars in the Open Cluster M67, R. L. Gilliland, T. M. Brown, D. K. Duncan, N.B. Suntzeff, G.W. Lockwood, D.T. Thompson, R.E. Schild, W.A. Jeffrey, and B.E. Penprase, *Ap.J.*, **101**, 541, 1991.

The Lithium Abundance of the T-Tauri Star BP Tau, *Ap. J.*, **373**, 250, 1991.

Ca II H and K Measurements Made at Mt. Wilson Observatory, 1966-1983, D.K. Duncan, A.H. Vaughan, O.C. Wilson, G.W. Preston, J. Frazer, H. Lanning, A. Misch, J. Mueller, D. Soyumer, L. Woodard, S.L. Baliunas, R.W. Noyes, L.W. Hartmann, A. Porter, C. Zwaan, F. Middelkoop, R. Rutten, and D. Mihalas, *Ap. J. Suppl.*, **76**, 383, 1991.

The Chromospheric Emission--Age Relation for Stars of the Lower Main Sequence, D. R. Soderblom, D. K. Duncan, and D. Johnson, *Ap. J.*, **375**, 722, 1991.

The Abundance of Boron in three Halo Stars, D. K. Duncan, D. L. Lambert, and M. Lemke, *Ap. J.*, **401**, 584, 1992.

Rotation of Young Solar-Type Stars in the Orion Nebula Region, *Ap. J.*, **406**, 508, 1993.

The Evolution of the Li Abundances of Solar-Type Stars III: The Pleiades, D. R. Soderblom, B. F. Jones, S. Balachandran, J. R. Stauffer, D. K. Duncan, S. B. Fedele, J. D. Hudon, *Ap.J.*, **106**, 1059, 1993.

Evidence for a Dispersion in the Lithium Abundances of Extreme Halo Stars, C. P. Deliyannis, M. H. Pinsonneault, D. K. Duncan, *Ap. J.*, **414**, 740, 1993.

Chromospheric Variations in Main-Sequence Stars II, S. Baliunas and 26 co-authors, *Ap. J.*, **438**, 269, 1995.

Lithium in Young Solar-Type Stars in the Orion Nebula Region, D. K. Duncan, and L. M. Rebull, *P.A.S.P.*, **108**, 738, 1996.

Some Surprises Concerning the Origin of the Light Elements, D. K. Duncan, *Nuclear Physics A*, **621**, 10c, 1997.

*Hubble Space Telescope* Beryllium Abundances in the  $\alpha$  Centauri System, F. Primas, D. K. Duncan, M. H. Pinsonneault, Constantine Deliyannis, and J. A. Thorburn, *Ap. J.*, **480**, 784, 1997.

The Evolution of Galactic Boron and the Production Site of the Light Elements, D. K. Duncan, F. Primas, L.M. Rebull, A. M. Boesgaard, C. P. Deliyannis, L. M. Hobbs, J. R. King, and S. Ryan, *Ap. J.*, **488**, 338, 1997.

Boron Abundances and Internal Mixing in Stars I: The Hyades Giants, D. K. Duncan, R. C. Peterson, J. A. Thorburn, and M. H. Pinsonneault, *Ap.J.*, **499**, 871, 1997.

Boron in the Very Metal-Poor Star BD-13 3442, D. K. Duncan, L.M. Rebull, F. Primas, A. M. Boesgaard, C. P. Deliyannis, L. M. Hobbs, J. R. King, and S. Ryan, *Astron. Astrophys.*, **332**, 1017, 1998.

Key Questions for Low Metallicity Stars, D. Duncan, *Space Sci. Reviews*, **84**, 167, 1998.

Limits on the Boron Isotopic Ratio in HD 76932, L. M.Rebull, D.K. Duncan, S.Johansson, J. A. Thorburn, D. N. Schramm, and B. Fields, *Ap. J.*, **507**, 387, 1998.

The Remarkable Boron Depleted, Lithium Normal Pop. II Star HD160617, Primas, F., Duncan, D.K., and J.A. Thorburn, *Ap. J.*, **506**, L51, 1998.

A New Set of HST Boron Observations I. Testing Light Elements Stellar Depletion, Primas, F., Duncan, D.K., Peterson, R.C., and J.A. Thorburn, *Astron. Astrophys.*, **343**, 545, 1999.

Circumstellar Disk Candidates Identified from UV Excesses in the Orion Nebula Cluster Flanking Fields, L.M. Rebull, L.A. Hillenbrand, S.E. Strom, D.K. Duncan, B.M. Patten, C.Pavlovsky, R. Makidon, and M.Adams, *Ap.J.*, **119**, 3026, 2000.

A New Study of Oxygen Abundances derived from the OI triplet, F. Primas, L.M. Rebull, D.K. Duncan, L.M. Hobbs, J.W. Truran, T.C. Beers, *New Astronomy Reviews*, **45**, 541, 2001.

HST/STIS High Resolution Echelle Spectra of Alpha Centauri A (G2 V), I. Pagano, J.L. Linsky, J. Valenti, D.K. Duncan, *Astron. Astrophys.*, **415**, 331, 2004.

Clickers: A New Teaching Aid with Exceptional Promise, *Astron. Educational Rev.*, **5**, 2006.

A Study of General Education Astronomy Students' Understandings of Cosmology, Part I: Development and Validation of Four Conceptual Cosmology Surveys, Colin Wallace, E. Prather, D.K. Duncan, *Astron. Educational Rev.*, **10**, 2011.

A Study of General Education Astronomy Students' Understandings of Cosmology, Part II: Evaluating Four Conceptual Cosmology Surveys: A Classical Test Theory Approach, Colin Wallace, E. Prather, D.K. Duncan, *Astron. Educational Rev.*, **10**, 2011.

Improving Student Attitudes about Learning Science and Student Scientific Reasoning Skills, D.K. Duncan and L. Arthurs, *Astron. Educational Rev.*, **11**, 2012.

A Study of General Education Astronomy Students' Understandings of Cosmology, Part III: Evaluating Four Conceptual Cosmology Surveys: An Item Response Theory Approach, Colin Wallace, E. Prather, D.K. Duncan, *Astron. Educational Rev.*, **11**, 2012.

A Study of General Education Astronomy Students' Understandings of Cosmology, Part IV: Common Difficulties Students Experience with Cosmology, Colin Wallace, E. Prather, D.K. Duncan, *Astron. Educational Rev.*, **11**, 2012.

Digital Devices, Distraction, and Student Performance: Does In-Class Cell Phone Use Reduce Learning? D.K. Duncan, A.R. Hoekstra, B.R. Wilcox, *Astron. Educational Rev.*, **11**, 2012.

Technology and Engagement in the University Classroom, *Astronomy Education 2: A Practitioner's Guide to the Research, Chapter 4*, 2019 (in press), IOP publishing.

## UNREFEREED PUBLICATIONS

Approaching the Speed of Light, w/Steven A. Hawley, *Griffith Observer*, **40**, 2, 1976.

A Study of the Binary  $\delta$  Scuti System  $\delta$  Delphini, w/George W. Preston, *Bull. American Astron. Soc.*, **11**, No. 4.

H<sub>2</sub> Kinematics in the Protoplanetary Nebula CRL 618, w/S. E. Persson, P. J. McGregor, H. L. Lanning, T. R. Geballe, and C. J. Lonsdale, *16th ESLAB Symposium on Galactic and Extragalactic Infrared Spectroscopy*, 1982.

On the Origins of Chromospheric Activity in Late-Type Stars, in *Cool Stars, Stellar Systems, and the Sun*, (Berlin: Springer-Verlag), p.128, 1983.

Did the Young Sun Rotate at 100 km s<sup>-1</sup>? in *The Hydromagnetics of the Sun*, T. D. Guyenne and J. J. Hunt, eds., ESA SP-220, Noordwijk, The Netherlands, 1984.

Stellar Activity, in IAU Symposium #118, *Instrumentation and Research Programs for Small Telescopes*, J.B. Hearnshaw, ed. (Reidel: 1986).

The Time Variability of Magnetic Fields on Epsilon Eridini, w/S.Saar, and J.L. Linsky, in *Cool Stars, Stellar Systems, and the Sun*, M. Zeilik and D.M. Gibson, ed. (Springer-Verlag, Berlin: 1986).

Primordial Nucleosynthesis of <sup>7</sup>Li, w/L. Hobbs, in IAU Symposium #124, *Observational Cosmology*, A. Hewitt, ed. (Reidel: 1987).

The Accuracy of High S/N Spectroscopic Measurements, in IAU Symposium #132, *The Impact of High S/N Spectroscopy on Stellar Physics*, Cayrel, G. and Spite, M., ed. (Kluwer: 1988).

Observations of Li, Be, and B in Metal-Poor Stars, *Ann. N.Y. Academy of Sciences*, **688**, 757, 1993.

Observations of Li, Be, and Boron: Implications for the Early Universe and the Early Galaxy, in *Evolution of the Universe and Its Observational Quest*, K. Sato, ed. (Universal Academy Press, Tokyo: 1994).

Be Abundances in the Alpha Centauri System, F. Primas, D. K. Duncan, R. C. Peterson, and J. A. Thorburn, in *Cool Stars, Stellar Systems, and the Sun*, R. Pallavicini and A. Deupree, ed. (ASP: San Francisco), 1996.

Boron in the Hyades Giants, D. K. Duncan, J. A. Thorburn, R. C. Peterson, M. H. Pinsonneault, and C. P. Deliyannis, in *Cool Stars, Stellar Systems, and the Sun*, R. Pallavicini and A. Deupree, ed. (ASP: San Francisco), 1996.

The Evolution of Boron in the Galaxy, D. K. Duncan, F. Primas, L.M. Rebull, A. M. Boesgaard, C. P. Deliyannis, L. M. Hobbs, J. R. King, and S. Ryan in *Cosmic Abundances*, C. Holt, ed. (ASP: San Francisco), 1996.

The Boron Abundance of BD-13 3442, L.M. Rebull, D. K. Duncan, A. M. Boesgaard, C. P. Deliyannis, L. M. Hobbs, J. R. King, and S. Ryan in *Cosmic Abundances*, C. Holt, ed. (ASP: San Francisco), 1996.

Boron in the Galactic Halo and Disk, D.K. Duncan, F. Primas, K.A. Coble, L.M. Rebull, A.M. Boesgaard, C.P. Deliyannis, L.M. Hobbs, J.R. King, and S. Ryan, in *Science with the Hubble Space Telescope II*, P. Benvenuti, F.D. Machetto, and E.J. Schreier, ed.(ASP: San Francisco), 1996.

The Boron Isotopic Ratio in HD 76932, L. M. Rebull, D.K. Duncan, S. Johansson, J. A. Thorburn, D. N. Schramm, and B. Fields, *Cool Stars 10*, CD-967.

What to Do in a Large Lecture Class besides Lecture, *Mercury*, Jan.-Feb. 1999.



What Topics are taught in Introductory Astronomy Courses, T. Slater, J.P. Adams, G. Brissenden, and D. K. Duncan, *The Physics Teacher*, **31**, 8, 2001.

Careers in Astronomy, D.K. Duncan, in *Space Sciences: Planetary Science and Astronomy*, Macmillan Reference, **2**, 2001.

Student Response Questions to accompany *The Cosmic Perspective*, (CD), Benjamin Cummings, 2006.

“Run a 2017 Eclipse Event,” D.K. Duncan, *Mercury Magazine* (Astron. Soc. Pacific), **44**, 3, 2015.

INTERNATIONALLY DISTRIBUTED VIDEOS IN 360 DEGREE (FULL-DOME) FORMAT  
(Scripts and narration; distributed to over 200 planetariums worldwide as of 2019)

“Cosmic Origins,’ planetarium program, 2014.

“The Great American Eclipse of 2017,” planetarium short feature, 2017.

“Explorations: Gravity Recovery and Climate Experiment,” planetarium short feature, 2018.

“Explorations: MU-69,” planetarium short feature, 2018.

“Explorations: CubeSats: Big Science, Small Package,” planetarium short feature, 2019

“Explorations: The Parker Solar Probe,” planetarium short feature, 2019.

“Explorations: Earth’s Story Told by the Moon – Science from the Apollo Missions,” planetarium short feature 2019.