

Jeremiah K. Darling

Assistant Professor of Astrophysics
Center for Astrophysics and Space Astronomy (CASA)
Department of Astrophysical and Planetary Sciences, University of Colorado
389 UCB, Boulder, CO 80309-0389
(303) 492-4881 (office); (303) 258-7423 (home)
e-mail: jdarling@origins.colorado.edu
<http://casa.colorado.edu/~jdarling>

EDUCATION

Cornell University. Ithaca NY, Department of Astronomy and Space Sciences

Ph.D. in Astrophysics 2/02; M.S. in Astrophysics 2/00, GPA 3.9

Dissertation: “*The Arecibo OH Megamaser Survey*”

Committee: R. Giovanelli (Major Advisor, Astrophysics), S. Teukolsky (Minor Advisor, Physics), M. Haynes, J. Cordes, D. Chernoff

California Institute of Technology. Pasadena, CA.

B.S. with Honors in Physics 6/96, GPA 3.9

Major Advisor: J. Pine (Physics); Research Advisors: S. G. Djorgovski & J. Cohen (Astronomy)

RESEARCH

Assistant Professor (8/06–present) University of Colorado. Applications of extragalactic formaldehyde to star formation, galaxy evolution, and cosmology. Mid-IR spectroscopy of OH megamaser galaxies. Search for maser emission from “Hot Jupiters.” Observation of an occultation of a radio lobe by Enceladus and Saturn’s E-ring. HI 21 cm surveys at high and low redshift. Constraints on the evolution of fundamental constants. The coevolution of galaxies and massive black holes.

Hubble Fellow (8/05–8/06) University of Colorado. Search for radio-loud probes of the epoch of reionization. HI 21 cm surveys for damped Ly α systems. Surveys for high redshift molecular absorption. Extragalactic formaldehyde as a tracer of cold dense molecular gas. Constraints on the evolution of physical constants. HI rotation widths of AGN host galaxies.

Barbara McClintock Fellow (7/04–8/05), **Carnegie Fellow** (7/02–7/04). Carnegie Observatories. Synthesis imaging, photometric, long-slit, and integrated field studies of OH megamasers and merging galaxies. OH megamaser variability studies. Surveys for high redshift OH megamasers. Maser searches toward super star clusters and extrasolar planets. The radio X-ray connection in galaxy groups. Constraints on the evolution of physical constants. Search for radio-loud probes of the epoch of reionization. HI 21 cm surveys for damped Ly α systems. Extragalactic surveys for molecular transitions.

Research Associate. (10/01–6/02) Cornell University. Monitoring campaign to characterize the variability, size scales, and mechanisms of OH megamasers. VLBA spectral line observations of OH megamasers at $z \simeq 0.2$ to characterize maser size, distribution, and mechanism (with A. Peck & K. Menten). Optical spectral classification of OH megamaser galaxies. Survey for methanol megamasers (with P. Goldsmith, D. Li, & R. Giovanelli).

Thesis Research. (3/99–10/01) Cornell. The Arecibo OH megamaser survey. Results applied to merger rate of galaxies and a detailed study of the OH megamaser phenomenon. Discovered 50 OH megamasers.

Graduate Research. (3/00–6/01) Cornell. Study of environments of damped Ly α systems, bias, and

evolution of “typical” galaxies (with A. Wolfe, E. Gawiser, J. Cooke, & J. Prochaska).

Graduate Research. (5/98–5/01) Cornell. R. Giovanelli. Astronomical site survey above 17,000 feet in northern Chile to characterize the seeing and water vapor profile throughout the seasonal cycle.

Undergraduate Research Assistant. (8/95–7/96) California Institute of Technology (Caltech). S. G. Djorgovski. Continued the high-redshift quasar search; discovered four quasars with $z > 4$.

NASA Summer Undergraduate Research Fellow. (SURF; 6/95–8/95) Caltech. S. G. Djorgovski. Search for high redshift quasars using the Second Digitized Palomar Sky Survey and the Palomar 5m telescope. Discovered six quasars with $z > 4$.

Undergraduate Research Assistant. (8/94–6/95) Caltech. J. Cohen. Observed and constructed detailed, low noise light curves for 60 RR Lyrae variable stars in the globular cluster M15.

NASA SURF. (6/94–8/94) Caltech. J. Cohen. Light curve of the supernova 1993J progenitor in M81.

FELLOWSHIPS AND AWARDS

National Science Foundation (NSF) Grant. (7/07) “Formaldehyde: A Unique Probe of Galaxy Evolution and Cosmology” (AST 07-07713)

NSF Grant. (8/07) “Cosmological Changes in Fundamental Constants of Nature” (J. Stocke PI; AST 07-07480)

Hubble Fellowship. (8/05–8/06)

Barbara McClintock Fellowship. (7/04–8/05)

Carnegie Fellowship. (7/02–7/04)

NSF Grant. (4/01) “OH Megamasers and Galaxy Evolution” (R. Giovanelli PI; AST 00-98526)

Cranson W. and Edna B. Shelly Award for Graduate Research in Astronomy. (5/00) Awarded by Cornell Astronomy Department for “outstanding graduate student research achievements in astronomy.”

Elanor York Prize. (5/99) Awarded by Cornell Astronomy Department to the “most outstanding graduate student.”

NASA Space Grant Fellowship. (8/96–12/96) Awarded by Cornell Astronomy Department.

Caltech Merit Scholarship. (9/95–6/96) Awarded by Caltech.

Doris S. Perpall SURF Speaking Award (First Place). (1/96) Awarded by Caltech/NASA JPL for summer research presentation competition.

Doris S. Perpall SURF Speaking Award (Semi-Finalist). (10/94) Awarded by Caltech/NASA JPL.

Millikan Book Scholarship. (9/92–6/94) Awarded by Caltech Admissions Office.

National Merit Scholarship. (9/92–6/93)

RESEARCH INTERESTS

Cosmology: Constraining evolution of physical constants, identifying radio-loud probes of the reionization epoch, employing formaldehyde as a probe of cosmological parameters.

Galaxy Evolution: Mergers, starbursts, damped Ly α systems, AGN evolution, star formation histories, the coevolution of galaxies and their massive black holes.

OH Megamasers: Applications to galaxy evolution, star formation, galaxy mergers, and binary massive black holes. Studies of the kinematics and size scales of OH megamasers with variability monitoring and synthesis imaging. Multiband studies of merging galaxies.

Neutral Hydrogen Absorption at High Redshift: Searches for damped Ly α systems and studies of reionization.

Centimeter Atomic and Molecular Lines: Searches for damped Ly α systems (in H I) and extragalactic molecular absorption and maser systems in OH, H₂O, methanol (CH₃OH), formaldehyde (H₂CO), and CH. Formaldehyde absorption against the CMB.

Extrasolar Planets: Maser emission and molecular spectroscopy of “hot Jupiters.”

Telescope Site Surveys: Astronomical seeing, water vapor, opacity, and meteorological measurements.

TECHNICAL SKILLS

Observing: Extensive experience with optical photometry, spectroscopy, and single dish radio spectroscopy (Magellan, Palomar 200”, Hubble Space Telescope, Kitt Peak, Arecibo, Green Bank Telescope). Experience with spectral line and continuum synthesis imaging (VLA, WSRT, GMRT, VLBA). Experience with near-IR imaging and mid-IR spectroscopy (Apache Point, Magellan, Spitzer Space Telescope).

Computing: C, perl, glish, cl, python, php. OS's: Mac OS X, Linux, Unix, MS Windows (admin and networking of all). Markup: HTML, LaTeX. Analysis and visualization: IRAF, AIPS++, AIPS, ANALYZ, Mathematica, SM, IDL, Matlab, CASA.

Site Survey Techniques: Acquisition and reduction of radiosonde and astronomical seeing data.

TEACHING AND OUTREACH

Instructor. (Fall 2006–present) University of Colorado. ASTR 5110 “Internal Processes in Gases,” ASTR 4020 “Senior Practicum,” ASTR 3520 “Astronomical Spectroscopy” (assisting J. Bally), Faculty Research Seminar for new graduate students

Mentor. (Summer 2007–present) Work with undergraduate student Erin Macdonald on a survey for HI 21 cm absorption in the local universe.

Mentor. (Spring 2007–present) Work with graduate student Benjamin Zeiger on formaldehyde applications in galaxy evolution and cosmology.

Mentor. (Fall 2006–present) Work with graduate student Kyle Willett on Spitzer programs “The Astrophysics of OH Megamasers” and “Compact Symmetric Objects” (the latter with John Stocke)

Mentor. (Summer 2004) Research Science Institute mentor for Daniel Thai on “A Search for Radio Probes of the Epoch of Reionization.”

Instructor. (Spring 2003) University of Southern California. Astronomy 420: “Galaxies and Cosmology.” (with P. Martini)

Outreach. Public sessions at Sommers Bausch Observatory. Class visits and special events work at local public schools (Longfellow Elementary, Pasadena High). Caltech SURF session chair for student presentations (2002, 2003). Work cited in popular articles in *Astronomy* (1/07) and *Astronomy Now* (UK; 8/02); “Ask a Scientist” article for Ithaca Journal. Info sessions for prospective graduate students.

John S. Knight Writing Program Teaching Assistant. (Spring 1998, 1999) Cornell. Astro 202: “Our Home in the Solar System.”

- John S. Knight Writing Program Teaching Assistant.** (Fall 1997, 1998) Cornell. Astro 201: “Our Home in the Universe.”
- Teaching Assistant.** (Spring 1997) Cornell. Astro 102/104: “Our Solar System.” Led recitation sections, wrote and graded problem sets and exams.
- SURF Program Peer Coach.** (6/95–10/95) Caltech. Advised SURF students on research presentations.

REFEREED PUBLICATIONS

- HI and OH Absorption in the Lensing Galaxy of MG J0414+0534.** S. J. Curran, *J. Darling*, A. D. Bolatto, M. T. Whiting, C. Bignell, & J. K. Webb. 2007, MNRAS, in press
- Formaldehyde Densitometry of Starburst Galaxies.** J. G. Mangum, *J. Darling*, K. M. Menten, & C. Henkel. 2007, ApJ, submitted
- Properties of Active Galaxies Deduced from HI Observations.** L. C. Ho, *J. Darling*, & J. E. Greene. 2007, ApJ, submitted
- A New HI Survey of Active Galaxies.** L. C. Ho, *J. Darling*, & J. E. Greene. 2007, ApJ, submitted
- A Dense Gas Trigger for OH Megamasers.** *J. Darling*. 2007, ApJ, in press
- Optical Spectral Classification of Major Mergers: OH Megamaser Hosts Versus Non-Masing (Ultra)Luminous Infrared Galaxies.** *J. Darling* & R. Giovanelli. 2006, AJ, 132, 2586
- The Arecibo Legacy Fast ALFA Survey. I. Science Goals, Survey Design, and Strategy.** R. Giovanelli, et al. 2005, AJ, 130, 2598
- On the X-Ray Properties of OH Megamaser Sources: Chandra Snapshot Observations.** C. Vignali, W. N. Brandt, A. Comastri, & *J. Darling*. 2005, MNRAS, 364, 99
- High Resolution Imaging of the OH Megamaser Emission in IRAS 12032+1707 and IRAS 14070+0525.** Y. M. Pihlström, W. A. Baan, *J. Darling*, & H.-R. Klöckner. 2005, ApJ, 618, 705
- Detection of 21 cm HI Absorption at $z = 0.78$ in a Survey of Radio Continuum Sources.** *J. Darling*, R. Giovanelli, M. P. Haynes, A. D. Bolatto, & G. C. Bower. 2004, ApJ, 613, L101
- A Laboratory for Constraining Cosmic Evolution of the Fine Structure Constant: Conjugate 18 cm OH Lines Toward PKS 1413+135 at $z = 0.2467$.** *J. Darling*. 2004, ApJ, 612, 58
- Methods for Constraining Fine Structure Constant Evolution with OH Microwave Transitions.** *J. Darling*. 2003, Phys. Rev. Lett., 91, 011301
- Peculiar Broad Absorption Line Quasars Found in The Digitized Palomar Observatory Sky Survey.** R. J. Brunner, P. B. Hall, S. G. Djorgovski, R. R. Gal, A. A. Mahabal, P. A. A. Lopes, R. R. De Carvalho, S. C. Odewahn, S. Castro, D. Thompson, F. Chaffee, *J. Darling*, & V. Desai. 2003, AJ, 126, 53
- A Search for 6.7 GHz Methanol Masers in OH Megamaser Galaxies at $0.11 < z < 0.27$.** *J. Darling*, P. Goldsmith, D. Li, & R. Giovanelli. 2003, AJ, 125, 1177
- The OH Megamaser Luminosity Function.** *J. Darling* & R. Giovanelli. 2002, ApJ, 572, 810
- The Discovery of Time Variability in OH Megamasers.** *J. Darling* & R. Giovanelli. 2002, ApJ, 569, L87
- A Search for OH Megamasers at $z > 0.1$. III. The Complete Survey.** *J. Darling* & R. Giovanelli. 2002, AJ, 124, 100

- A Search for OH Megamasers at $z > 0.1$. II. Further Results.** *J. Darling & R. Giovanelli.* 2001, AJ, 121, 1278
- A Search for OH Megamasers at $z > 0.1$. I. Preliminary Results.** *J. Darling & R. Giovanelli.* 2000, AJ, 119, 3003
- The Optical/Infrared Astronomical Quality of High Atacama Sites. I. Optical Seeing** R. Giovanelli, *J. Darling*, M. Sarazin, J. Yu, P. Harvey, C. Henderson, W. Hoffman, L. Keller, D. Barry, J. Cordes, S. Eikenberry, G. Gull, J. Harrington, J. D. Smith, G. Stacey, & M. Swain. 2001, PASP, 113, 789
- The Optical/Infrared Astronomical Quality of High Atacama Sites. II. Infrared Characteristics** R. Giovanelli, *J. Darling*, C. Henderson, W. Hoffman, D. Barry, J. Cordes, S. Eikenberry, G. Gull, L. Keller, J. D. Smith, & G. Stacey. 2001, PASP, 113, 803
- The Nonvariability of the Progenitor of Supernova 1993J in M81.** J. G. Cohen, *J. Darling*, & A. Porter. 1995, AJ, 110, 308

SELECTED TALKS

- Redshifted Extragalactic Molecular Lines** (09/07) *Invited talk* for “Frontiers of Astronomy with the World’s Largest Radio Telescope” Washington, D. C.
- Masers in Starburst Galaxies** (03/07) *Invited review* for IAU Symposium 242 “Astrophysical Masers and Their Environments” Alice Springs, Australia
- Molecular Pathologies: Probes of Galaxy and Black Hole Evolution, Cosmology, and Fundamental Physics** Colloquium, Cornell and U Wyoming (10/06)
- Pathologies as Probes: Tunneling, Masing, and Dasing Insights into Galaxy and Black Hole Evolution, Cosmology, and Fundamental Physics** Colloquium, U Colorado Boulder (2/06)
- Are Constants Constant? A New Approach to Precision Measurement of the fine Structure Constant** JILA Astrophysics Lunch Seminar, U Colorado Boulder (9/05)
- The OH Molecule as a Probe of Galaxy Evolution and Cosmology** Colloquium, U Washington (2/04), U Colorado Boulder (3/04), UC Berkeley (3/04), Lawrence Livermore National Laboratory (3/04), NRAO Socorro (10/04), Spitzer Science Center (10/04), UC Santa Barbara (11/04), New Mexico State University (3/05)
- Cosmic Evolution of the Fine Structure Constant: Microwave Measurement Techniques, New Results, and Future Prospects** (2/04) Physics Seminar, U Washington
- OH Megamasers** (11/03) *Invited talk* for “40 Years of Scientific Discovery at Arecibo,” Arecibo
- OH Megamasers** (07/03) *Invited review* for IAU JD 21, “Astrochemistry of External Galaxies,” Sydney
- OH Megamasers: Discoveries, Insights, and Future Directions** (06/03) *Invited review* for “Future Directions in High Resolution Astronomy: The 10th Anniversary of the VLBA,” Socorro
- OH Megamasers: Luminous Tracers of Merging Galaxies, Extreme Starbursts, and Massive Black Holes** (03/02) *Invited talk* for the NAIC Visiting Committee, Arecibo Observatory.
- The Arecibo OH Megamaser Survey** (11/01) Colloquium, National Radio Astronomy Observatory, Charlottesville.
- Observing OH Megamasers with the Upgraded Arecibo Telescope** (6/01) *Invited talk*, Special Session 89: Observing with the Upgraded Arecibo Telescope: Methods and Recent Results, AAS Meeting

198, #89.03

The Arcibo OH Megamaser Survey: Detecting Radio Beacons of Merging Galaxies.

(7/00) Colloquium, NRAO Green Bank.

OH Megamasers at High Redshift and the Galaxy Merger Rate. (2/00) Contributed talk, Science with the Square Kilometer Array, NAIC.

Sleepless on the Altiplano: An Astronomical Site Survey. (4/99) Andes Seminar, Department of Earth and Atmospheric Sciences, Cornell.

CONFERENCE PROCEEDINGS & BOOK CHAPTERS

Masers in Starburst Galaxies *J. Darling.* 2007, Proc. IAU Symp. 242, Astrophysical Masers and Their Environments, eds. J. M. Chapman & W. A. Baan, in press

Formaldehyde: A High Redshift Tracer of Pre-Starburst Gas? *J. Darling.* 2006, ASP Conf. Ser., From Z-Machines to ALMA: (Sub)millimeter Spectroscopy of Galaxies, eds. A. J. Baker, J. Glenn, A. I. Harris, J. G. Mangum, & M. S. Yun., in press

Searching for High-Redshift Centimeter-Wave Continuum, Line, and Maser Emission Using the Square Kilometer Array. A. W. Blain, C. Carilli, & *J. Darling.* 2004, Science with the Square Kilometer Array, eds. C. Carilli & S. Rawlings, New Astronomy Reviews, 48, 1247

Measuring Changes in the Fundamental Constants with Redshifted Radio Absorption Lines. S. J. Curran, N. Kanekar, & *J. Darling.* 2004, Science with the Square Kilometer Array, eds. C. Carilli & S. Rawlings, New Astronomy Reviews, 48, 1095

OH Megamasers: Discoveries, Insights, and Future Directions. *J. Darling.* 2005, ASP Conf. Ser., Future Directions in High Resolution Astronomy: The 10th Anniversary of the VLBA, ed. J. D. Romney & M. J. Reid, 340, 216

The Arcibo OH Megamaser Survey and the Galaxy Merger Rate. *J. Darling,* and R. Giovanelli. 2000, ASP Conf. Ser., Gas and Galaxy Evolution, ed. J. Hibbard, M. Rupen, & J. van Gorkom, 240, 200

A Search for OH Megamasers at $z > 0.1$: Preliminary Results. *J. Darling,* and R. Giovanelli. 2001, ASP Conf. Ser., Science with the Atacama Large Millimeter Array, ed. A. Wootten, 235, 309

Luminosity Function of $z > 4$ Quasars from the Second Palomar Sky Survey. J. D. Kennefick, *J. Darling,* S. G. Djorgovski, & R. R. de Carvalho. 1997, Young Galaxies and QSO Absorption-Line Systems, ASP Conference Series, Vol. 114, ed. Sueli M. Viegas, Ruth Gruenwald, & Reinaldo R. de Carvalho, 95

ABSTRACTS

Formaldehyde Absorption Toward the Gravitational Lens B0218+357 at $z=0.68$. *J. Darling & T. Wiklind.* 2005, AAS Meeting 207, #203.01

Molecular Tori in AGN: A Search Using Excited States of OH. C. M. V. Impellizzeri, A. L. Roy, C. Henkel, *J. Darling,* & J. A. Braatz. 2005, Astron. Nachr., 326, 544

The Broad OH Megamaser Lines in Ultra Luminous Infrared Galaxies. Y. M. Pihlström, J. E. Conway, & *J. Darling.* 2004, AAS Meeting 205, #26.09

OH Maser Disks and Outflows in ULIRGs: VLBA Observations of two IRAS Galaxies. Y. M.

- Pihlström, W. A. Baan, *J. Darling*, & H.-R. Klöckner. 2003, AAS Meeting 203, #146.02
- OH Megamasers in External Galaxies.** *J. Darling*. 2003, The Astrochemistry of External Galaxies, IAU 25, JD 21
- The Green Bank Telescope OH Megamaser Survey.** B. Kent, J. Braatz, & *J. Darling*. 2002, AAS Meeting 201, #52.16
- The Arecibo OH Megamaser Survey.** *J. Darling*. 2001, AAS Meeting 199, #35.05
- Observing OH Megamasers with the Upgraded Arecibo Telescope.** *J. Darling* & R. Giovanelli. 2001, AAS Meeting 198, #89.03
- OH Megamasers: Luminous Radio Beacons of Merging Galaxies.** *J. Darling* & R. Giovanelli. 2001, AAS Meeting 198, #34.05
- A Survey of Lyman Break Galaxies Associated with Damped Lyman Alpha Systems at $z \sim 3$.** J. Cooke, A. M. Wolfe, E. Gawiser, J. X. Prochaska, & *J. Darling*. AAS Meeting 198, #54.10 (2001)
- The Arecibo OH Megamaser Survey and the Galaxy Merger Rate.** *J. Darling*, and R. Giovanelli. 2000, AAS Meeting 196, #51.01
- Optical/Infrared Site Survey in the High Atacama Desert.** R. Giovanelli, *J. Darling*, M. Sarazin, S. Eikenberry, B. Hoffman, M. Swain, J. Yu, P. M. Harvey, A. Otarola, and G. Valladares. AAS Meeting 193, #11.02 (1999)
- High-Redshift Quasars and Other Peculiar-Color Objects in DPOSS.** S. G. Djorgovski, S. C. Odewahn, R. R. Gal, R. R. De Carvalho, A. Kelly, J. Kollmeier, E. Kartalov, *J. Darling*, and V. Desai. AAS 192, #55.22 (1998)
- Galaxy Companions of Quasars at $z > 4$: Formation of Protocluster Cores?.** S. G. Djorgovski, K. R. Banas, S. C. Odewahn, R. R. Gal, M. A. Pahre, R. R. de Carvalho, V. Desai, & *J. Darling*. 1997, BAAS, 191, #95.07
- Discovery of 6 Bright Quasars at $z > 4$ From Digitized POSS-II.** *J. Darling*, R. R. de Carvalho, J. Kennefick, & S. G. Djorgovski. 1995, BAAS, 187, #84.17

COMMITTEES & PROFESSIONAL SOCIETIES

- Journal Referee.** Refereed submissions for Phys. Rev. Lett., ApJ, MNRAS, and A&A.
- Grant Referee.** Refereed grant proposals for the U.S. Civilian Research and Development Foundation and for the Basic Research Department of the Ministry of Science and Environmental Protection, Republic of Serbia. Refereed NASA Postdoctoral Program applications.
- Observatory Referee.** Refereed proposals for NRAO for VLA and VLBA programs.
- NRAO Users Committee.** A National Radio Astronomy Observatory advisory committee (2004–2007)
- Advisory Panels.** National Astronomy and Ionosphere Center program plan review (2007)
- Scientific Organizing Committees.** “Chicago-3 Community Workshop: Implementation of the SKA Program for the US Community” (2007)
- Square Kilometer Array Science Working Group.** Contributing author to two chapters of the book “Science with the Square Kilometer Array,” eds. C. Carilli & S. Rawlings, 2004, New Astronomy Reviews (Elsevier; Amsterdam).
- American Astronomical Society.** (1998–)

Sigma Xi. The Scientific Research Society (1995–)

REFERENCES

Riccardo Giovanelli. Professor of Astronomy, riccardo@astro.cornell.edu, (607) 255-6505, 412 Space Sciences Building, Cornell University, Ithaca, NY 14853

Wendy Freedman. Director of Carnegie Observatories, wendy@ociw.edu, (626) 304-0204, Carnegie Observatories, 813 Santa Barbara St, Pasadena, CA 91101

Martha Haynes. Goldwin Smith Professor of Astronomy, haynes@astro.cornell.edu, (607) 255-0610, 530 Space Sciences Building, Cornell University, Ithaca, NY 14853

Chris Carilli. North American ALMA Science Center Head, ccarilli@nrao.edu, (505) 835-7306, NRAO, Array Operations Center, P.O. Box 0, 1003 Lopezville Road, Socorro, NM 87801-0387

John Mulchaey. Staff Scientist, mulchaey@ociw.edu, (626) 304-0257, Carnegie Observatories, 813 Santa Barbara St, Pasadena, CA 91101