

Daniel Grin

Curriculum Vitae and Publication List

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BIOGRAPHICAL INFORMATION

Date of birth: February 23, 1981.

Citizenship: United States.

RESEARCH INTERESTS

Cosmic microwave background radiation, hydrogen recombination, dark matter halo merger histories and structure, axionic dark matter, non-standard cosmological thermal histories, astrophysical constraints to the properties of dark matter and dark energy, effective field theory approaches to gravity, galaxy clusters, gravitational lensing, baryogenesis, sterile neutrinos, Lyman-limit absorption systems in the Sloan Digital Sky Survey.

EDUCATION

- *Sept. 2004-present:* CALIFORNIA INSTITUTE OF TECHNOLOGY, Ph. D. Candidate in Astrophysics; degree expected June 2010.
Thesis: *Astrophysical windows on new degrees of freedom.*
Advisor: Prof. Marc Kamionkowski.
- *Sept. 2003-June 2004:* UNIVERSITY OF OXFORD, M. Studies in Philosophy, with focus in Philosophy of Science/Physics.
Examination Topics: *Philosophy of Physics, The Rise of Modern Logic.*
Supervision Topics: *Philosophy of Physics* (Drs. Harvey Brown and Simon Saunders), *The Rise of Modern Logic* (Dr. Ian Rumfitt), *Wittgenstein's 'Tractatus'* (Dr. Jan Westerhoff).
- *Sept. 1999-June 2003:* PRINCETON UNIVERSITY, A.B. in Physics, *magna cum laude.*
Thesis: *Galaxy bias in the halo model.*
Advisor: Prof. Uroš Seljak.

PUBLICATIONS

- *Thermal axion constraints in non-standard thermal histories*, e-Print: arXiv:0812.4721, invited proceedings for Dark Matter '08.
- *Lower Limit to the Scale of an Effective Theory of Gravitation*, Phys.Rev.Lett.100:031301 (2008).
- *Axion constraints in non-standard thermal histories*, Phys.Rev.D77:085020 (2008).

- *Telescope search for decaying relic axions*, Phys. Rev. D 75, 105018 (2007).

WORK IN PROGRESS

- *Hydrogen recombination: the effect of high- n states*, in collaboration with Prof. Christopher Hirata, California Institute of Technology. This work is nearly ready for submission to the Los Alamos preprint archive (xxx.arxiv.org) and Physical Review D.
- *A new model for the scatter and evolution in the halo mass-concentration relationship*, in collaboration with Dr. Andrew Benson, California Institute of Technology, Dr. Stelios Kazantzidis, Ohio State University.
- *A search for decaying relic 8-20 eV axions in the high- z galaxy cluster RDCS 1252*, in collaboration with Prof. Marc Kamionkowski, California Institute of Technology, Prof. Jean-Paul Kneib, Laboratoire d'Astrophysique de Marseilles, Giovanni Covone, Osservatorio Astronomico di Capodimonte, and Eric Jullo, NASA Jet Propulsion Laboratory.
- *Lyman Limit Absorbers in the SDSS*, in collaboration with Prof. Michael Strauss, Princeton University.

RESEARCH EXPERIENCE

- *Sept. 2004-present: GRADUATE STUDENT, CALIFORNIA INSTITUTE OF TECHNOLOGY*
Topics in theoretical and observational cosmology, including gravitational baryogenesis, effective field theory approaches to gravity, axionic dark matter, sterile neutrinos, gravitational lensing, galaxy clusters, integral field spectroscopy, dark matter halo merger histories and structure, hydrogen recombination, non-standard thermal histories, and the cosmic microwave background. Advisor: Prof. Marc Kamionkowski, Collaborators: Prof. Marc Kamionkowski, Prof. Christopher Hirata, Dr. Andrew Benson, Prof. Andrew Blain, Prof. Robert Caldwell (visiting from Dartmouth College), Dr. Tristan Smith.
- *Summers 2002, 2003: UNDERGRADUATE RESEARCH ASSISTANT, PRINCETON UNIVERSITY*—Continued academic-year research finding and characterizing the population of Lyman Limit Absorbers in the SDSS quasar sample. Supervisor: Prof. Michael Strauss.
- *Summer 2001: NSF RESEARCH EXPERIENCE FOR UNDERGRADUATES (REU) FELLOW, UNIVERSITY OF MICHIGAN*—Applied existing galaxy lensing software to new clusters found in SDSS data, explored correlation of various cluster richness measures with lensing masses, and compared different theoretical density profiles to observed shear profiles around cluster. Supervisor: Prof. Timothy McKay.

- *Summer 2000*: UNDERGRADUATE RESEARCH ASSISTANT, STANFORD UNIVERSITY–STACS Galaxy Cluster Survey. Work included preparation of spectroscopic slit charts for spectroscopic confirmation of candidate galaxy clusters, extraction of galaxies from DEEP survey data, and verification of star/galaxy separation. Supervisors: Prof. Jeffrey Willick, Dr. Keith Thompson.
- *Fall 1999-Summer 2000*: UNDERGRADUATE RESEARCH ASSISTANT, PRINCETON UNIVERSITY–Built temperature control circuitry for PIQUE Cosmic Microwave Background Polarization Experiment, Supervisor: Prof. Suzanne Staggs.

CALIFORNIA INSTITUTE OF TECHNOLOGY COURSEWORK

- Astronomy: Ay 121- *Radiative Processes*, Ay 123- *Stellar Structure and Evolution*, Ay 124- *Structure and Dynamics of Galaxies*, Ay 125- *High Energy Astrophysics*, Ay 126- *Physics of the Interstellar Medium*, Ay 127- *Cosmology and Galaxy Formation*, Ay 141-*Astronomy Journal Club*.
- Physics: Ph 235ab- *General Relativity*, Ph 205bc- *Quantum Field Theory*, Ph 235 ab- *Introduction to Supersymmetry and String Theory*, Ph 135a- *Applications of Quantum Mechanics*, Ph 136bc- *Applications of Classical Physics*.

OTHER ACTIVITIES AT THE CALIFORNIA INSTITUTE OF TECHNOLOGY

Weekly cosmology group meetings, in which we read, significantly updated errata for, and did all problems in Dodelson's *Modern Cosmology*, Binney and Tremaine's *Galactic Dynamics*, second edition, presented classic papers, current preprints, and pedagogical reviews of our own research. Weekly galaxy formation discussion group, in which we went through classic papers and recent preprints.

TEACHING

- TEACHING ASSISTANT, CALIFORNIA INSTITUTE OF TECHNOLOGY:
Ph136abc- *Applications of Classical Physics*, Fall 2008-Spring 2009. Prof. Kip Thorne.
Graded problem sets, held office hours, composed problem solutions.
- TEACHING ASSISTANT, CALIFORNIA INSTITUTE OF TECHNOLOGY:
Ay 127- *Cosmology and Galaxy Formation*, Spring 2006, Spring 2007. Prof. Sterl Phinney.
Graded problem sets, held office hours, composed problem solutions, gave three lectures.
- TEACHING ASSISTANT, CALIFORNIA INSTITUTE OF TECHNOLOGY:
Ay 124- *Structure and Dynamics of Galaxies*, Winter 2006. Prof. Sterl Phinney.
Graded problem sets, held office hours, composed problem solutions.

- TEACHING ASSISTANT, CALIFORNIA INSTITUTE OF TECHNOLOGY:
Ay 20- *Basic Astronomy and the Galaxy*, Fall 2005. Prof. Andrew Blain.
Graded problem sets, ran problem sessions, composed problem sets and solutions.
- COURSE ASSISTANT, PRINCETON UNIVERSITY:
AST 204- *Basic Astronomy and the Galaxy*, Spring 2002. Profs. J.R. Gott III, Michael Strauss, and Neil deGrasse Tyson.
Graded problem sets and exams, held office hours.

CONFERENCES/SUMMER SCHOOLS

- July 2009 Paris workshop on cosmological recombination, University of Paris-Sud, Orsay.
- 213th meeting of the American Astronomical Society, Long Beach, CA, Jan. 2009.
- *Building the Milky Way* workshop, Kavli Institute for Theoretical Physics, UC Santa Barbara, Santa Barbara, CA, Dec. 2008.
- *Back to the Galaxy* conference, Kavli Institute for Theoretical Physics, UC Santa Barbara, Santa Barbara, CA, Sep-Oct. 2008.
- *Santa Cruz Galaxy Workshop*, UC Santa Cruz, Santa Cruz, CA, Aug. 2008.
- UCLA *Dark Matter '08* Conference, Marina Del Rey, CA, Feb. 2008.
- Sante Fe Cosmology Summer Workshop, St John's College, Santa Fe, NM, Jul. 2007.
- 3rd Irvine Cosmology Workshop- *Astrophysical Probes of the Nature of Dark Matter*, UC Irvine, Irvine, CA, Mar. 2007.
- Les Houches Summer School Session 86- *Particle Physics and Cosmology: The Fabric of Spacetime*, Les Houches, France, Aug. 2006.
- SLAC Summer Institute- *Gravity in the Quantum World and the Cosmos*, Palo Alto, CA, Jul. 2005.
- TASC Meeting- *Theoretical Astrophysics in Southern California*, Fall 2004, 2005, 2006, 2007, 2008.

SEMINAR/CONFERENCE PRESENTATIONS

- *Thermal axions: Astrophysical and cosmological constraints*. Review talk at Keck Institute for Space Science conference, "Shedding Light on the Nature of Dark Matter."

- *Cosmological hydrogen recombination: The effect of high- n states and electric quadrupole transitions*, University of Paris-Sud, July 2009 ESA workshop on cosmological recombination.
- *Cosmological hydrogen recombination: The effect of high- n states*, Invited talk, University of Waterloo, Ontario, Canada, Feb. 2009.
- *Cosmological hydrogen recombination: The effect of high- n states*, Friday Cosmology Club, University of Michigan, Ann Arbor, MI, Feb. 2009.
- *Cosmological hydrogen recombination: The effect of high- n states*, NPAC Forum, University of Wisconsin, Madison, WI, Feb. 2009.
- *Cosmological hydrogen recombination: The effect of high- n states*, Poster presented at 213th meeting of the American Astronomical Society, Long Beach, CA, Jan. 2009.
- *Cosmological hydrogen recombination: The effect of high- n states*, NUPAC Seminar, University of New Mexico, Albuquerque, NM, Nov. 2008.
- *Cosmological hydrogen recombination: The effect of high- n states*, 8th Annual TASC Meeting, UC Irvine, Irvine, CA, Oct. 2008.
- *Axion constraints in non-standard thermal histories*, UCLA Dark Matter '08 Conference, Marina Del Rey, CA, Feb. 2008.
- *A telescope search for decaying relic axions and the effect of non-standard thermal histories on cosmological axion constraints*, Wednesday Lunch Talk, Princeton University, Princeton, NJ, Dec. 2007.
- *Axion constraints in non-standard thermal histories*, 7th Annual TASC Meeting, UCLA, Los Angeles, CA, Nov. 2007.
- *A telescope search for decaying relic axions*, Poster presented at 3rd Irvine Cosmology Workshop- *Astrophysical Probes of the Nature of Dark Matter*, UC Irvine, Irvine, CA, Mar. 2007.
- *A telescope search for decaying relic axions*, Friday Cosmology Seminar, Stanford University Physics Department, Palo Alto, CA, Feb. 2007.
- *A telescope search for decaying relic axions*, INPA Journal Club, Lawrence Berkeley National Labs, Berkeley, CA, Feb. 2007.
- *A telescope search for decaying relic axions*, 6th Annual TASC Meeting, Kavli Institute for Theoretical Physics, UC Santa Barbara, Santa Barbara, CA, October 2006.

- *Decaying axions in galaxy clusters*, 5th Annual TASC Meeting, California Institute of Technology, Pasadena, CA, Oct. 2005.

AWARDS/PRIZES

- Dan David Prize Fellowship, May 2009, Past Time Dimension in the field of Astrophysics: History of the Universe.
- Kusaka Memorial Prize in Physics, Princeton University, June 2003.
- Member, Phi Beta Kappa, since June 2003.
- Member, Sigma Xi Scientific Research Society, since June 2003.
- The Shapiro Prize for Academic Excellence (Princeton University), 2001.

LANGUAGES

English– Fluent, French– Proficient reading, writing, conversation, Russian– Proficient reading, conversation.

COMPUTER SKILLS

Proficient in C, FORTRAN 77/90, IDL, Mathematica, Super-Mongo, and HTML. Proficient with PC, Macintosh, and Linux Platforms.

OTHER WORK EXPERIENCE

Technical consultant, Imperial Woodpecker, Intel advertisement “Our jokes are different than your jokes.”

Physics tutor at Princeton University (2001-2)

NON-ACADEMIC INTERESTS

Chamber music, classical cello, swimming, photography, hiking.

REFERENCES

- Prof. Marc Kamionkowski, Prof. Christopher M. Hirata, Dr. Andrew Benson, Theoretical Astrophysics including Relativity (TAPIR) research group, Mail Code 350-17, California Institute of Technology, Mailcode 350-17, Pasadena, CA, 91125.
- Prof. Robert Caldwell, Department of Physics, Dartmouth College, 6127 Wilder Laboratory, Hanover, NH, 03747.