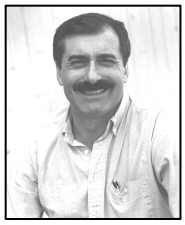

Edward W. (Rocky) Kolb

Arthur Holly Compton Distinguished Service Professor
Department of Astronomy & Astrophysics
Kavli Institute for Cosmological Physics
and Enrico Fermi Institute, The University of Chicago

[redacted]

PERSONAL DATA

[redacted]

EDUCATION

PhD, Physics May 1978
University of Texas, Austin, Texas
Dissertation: Astrophysical Limits to Weak Interaction Phenomenology
Thesis Advisor: Duane A. Dicus

BS, Physics May 1973
University of New Orleans, New Orleans, Louisiana

POSTDOCTORAL EXPERIENCE

California Institute of Technology May 1978—September 1980
Postdoctoral Advisor: William A. Fowler

Theoretical Division, Los Alamos National Laboratory September 1980-September 1982
J. Robert Oppenheimer Research Fellow
Postdoctoral Advisor: Stirling A. Colgate

EMPLOYMENT HISTORY

Professor of Astronomy & Astrophysics 1986—present
Member, Enrico Fermi Institute & Kavli Institute for Cosmological Physics
University of Chicago

David N. Schramm Director 2019-2022
Kavli Institute for Cosmological Physics
University of Chicago

Dean, Division of the Physical Sciences 2013-2018
University of Chicago

Chair, Department of Astronomy & Astrophysics 2006-2012
University of Chicago

Director, Particle Astrophysics Center 2001-2006
Fermi National Accelerator Laboratory

Scientist III (Highest Level), Head of Theoretical Astrophysics Group 1998-2001
Fermi National Accelerator Laboratory

Scientist III (Theoretical Astrophysics Group) 1991-1997
Fermi National Accelerator Laboratory

Scientist II, Head of Theoretical Astrophysics Group 1984-1991
Fermi National Accelerator Laboratory

Scientist I, Co-Head of Theoretical Astrophysics Group 1983-1984
Fermi National Accelerator Laboratory

Deputy Group Leader, Staff Member Theoretical Astrophysics Group 1981-1983
Theoretical Division, Los Alamos National Laboratory

LONG-TERM VISITING POSITIONS

J. Hans D. Jensen Prize Professor October 2012-December 2012
Institute for Theoretical Physics, The University of Heidelberg August 2015
Visiting Professor 2001-2002
CERN Theory Group
Program Coordinator January-June 1992
Institute for Theoretical Physics, UCSB
Visiting Professor July-August 1988
University of Sussex
Visiting Professor July-August 1988
University of Rome & Osservatorio Astronomico di Roma
Visiting Professor March-April 1987
University of Michigan
Visiting Professor May-June 1987
University of Rome & Osservatorio Astronomico di Roma
Visiting Associate Research Physicist Spring 1981
Institute for Theoretical Physics, UCSB

RESEARCH FIELD

Early-Universe Particle Cosmology

Origin of dark matter, phase transitions, baryogenesis, cosmological limits on new particles and forces beyond the standard model, axions in cosmology and astrophysics, cosmological gravitational particle production, applications of particle physics to understanding the origin and evolution of the universe.

HONORS AND AWARDS

J. Hans D. Jensen Prize, 2012
Institute for Theoretical Physics, University of Heidelberg, Germany
Docteur Honoris Causa 2010
University of Lyon, France
Dannie Heineman Prize for Astrophysics (shared with M. Turner) 2010
American Astronomical Society and American Institute for Physics
Excellence in Teaching Award 2009
Master of Liberal Arts Program, Graham School, The University of Chicago
Distinguished Alumnus of the Year 2005
The Graduate School, The University of Texas, Austin
Homer L. Hitt Distinguished Alumnus of the Year 2004
The Graduate School, The University of Texas, Austin
Oersted Medal 2003
Highest Recognition of the American Institute of Physics Teachers
Elected Fellow 2002
American Academy of Arts and Sciences
George Marx Medal 2002
Hungarian Academy of Science
Forum Fellow 1998
World Economic Forum, Davos, Switzerland
Eugene M. Emme Astronomical Literature Award 1996
World Economic Forum, Davos, Switzerland
Lleweellyn John and Harriet Manchester Quantrell Award 1993
World Economic Forum, Davos, Switzerland
Fellow 1984
American Physical Society

SCIENTIFIC PUBLICATIONS (AS OF NOVEMBER 2022)
(INSPIRE DATABASE HTTPS://INSPIREHEP.NET/AUTHORS/1002355?UI-CITATION-SUMMARY=TRUE)

232 citeable articles
20,572 citations (excludes 4,081 citations of 2000 Review of Particle Physics)
h-index = 74
Citations per paper 106.3
Selection of representative publications

1. Report of the Dark Energy Task Force, astro-ph/0609591 [1,093 citations] (chaired Committee)
2. Reconstructing the inflaton potential: an overview, *Rev. Mod. Phys.* **68** (1997) 373 [817 citations]
3. Cosmological problems for the polonyi potential, *Phys. Lett. B* **131** (1983) 59 [776 citations]
4. Largest temperature of the radiation era and its cosmological implications, *Phys. Rev. D* **64** (2001) 023508 [558 citations]
5. Superheavy dark matter, *Phys. Rev. D* **59 (**1998) 023501 [509 citations]
6. Astrophysical bounds on the masses of axions and Higgs particles, *Phys. Rev. D* **18** (1978) [445 citations]
7. Production of massive particles during reheating, *Phys. Rev D* **60** (1999) 063504 [420 citations]
8. Baryon number generation in the early universe, *Nucl. Phys. B* **172** (1980) 224 [404 citations]
9. Solutions to the strong CP problem in a world with gravity, *Phys. Lett. B* 282 (1992) 132 [400 citations]
10. Maverick dark matter at colliders, *JHEP* **09** (2010) 037 [354 citations]
11. Axion miniclusters and Bose stars, *Phys. Rev. Lett.* **71** (1993) 3051 [327 citations]
12. Primordial nucleosynthesis including radiative, Coulomb, and finite temperature corrections to weak rates, *Phys. Rev. D* **26** (1982) 2694 [256 citations]
13. Probing Planckian physics: Resonant production of particles during inflation and features in the primordial power spectrum, *Phys. Rev D* **62** (2000) [249 citations]
14. Cosmological upper bound on heavy neutrino lifetimes, *Phys. Rev Lett.* **39** (1977) 973 [248 citations]
15. Nonlinear axion dynamics and formation of cosmological pseudosolitons, *Phys. Rev. D* **49** (1994) 5040 [239 citations]
16. Astrophysical bounds on very low mass axions, *Phys. Rev. D* **22** (1980) 839 [238 citations]

SIGNIFICANT SCIENTIFIC CONTRIBUTIONS

- First cosmological bound on lifetime of massive neutrinos [#14]
- First astrophysical bound on axions from stellar energy loss, proposed "Primkoff process" [#6]
- First use of reaction network in calculation of baryon number generation [#8]
- Proposed "Figure of Merit" to track progress in determination of properties of dark energy [#1]
- Introduced concept of cosmological production of axion miniclusters [#11]
- Proposed gravitational particle production as origin of dark matter (WIMPzillas) [#5, #7]
- Pointed out issue of gravitational corrections to global symmetries for axions [#9]
- Proposed missing energy as signal for dark matter production at colliders [#10]
- First pointed out that tensor component vs. scalar spectral index can discriminate inflation models
- First observation of cosmological issues with moduli fields [#3]

BOOKS

Author:

1. *The Early Universe*, (with M. S. Turner) Addison-Wesley (1990).
2. *Blind Watchers of the Sky*, Helix Books (1996) [1996 Eugene M. Emme Astronautical Literature Award]

Editor:

1. *Science Underground*, AIP Conference Proceedings 96 (1983).
2. *Inner Space/Outer Space*, University of Chicago Press (1985).
3. *The Early Universe: Reprints*, (with M. S. Turner) Addison-Wesley (1988).
4. *Cosmology and Particle Physics*, (with D. Lindley and D. N. Schramm) American Association of Physics Teachers (1991).
5. *Particle and Nuclear Astrophysics and Cosmology in the Next Millennium*, (with R. D. Peccei) World-Scientific Publishing Company, 1995.

COLLOQUIA, LECTURES AT SCHOOLS, SEMINARS

Presented more than 175 lectures, lecture series, invited talks at conferences and workshops.
Representative Selection:

1. Brazilian School on Cosmology and Gravitation, Rio de Janeiro, Brazil, 1984, 1987, 2002, 2022
2. Rencontres de Blois Particle Astrophysics, 1992
3. Lecturer, Summer Course on Astrophysics and Particle Physics, Eötvös University, Budapest, July 1993.
4. Rapporteur, XXVIIth International Conference on High Energy Physics, Glasgow, , 1994
5. International School of Physics "Enrico Fermi" Dark Matter in the Universe, Varenna, Italy, July 1995
6. 16th UK Institute for Theoretical High Energy Physics, Swansea, Wales 1995
7. British Universities Summer School in Theoretical Elementary Particle Physics, Sussex, England, 1997
8. St. Croix Summer School in Experimental Elementary Particle Physics, St. Croix, Virgin Islands, 1998
9. XXIXth International Conference on High Energy Physics, plenary lecture, Vancouver, Canada, 1998
10. Particle Physics and the Universe—Nobel Symposium, Haga Slott, Sweden, August 1998
11. ICTP Summer School on Particle Astrophysics, Trieste, Italy, June 2000.
12. International School "Bruno Touschek" Nuclear, Subnuclear and Astroparticle Physics. Frascati, Italy, 2002
13. SLAC Summer Institute, SLAC, Palo Alto, CA, August 2003
14. Loeb Lecturer, Harvard University, December 2006
15. Theoretical Advanced Studies Institute, Santa Cruz, California, July 1986

PUBLIC LECTURES AND OUTREACH

More than 70 named or notable public in 15 countries, including Brazil, Canada, Chile, China, Denmark, England, Germany, Greece, India, Italy, Korea, Pakistan, Scotland, Spain, Sweden, US
Outreach efforts recognized by Oersted Medal of the American Institute of Physics Teachers
Some named or notable public lectures

1. Raychaudhuri Memorial Lecture, University of Kolkata, 2020
2. Hintze Lecture, Oxford University, 2018
3. Coloquios Paco Ynduráin, Universidad Autónoma de Madrid, Madrid, Spain, 2013
4. Tschira Public Lecture, Heidelberg, Germany, 2012
5. Sackler Lecture, Distinctive Voices, Irvine, 2012
6. Siemens Stiftung Lecture, Munich, Germany, 2012
7. Fermilab Friday Evening Public Lecture, (four different occasions)
8. Neils Bohr Lecture, Neils Bohr Institute, Copenhagen, 2009
9. Buhl Lecture, Carnegie Mellon University, Pittsburgh, 2009 & 1997
10. Celsius Lecture, Uppsala University, Uppsala Sweden, 2008
11. Century Lecture, American Astronomical Society, Kansas City, 2004
12. Cosmic Questions Lecture, National Geographic Society, Washington, 2003
13. Public Lecture, The Royal Society (London, England), 2003
14. Lansdowne Lecture, University of Victoria, Victoria BC, Canada, 2002
15. Il Quanto ed il Cosmo, Public lecture associated with the Lepton-Photon Meeting, Rome, 2001
16. Public lecture associated with the 29th International Meeting on High-Energy Physics, Vancouver, 1998
17. Resnick Lecturer, Rensselaer Polytechnic Institute, 1998
18. Address to the President of Pakistan, Islamabad, Pakistan, 1997
19. Public lecture associated with the 26th International Meeting on High-Energy Physics, Dallas, Texas, 1992
20. Public lecture associated with the annual meeting of the Division of Particles and Fields, Vancouver, 1991

PH.D. STUDENTS SUPERVISED (UNIVERSITY OF CHICAGO UNLESS OTHERWISE INDICATED)

Terrance P. Walker, 1986, Indiana University; Frank S. Accetta, 1987; Lawrence Kawano, 1990; Alessandro Massarotti, 1992; Sharon L. Vadas, 1993; Lloyd Knox, 1995; Mark Abney, 1996; Daniel J. Chung, 1998; Patrick R. Crotty, 2002; James R. Chisholm, 2005; Alberto Valinotto, 2006; Valentin Kostov, 2009; Zosia Krusberg; 2010; Michael Fedderke, 2018

POSTDOCS SUPERVISED AND MENTORED

From 1983-2006, at Fermilab I hired and mentored 46 postdocs, many of whom continued academic careers.
Keith Olive, David Seckel, David Lindley, Lars Jensen, Rich Holman, Jamie Stein-Schabes, David Bennett, Marcelo Gleiser, Albert Stebbins, Ed Copemald, Angela Olinto, Dongsu Ryu, Ruth Gregory, David Haws, David Salopek,

Beni Gradwohl, Esteban Roulet, Fay Dowker, Scott Dodelson, Jim Gelb, David Caldwell, Igor Tkachev, Stefan Colombi, Yun Wang, Andrew Heckler, Itsvan Szapudi, David Metzler, Antonio Riotto, Lam Hui, Will Kinney, Ian Stewart, Andrew Sornborger, Zoltan Haiman, Idit Zehavi, Pasquali Blasi, Michael Blanton, Ravi Sheth, John Beacom, Kev Abazajian, Michael Greene, Nicole Bell, Mark Jackson, Jochim Weller, Kenji Kadota, Dan Hooper

TEACHING EXPERIENCE

Cosmology for non-science majors (recognized with the 1993 Quantrell Award for Excellence in Undergraduate Teaching); junior-level astrophysics courses for physics majors; first-year graduate courses as part of the required courses for graduate students in the Department of Astronomy and Astrophysics; cosmology for graduate students; relativistic astrophysics for graduate students; special topics courses for graduate students, science and public policy course in the University of Chicago Harris School of Public Policy, cosmology for students in the University of Chicago Graham School for Continuing Education (recognized with the 2008 award for excellence in teaching in the Masters of Liberal Arts program)

PROFESSIONAL AFFILIATIONS AND SERVICE

1. Member, Physics Policy Committee of the American Physical Society, 2019-2021
2. Co-Chair (with Hendrik Weerts), DOE Basic Needs Research Workshop, 2018
3. Member, Advisory Committee, Fine Institute of Theoretical Physics, University of Minnesota, 2015-2019 (Chair 2018)
4. Chair, Division of Astrophysics, American Physical Society, 2011 – 2012
5. Chair, Dark Energy Science Plan Community Report, 2012
6. Member, CERN Theory Group External Advisory Committee, 2010 – 2013 (Chair, 2011)
7. Board Member, Giant Magellan Telescope, 2010 – 2015
8. Board Member, Adler Planetarium, 2010 – 2019
9. Member, Interim Science Working Group, Joint Dark Energy Mission (NASA/DOE), 2009 – 2010
10. Chair, Figure of Merit Science Working Group (NASA/DOE), 2009
11. Member, Science and Security Board, Bulletin of the Atomic Scientists, 2009 – present
12. Vice-Chair, Chair Elect, Chair, Division of Astrophysics, American Physical Society, 2009 – 2011
13. Vice-Chair, Astronomy and Astrophysics Advisory Committee (NSF/NASA/DOE/OSTP/OMB), 2008 – 2010
14. Board Member, Combined Array for Millimeter Wave Astronomy, 2008 – 2013
15. Chair, Joint Dark Energy Mission Figure of Merit Science Working Group (NASA, DOE, and NSF), 2008
16. Vice-Chair, Astronomy & Astrophysics Advisory Committee, 2008 – 2011
17. Chair, Dark Energy Task Force (DOE/NASA/NSF), 2005 – 2006
18. Chair, Structure and Evolution of the Universe Subcommittee (SEUS), NASA, 2001 – 2005
19. Member, NASA Space Science Advisory Committee (SScAC), 1999 – 2005
20. Elected: American Physical Society Executive Council, Division Councilor, Representing Division of Astrophysics 2002 – 2005
21. External Advisory HEPAP Quantum Universe Subpanel, Member, October 2003
22. External Advisory Committee, Center for Space Research, MIT, 2003 – 2008
23. External Advisory Board, CDMS, 2003 – present
24. Member, Board of Trustees, Adler Planetarium, 1998 – 2006
25. Adler Planetarium Council, 1993 – present
26. Scientific Policy Committee, Stanford Linear Accelerator Center, 2000 – 2005
27. Scientific Council, Laboratorie de l'Accelerateur Lineaire, Universite de Paris-Sud, 2000- 2005
28. External Advisory Committee, IceCube Project, 2000- present
29. HEPAP Subpanel on Long-Range Planning (Bagger-Barish Panel), DOE and NSF, 2001
30. Advisory Council, Sloan Digital Sky Survey, 1998 – 2006
31. Elected: Executive Committee of the Division of Astrophysics, American Physical Society, 1993-1995
32. NSERC (Canada) Special Project Grant Committee, 1994
33. Consultant, NSF review of HiRes proposal, 1991
34. Physics Panel, Texas Advanced Research/Technology Program, 1991
35. Scientific Advisory Committee, Theoretical Physics Institute, University of Minnesota
36. Member of Particles Panel, National Academy of Sciences 1990 Astronomy and Astrophysics Survey
37. External Advisory Committee, Center of Particle Astrophysics NSF Science and Technology Center

38. Panel Chair, NASA Long-Term Space Astrophysics Program 1990
39. Referee: *Physical Review, Physical Review Letters, Physics Letters, Nuclear Physics, Nature, Science, Astrophysical Journal, NASA, NSF, DOE, NATO, Classical and Quantum Gravity, Astronomy and Astrophysics, Annals of Physics*
40. Editorial Board: *Nuovo Cimento*
41. Editorial Board: *Reports on Astrophysics and Cosmology*
42. Editor-in-charge for high energy physics – cosmology interface: *International Journal of Modern Physics A, Modern Physics Letters A*
43. Divisional Associate Editor: *Physical Review Letters*
44. Editor: *Gravitation, Astrophysics, and Cosmology*
45. Editorial Advisory Board: *Astronomy* magazine
46. Series Editor: *High Energy Physics, Cosmology and Gravitation* Book Series, Institute of Physics Publishing
47. Faculty Associate: *Council for International Exchange of Scholars for the Fulbright Program*
48. Member: *American Physical Society, American Astronomical Society, International Astronomical Union*

CONFERENCE AND SYMPOSIUM ORGANIZER

Organizer or member of organizing committee of over 75 Symposia/Conferences