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Research Interests

Experimental cosmic ray particle astrophysics; instrument design, fabrication, and testing; and computer analysis and simulation of cosmic ray experiment data.

Education

Ph.D. Physics, Astronomy minor, Indiana University, May 1991. "The isotopic composition of cosmic ray helium from 500 to 1100 MeV per nucleon" Dr. Richard Heinz, advisor.

MS Physics, Indiana University, August 1987.

BS Mathematics, minors in Physics and Philosophy, University of Georgia, with Honors, Cum Laude, June 1985. Phi Beta Kappa, Phi Kappa Phi.

Employment History

- 8/01- present **Associate Professor of Physics, Northern Kentucky University**
Conducting research in particle astrophysics on the CREAM and HEAT experiments, teaching 9 contact hours.
- 7/00 – 8/01 **Visiting Associate Professor of Physics, Pennsylvania State University**
One-year position (while on leave from ENMU) to further research activities on cosmic ray astrophysics. Teaching one class per semester. Active learning techniques used in introductory mechanics.
- 8/94 to 7/00 **Associate/Assistant Professor of Physics, Eastern New Mexico University.**
Tenured 1999, promoted 2000. Six years of teaching (12 credit hours/semester) at upper and lower levels. Participation in teacher education programs. Active research program with undergraduate involvement with grants and other support. Strong service record to University and local communities.
- Summers 1995-99 **Visiting Assistant Professor of Physics, Penn State University.**
Fabricated prototype time of flight paddles for CREAM experiment. Designed, constructed, and tested time-of-flight detector for HEAT antiproton experiment. Built HEAT antiproton experiment primary gondola support frame. Participated in flight of HEAT positron/electron instrument.
- 8/92 to 7/94 **Postdoctoral Fellow, University of Michigan.** Dr. G. Tarle, APS Fellow, faculty mentor.
Tested radiation hardened flash ADC for GEM (Superconducting SuperCollider) experiment. Participated in integration of HEAT positron/electron instrument.
- 5/91 to 7/92 **Postdoctoral Fellow, Istituto Nazionale di Fisica Nucleare (INFN)/Indiana University.**
Competitively-awarded fellowship with joint appointment located on-site in Italy. Furthered construction of large underground detector (MACRO).
- 9/85 to 4/91 **Research Associate, Graduate Assistant, Associate Instructor, Indiana University.**
Taught introductory undergraduate labs for scientists and non-scientists and performed research leading to Ph.D. in astrophysics.

Undergraduate Teaching Experience

Teaching undergraduate classes since 1994, all years except one with multiple course load. Experienced in laboratory and course design.

Courses taught (NKU)

<i>Course number (credit hrs/contact hrs)</i>	<i>Course title</i>	<i>Number of times taught</i>
211/213 and labs (5/6)	General Physics (algebra-based) sequence	3/2
220/222 and labs (4/6)	Calculus based introductory sequence	5/4
460 (3)	Quantum Mechanics	4
410 (3)	Electromagnetic Theory	3
315 (3)	Astrophysics	2
305 (3)	Statics	4
397 (2)	Special Projects	1
399 (2)	Readings	5
392/492 (varies)	Student Research	13
Penn State Courses		
211H (3)	Honors section of Physics I (Calculus- based)	1
406 (3)	Subatomic Physics	1
ENMU Courses		
113/113L (3/1)	Survey of Physics and Laboratory	12
201/202 (4/4) 201L/202L (1/1)	Physics I and II (Calculus-based) and Laboratory	6 two-semester sequences
141/141L (3/1)	Astronomy and Laboratory	5/4
303 (3)	Classical Mechanics I	1
305L (2)	Advanced Laboratory	2
421 (3)	Electricity and Magnetism	3
435 (3)	Quantum Physics	1
439/539 (1)	Teaching in Physics	2
465 (2)	Senior Research Project and Report	6 students
493 (3)	Topics: Perspectives in Physics*	1
293 (3)	Topics: Meteorology	1

* My course conception and design, using Thomas Kuhn, **The Structure of Scientific Revolutions**, as primary text.

Awards

Istituto Nazionale di Fisica Nucleare (INFN) Postdoctoral Fellowship 1991-1992

National Research Council Fellowship (turned down) 1991.

William Koss Memorial Award for Outstanding Researcher and Teacher, Indiana University Physics Department 1989

Outstanding Associate Instructor, Indiana University Physics Department April 1987

Outreach and Public Engagement:

- Public lectures/classes at Cincinnati Observatory, Mt Lookout, Cincinnati, OH. Invited by Friends of the Observatory (FOTO).
 - “Cosmic rays” October 10, 2008. A “class” on cosmic rays which included doing relativistic calculations.
 - “Astrophysics in Antarctica: Cosmic rays and the art of scientific ballooning on the Ice.” October 5, 2006.
 - “Cosmic Rays: An Alternative Eye on the Sky.” January, 2004.
- Antarctic blog, <http://antarctic-scott.blogspot.com>, 2005, 2008.
- Norse Physics Force (traveling physics demo show) participant, demo designer 2005-06.
- Multiple articles about 2005 Antarctica trip, including in KY Enquirer, NKU student paper, and NKU A&S Vista, 2006.
- CINSAM CSI Forensics Camps, activity co-leader in automobile accident reconstruction, summers 2003-04. Appeared on Channel 12 11PM news spot on the camp.
- Direct outreach to elementary/middle school children through class visits, CINSAM activities, Physics Alliance activities at NKU 2001-2005. Elementary Science Day Activity Leader, May 2002.
- Design, implementation, and frequent delivery of “NASA Educational Materials and Opportunities Workshop” (K-12 teacher professional development workshop) with grant funding, spanning 1995-2002.
- Regional Science Fair judge, Spring 1997 - present. International Science Fair judge (Louisville), Spring 2002.
- Lead class/workshop activities to assist in teacher preparation utilizing New Mexico space science facilities and NASA educational materials as part of NASA Minority Initiative grant, 2001.
- Organized and conducted frequent public astronomy viewings with telescopes at ENMU, 1994-1999.
- Director, ISEF Southeastern New Mexico Science and Engineering Fair, 1994-1996.

University Service

- General Education Exploration Committee (University-wide ad hoc) member, 2008-09.
- Faculty Senate Arts & Sciences At-Large member, 2008-present.
- Physics & Geology Department RPT committee, 2005-present.
- Physics program assessment document author, 2006.
- “Conversations, Connections, and Collaborations: Enhancing P-12 Education, with an Emphasis on Math and Science Education.” NKU/XU/UC President’s Initiative. Member, Organizing Committee and Panelist. October 28, 2004.
- Benefits Committee, 2001-present. Chair, Sabbatical Review Committee 2005. Faculty Dependent Scholarship sub-committee member, 2006, Chair 2007. Faculty Fellowship sub-committee, Chair, 2008.
- Hosted various speakers, including Michael Schubnell (University of Michigan) for joint Sigma Xi/Physics talk Spring 2002; Stephen Minnick (Kent State) 2005, others.
- Physics Faculty Search Committee 2003.
- Web technology: managed PGA listserv (physics and geology informative email list) 2001-2005, assisted other faculty with web page issues, redesigned physics web pages, including 2008 NKU-wide effort. 2001-present. See <http://physics.nku.edu>.
- Contribute to departmental and discipline discussions, subcommittees (e.g. Search Committees, text review, equipment identification and organization), and activities, 2001-present.
- Physics student advising, 1994-present.
- Member, CINSAM Outreach Steering Committee, 2001-2004.

- Buildup of the Eastern New Mexico University (ENMU) Society of Physics Students club through activities, such as visiting the VLA near Socorro and the Trinity site, participation in zone meetings, social events, and sponsorship of lectures and night sky viewings, 1994-2000.
- Organized remodeling of the Astroshed facility (telescope facility associated with Eastern New Mexico University), obtaining funds to build a new observatory from the Instructional Equipment Fund in 1999, and the instigation of public night sky viewing nights.
- Chaired the campus Teaching and Learning Technology Roundtable, a faculty think-tank to assist the administration in the implementation of teaching technology 1999-2000.
- Held ENMU College of Languages, Arts, and Sciences position as *Technology Coordinator*, assisting faculty with technology needs.
- Designed, found funding for, and oversaw renovation of a teaching technology enhancement of an existing large classroom (107 seats) 1996-1998.

Professional Collaborations

- CREST (Cosmic Ray Electron Synchrotron Telescope) collaboration member, 2003-present.
- CREAM (Cosmic Ray Energy and Mass) collaboration member, 1999-present.
- Kentucky Academy of Science (KAS), member, 2002-present; Physical Science representative on Governing Board, 2004-2008, Superlative Awards sub-committee, 2004-2008.
- NSF CCLI proposal review meeting panelist, July 28-31, 2004.
- Kentucky Association of Physics Teachers, member 2002-present; University representative, 2004-2006.
- Sigma Xi Scientific Research Society, member, 2002-present.
- HEAT (High Energy Antimatter Telescope) experiment collaboration member 1993 - present.
- New Mexico Collaborative for Excellence in Teacher Preparation (CETP) member, 1999-2000.
- New Mexico Science Teachers Association member, 1999-2000.
- American Physical Society, member since 1991. Founding member, Four Corners Section. Service on ByLaws Committee 4/97-8/97; Organizing Committee for Spring 1998 meeting.
- GEM (Gamma, Electron, Muon) Collaboration (Superconducting SuperCollider) 1992-94.
- MACRO (Monopole and Astrophysics Cosmic Ray Observatory) collaboration 1991-93.
- SMILI (Superconducting Magnet Instrument for Light Isotopes) collaboration 1987-1999.

Grant History (funded)

1. Penn State University/NASA subcontract *CREST* 2008-12 (PI: \$123,000)
2. Penn State University/NASA subcontract *CREAM3* 2008-10 (PI: \$150,000)
3. Penn State University/NASA subcontract *Cosmic Ray Electron Synchrotron Telescope (CREST)* 2004-2007 (PI: \$ 58,582)
4. Penn State University/NASA subcontract *CREAM-II* 2005-07 (PI: \$131,672)
5. American Physical Society World Year of Physics “Physics on the Road” grant: *Norse Physics Tour de Force* 2005 (Co-I: \$10,000).
6. CINSAM Outreach (NKU) *Seeing Science: A Physics Demonstration for Elementary School Students and Teachers*. 2005 (Co-I: \$5821)
7. CINSAM (NKU) Research Grant: *Monte-Carlo simulation of atmospheric background radiation due to cosmic ray atmospheric showers*. 2005 (PI: \$11,929)
8. Penn State University/NASA subcontract *CREAM Timing Charge Detector* 2002-2004 (PI: \$69,500)
9. Kentucky Space Grant Consortium *A measurement of the cosmic ray antiproton flux from the HEATpbar instrument data* 2003-2004 (PI: \$9999)
10. CINSAM (NKU) *Explorations into NKU involvement in the AUGER project*. 2002 (PI: \$14,888)
11. CINSAM (NKU) *NASA Educational Materials and Opportunities Workshop*. 2002 (PI: \$9748)
12. NASA 00-OSS-02 (Minority Initiative) *New Mexico Connections: Connecting Teachers, Research, and Resources*. 2001-03 (Principal Investigator; \$365,000. Forfeited 2001 after move to NKU.)

13. Penn State University (informal funding) for participation in the HEAT collaboration 1995-99 (summer salary, travel, student hire; estimated \$46,900)
14. Internal Research Grant (ENMU). *A measurement of cosmic ray antiprotons*. 1999-2000 (PI: \$3499)
15. Instructional Equipment Fund Grant (ENMU). *An ENMU Campus Observatory*. 1999-2000 (PI: \$18,000)
16. New Mexico Center for Teaching Excellence Effective University Instruction Research Grant. *Optical Mark Readers for Instruction*. 1999-2000 (PI: \$2111)
17. Internal Research Grant (ENMU). *Time-of-Flight Detector for the HEAT-PBAR Instrument: A Continuation*. 1997/98 (PI: \$1405)
18. Internal Research Grant (ENMU). *Time of Flight Detector for the HEAT-PBAR Instrument*. 1996/97 (PI: \$2099)
19. Instructional Equipment Fund Grant (ENMU). *Extension of the Physics Visualization Laboratory*. 1995-96 (PI: \$6128)
20. Teaching Technology Initiative (ENMU). *Physics Visualization Laboratory*. 1994-95 (PI: \$2500)
21. Internal Research Grant for New Faculty (ENMU). *Measurement of the charged particle spectrum in cosmic ray showers as a function of altitude in the atmosphere*. 1994-95 (PI: \$2617)
22. Graduate Student Researchers Program (NASA). *A Cerenkov detector to measure cosmic ray Helium isotopes*. 1989-1991 (PI: \$52,340).

Student grants:

1. Alex Lubbers – “Analysis of CREST 2005 prototype flight data” Kentucky Space Grant Consortium Summer Fellowship, Summer 2006 (\$6100).
2. Justin Bench – Student Publication/Presentation Travel Grant, NKU Research Foundation, Spring 2006 (\$400).
3. Jared Weatherford – Greaves Summer Fellowship (NKU), Summer 2005 (\$3000).

Student Presentations:

1. Justin Bench– Simulation of Atmospheric Cosmic Ray Showers. Kentucky Academy of Sciences Fall Meeting, 2005.
2. Kelly Chastain – Use of ROOT Data Analysis Software to Better Understand Local Sources of High-Energy Cosmic Rays. Kentucky Academy of Sciences Fall Meeting, 2005.
3. Justin Bench- Using GEANT4 to model the photonic component of cosmic ray air showers. American Physical Society April Meeting, Dallas TX 2006.
4. Justin Bench– Using GEANT4 to model the photonic component of cosmic ray air showers. NKU Board of Regents Meeting focused on Student Research, Spring 2006.
5. Sean Bodine- CREST Veto Counter Design and Fabrication. Kentucky Academy of Sciences Fall Meeting, 2008.
6. Mitchell Cahill – Computer Simulations for the CREST Data Analysis. Kentucky Academy of Sciences Fall Meeting, 2008.

Student Poster Presentations:

1. Amanda Day-Simulation of Atmospheric X ray Background at Very High Altitudes. 2004 Celebration of Research, NKU.
2. Jared Weatherford- Measuring electron drift velocity in gases at high electric fields. 2005 Celebration of Research, NKU.
3. Justin Bench- Simulation of Atmospheric Cosmic Ray Showers. 2005 Celebration of Research, NKU.
4. McLaughlin Ryan- Veto Counter for Cosmic Ray Electron Synchrotron Telescope (CREST). 2005 Celebration of Research, NKU.