

Dr. Matthew R. Francis

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Prior Positions

- Visiting Assistant Professor of Physics, Randolph-Macon College (2009-2011)
- Assistant Professor of Physics and Planetarium Director, Lambuth University (2007-2009)
- Special Lecturer, New Jersey Institute of Technology (NJIT) (September 2006–June 2007)
- Adjunct Faculty Member, Rutgers University (September 2005–June 2006)
- Visiting Scientist, Center for Gravitational Wave Physics, Pennsylvania State University (October 2005)
- Postdoctoral Researcher, Atacama Cosmology Telescope Project, Rutgers University (July–August, 2005)

Education

- Rutgers University, Piscataway, New Jersey: Ph.D. in Physics and Astronomy, May 2005
Thesis Title: “From Structure Evolution to Gauge Theories: Topics in Gravitational and Cosmological Physics” (Thesis Advisor: Arthur Kosowsky)
- Johns Hopkins University, Baltimore, Maryland: 1998–1999
- Central College, Pella, Iowa: B.A. *Summa Cum Laude* in Physics, May 1998

Teaching: Randolph-Macon College

- Introduction to Astronomy (Astronomy 101): Lecture and Lab (two sections), Summer 2011
- Modern Physics (Physics 205): Lecture and Lab, Spring 2011
- Electricity and Magnetism (Physics 340): Lecture, Spring 2011
- Quantum Mechanics (Physics 430): Lecture, Spring 2011
- Introduction to Physics I and II (Physics 151–152): Lecture and Lab, Fall 2009–Fall 2010
- Modeling Data in Physics (Physics 382): Lecture, Fall 2010
- Science Vs. Pseudoscience (Honors 280): Seminar, Fall 2010
- Hitchhiker’s Physics (Physics 105): Lecture and Lab, Fall 2009
- Mathematical Physics (Physics 250): Lecture, January 2010
- Thermal Physics (Physics 440), Randolph-Macon: Lecture, Spring 2010

Teaching: Previous Instructor Positions

- Nonlinear Dynamics (Math 4703/Physics 4703), Lambuth: Lecture, Spring 2009
- Physics for Science and Engineering (Physics 2314–2324), Lambuth: Lecture and Lab, Fall 2008–Spring 2009
- College Physics (Physics 2214–2224), Lambuth: Lecture and Lab, Fall 2007–Spring 2008
- Astronomy and Cosmology (Physics 1214), Lambuth: Lecture and Lab, Fall 2008–Spring 2009
- Planetary Astronomy (Physics 1314), Lambuth: Lecture and Lab, Fall 2007
- Stellar Astronomy (Physics 1324), Lambuth: Lecture and Lab, Spring 2008
- Astronomy and Astrophysics I and II (Physics 320–321), NJIT: Lecturer, Fall 2006–Spring 2007
- Introductory Astronomy and Cosmology (Physics 202, two sections), NJIT: Lecturer, Fall 2006–Spring 2007
- Mechanics (Physics 105), NJIT: Lecturer, Fall 2006
- Mechanics (Physics 111), NJIT: Workshop Instructor, Spring 2007
- Electricity and Magnetism (Physics 121), NJIT: Recitation Instructor, Spring 2007

- Analytical Physics II (Physics 227–228), Rutgers University: Instructor and Course Administrator, Fall 2005–Spring 2006
- Introduction to Radio Astronomy (Physics 343), Rutgers University: Laboratory Instructor, Fall 2003, 2004, and 2005

Teaching: Previous Assistantships

- Honors Physics (Physics 271–272), Rutgers University: Recitation Instructor, 2002–2003
- Extended Analytical Physics (Physics 203–204), Rutgers University: Teaching Assistant, 2001–2002
- Extended General Physics (Physics 201–202), Rutgers University: Teaching Assistant, 2000–2001
- General Physics, Johns Hopkins University: Teaching Assistant (1998–1999)
- Nature of Science (science elective), Central College: Teaching Assistant, Spring 1998
- General Physics, Central College: Laboratory Teaching Assistant and Peer Instructor, 1995–1998

Other Teaching Activities

- Faculty advisor, Lambuth Pre-Engineering Program: 2007–2009
- Facilitator of Astronomy Salon, NJIT: Spring 2007
- Unofficial advisor of Society of Physics Students, NJIT: Spring 2007

Students Supervised

- Zach Radeka (Class of 2014), Freshman Research Student, Randolph-Macon: Spring 2011
- Michael Hudson (Class of 2011), Research Student, Randolph-Macon: 2010–2011
- James Olson (Class of 2010), Research Student, Randolph-Macon: Fall 2009
- Peter Bonanno (Class of 2007), Research Student, NJIT: Spring 2007
- Jeremiah Rogers (Class of 2012), Planetarium Assistant, Lambuth: 2008–2009
- Tad McElroy (Class of 2009), Planetarium Assistant, Lambuth: 2007–2008
- Margaret Day (Class of 2011), Physics Laboratory Assistant, Lambuth: 2007–2008

Refereed Papers

1. **M. R. Francis** and E. J. Fertig, Quantifying the dynamics of coupled networks of switches and oscillators, PLoS One, PONE-D-11-19604 (in press). Preprint: <http://arxiv.org/abs/1111.7243>
2. **M. R. Francis** and A. Kosowsky, Post-Newtonian parameters for generalized Einstein-Æther models, in preparation.
3. **M. R. Francis**, A. Kosowsky, and R. E. Byers, A new approach to relativistic point-particle dynamics, in preparation.
4. **M. R. Francis**, R. Bean, and A. Kosowsky, Impact of Systematic Errors on Sunyaev-Zel'dovich Effect Surveys, *JCAP* **0512** (2005), 001. [astro-ph/0511161](http://arxiv.org/abs/astro-ph/0511161)
5. **M. R. Francis** and A. Kosowsky, The Construction of Spinors in Geometric Algebra, *Ann. Phys.* **317** (2005), 383–409. [math-ph/0403040](http://arxiv.org/abs/math-ph/0403040)
6. **M. R. Francis** and A. Kosowsky, Geometric Algebra Techniques for General Relativity, *Ann. Phys.* **311** (2004), 459–502. [gr-qc/0311007](http://arxiv.org/abs/gr-qc/0311007)
7. **M. R. Francis** and A. Kosowsky, Geodesics in the Generalized Schwarzschild Solution, *Am. J. Phys.* **72** (2004), 1204–1209. [gr-qc/0311038](http://arxiv.org/abs/gr-qc/0311038)
8. J. Javanainen, J. Ruostekoski, B. Vestergaard, and **M. R. Francis**, One-Dimensional Modeling of Light Propagation in Dense and Degenerate Samples, *Phys. Rev. A* **59** (1999), 649–666.

Writing and Public Outreach

- Physics and math editor, Double X Science (<http://doublexscience.blogspot.com/>)
- Scientific American Guest Posts: [What We Know About Black Holes](#) (September 2, 2011) and [What Does the New Double-Slit Experiment Actually Show?](#) (June 7, 2011)
- 365 Days of Astronomy Podcasts: [The Biggest Things in the Universe](#) (June 13, 2011) and [Seeing Through Gravity's Lens](#) (April 22, 2011)
- “Boxing the Universe” public presentation at ThirstDC (<http://thirstdc.com/speakers.php>)
- Planetarium Activities (2007-09)
 - Presented twice-monthly public programs and frequent shows for school groups
 - Design and management of website (<http://planetarium.lambuth.edu/>, now defunct)
 - Organized Grand Reopening event (February 9, 2008)
 - Keynote Address: [Lawrence Krauss](#) (then of Case Western Reserve University)
 - Original Programming:
 - “See How Far the Light Came”; written/produced/narrated for the Grand Reopening
 - “Could There Be Life in the Solar System?”, show for K-3 schoolchildren; written and produced in collaboration with the Lambuth Education Department
 - “Saturn: News from the Ringed Planet”, special presentation on April 7, 2008
 - “Water on Mars, Life on Mars”, special presentation for Fall 2008
 - Supervised renovations and projector replacement (Fall 2007)
- Judge, West Tennessee Regional Science Fair (March 14, 2008)
- TV interview, “Good Morning West Tennessee”, [WBBJ](#)/ABC affiliate (February 7, 2008)
- United Astronomy Clubs of New Jersey Symposium, invited talk (September 23, 2006)

Academic Service Work

- Admissions Committee, Lambuth University: Fall 2008–Spring 2009
- Long-Range Planning Committee, Lambuth University: Spring 2008
- Bookstore Committee, Lambuth University: 2007–2009
- Teaching and Graduate Assistant Steering Committee, Rutgers Council of the AAUP: 2003–2005
- Computer Committee, Department of Physics, Rutgers University: 2001–2003
- Graduate Studies Committee, Department of Physics, Rutgers University: 2002

Seminar Talks

- Randolph-Macon Mathematics Seminar (February 26, 2010)
- Lambuth University Faculty Forum (November 20, 2008)
- Sources and Simulations Seminar, Penn State [CGWP](#) (March 16, 2006)
- Rutgers Astrophysics Seminar (March 10, 2006)

Conference Attendance

- Session moderator for [Science Online 2012](#) (January 19-21, 2012 – upcoming event), North Carolina State University
- [DC Science Writer's Association Professional Development Day](#) (April 23, 2011), AAAS
- [Chesapeake Section of the AAPT Fall Meeting](#) (October 29–30, 2010), Randolph-Macon College (contributed talk)
- [Great Lakes Cosmology Workshop](#) (June 8–11, 2008), Carnegie Mellon University

- Atacama Cosmology Telescope general meeting (May 5–6, 2005), Princeton University (contributed talk)
- 3rd Oxford-Princeton Workshop on Astrophysics and Cosmology (February 28–March 2, 2005), Princeton University (contributed talk)
- [205th Meeting of the American Astronomical Society](#) (January 9–13, 2005), San Diego (contributed talk)
- [Fundamental Physics from Clusters of Galaxies](#) (December 9–11, 2004), Fermilab (contributed talk)
- American Physical Society April Meeting (April 5–8, 2003), Philadelphia (contributed talk)

Society Memberships

- [American Association of Physics Teachers](#)
- DC Science Writers Association

Computer Skills

- [Moodle](#) course management system
- Programming languages: Python, C/C++, Matlab, Fortran 90/95, Perl, R
- Computer algebra systems: Mathematica, Maple, Maxima
- Linux system administration
- Multimedia: Audacity, The GIMP
- Web development: HTML/XHTML, CSS, Wordpress

Other Professional Experience

- Independent contractor (Python programming), Right Force Orthodontics (June–July 2006)
- Senior Cyber Net, Baltimore, Maryland: Systems Administrator (Linux/Windows), 1999–2000