STATEMENT OF TEACHING PHILOSOPHY AND ACHIEVEMENTS

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MU PROFESSOR OF ASTROPHYSICS AND DIRECTOR OF ASTRONOMY

PERSONAL TEACHING PHILOSOPHY:

There should be a strong synergy between the research, teaching and service components for any faculty member. Rather than being separate components, I view all three as intimately linked by two-way feedback. There is an education theme that runs through all these aspects of my academic life. For example, what is research if not us educating ourselves? From improving scientific literacy amongst the tax-paying populace that ultimately support academia and much of science, to ensuring that there is a next generation of well-trained scientists, education is the thread that binds my research, teaching and service together. As an academic and a scientist it is my job goes beyond training researchers, I must train well-rounded scientists. As Director of Astronomy at MU, I use astronomy as my tool to achieve this goal. My work has been recognized by a Kemper Fellowship for Excellence in Teaching, MU’s highest teaching award.

We must convey the importance of cutting-edge science to a recession-burdened public, while also ensuring that our new generations of professional scientists are equipped for the changing technologies and modes of research. Furthermore, at the public level, it is important to convey the intricacies and joys of science, what we know, how we know it and what we don’t know. Astronomy provides ample opportunity to engage the public, and explore the nature of science as well as its content.

As an educator, my “students” include all constituencies, from pre-school through to faculty and from academics to the general public. I would like to be remembered by my students as a person who challenged them to think. I have three main aims in teaching: (1) to propagate scientific literacy; (2) to stimulate interest in the subject; and (3) to help students learn new ways of thinking and approaching problems. In addition I want to always learn something from my teaching experiences.

Until my arrival in 2002, the Physics & Astronomy department at MU was lacking in astronomy, in terms of both research and teaching, with just one professor teaching astronomy and no active astronomy research outside of cosmology. I led an effort to develop the Astronomy program, which now offers many upper-level undergraduate and graduate course offerings, and a vibrant and well-funded research program, including many graduate students and undergraduate researchers. The program now includes an Astronomy Minor, and enough upper-division astronomy courses that MU students Physics majors can acquire an emphasis in Astronomy, which is effectively a degree in astrophysics in all but name. The development of the Astronomy program, together with efforts towards outreach and revamping the non-majors’ Astronomy program led to my appointment as the Director of Astronomy in 2009. My responsibilities include development and maintenance of the curriculum and student recruitment, as well as outreach. I advise all students interested in astronomy, especially those taking the Astronomy minor, or Physics majors who the astronomy emphasis. I also provide training/guidance for colleagues on teaching methods. My work on developing all aspects of the MU Astronomy Program has been shaped by research, teaching and service, and has in turn shaped them. Developing a curriculum requires a way of thinking that can also be applied to developing a course, or a public talk or a professional presentation or a grant proposal. Consequently I work to instil this knowledge that all aspects of my academic life influence all other aspects in my students and colleagues. Most recently I have taken the lead on the MU portion of a CIRTL (Centers for the Integration of Research Teaching & Learning), which is a network of 25 universities who also espouse my synergist approach to research, teaching and service for STEM (Science, Technology, Engineering, and Math) students.
Astronomy and astrophysics are subjects where most problems require a combined observational, theoretical and experimental approach. It is therefore important that all these aspects are addressed when discussing any given topic. It can be very effective to use analogy to enhance learning by relating new information to prior knowledge, which aids both in immediate learning and in long-term information retention. Combining sketches, notes, animations, videos, simulations, analogies and demonstrations enables me to give several approaches to understanding the same concept. Engaging students using learner-centered/peer instruction techniques is a core part of my teaching style, and modern technologies such as Clickers facilitate these pedagogical techniques, especially in large-enrolment classes. These techniques can be applied to any level of audience. Furthermore, both designing and participating in an engaging classroom or public speaking event, teaches me a great deal both in terms of content knowledge and techniques for communicating ideas, as well as forcing me to think about topics in new ways. This desire to engage students is what led me to be heavily involved with the development of a new graduate level course: Inclusive Design for Learning. This course is part of the CIRTL program and aims to provide STEM graduate students with the tools they need to make their own classrooms accessible to students with both physical and learning disabilities.

Introductory (non-science-majors) astronomy courses are particularly challenging. Many of the students are science and/or math phobic and the approach to such courses needs to reflect this. In particular, the point of an introductory course is to raise the scientific literacy of the non-science undergraduate population. With this in mind, both the teaching and assessment of astronomy must be conceptual rather than numerical, a shift in technique which is often alien to the average scientist. I have completely renovated the introductory astronomy courses by implementing learner-centered teaching/peer-instruction techniques with the goal of improving scientific literacy and student learning. This effort has led me to begin education research, in particular with respect to using technology for teaching. Involvement in “Teaching-As-Research” projects has been an important part of my own evolution as an educator and as a researcher. I have developed, and continue to assess and refine, a computer-based laboratory course on Astronomy for non-scientists. Moreover, it is important to continue to develop and implement new teaching tools. With the help of colleagues, we have developed a laboratory exercise on observing stars that has been presented at several conferences. In addition, we have an NSF-funded project to develop 3-D virtual reality environments to aid in understanding of astronomical concepts and to test the impact of these 3-D environments on learning. We also have ongoing projects in which we test existing software for educational efficacy.

Whether I am teaching introductory, upper-level or graduate courses, I always use techniques that encourage students to actively participate in class, to help them understand principles rather than simply obtaining the “right” answer, and always ask questions. Instead of directly answering a question, wherever possible I will reply with a series of easier queries that lead from the knowledge they already have to the bigger answer they are seeking. When grading I always make notes on the students’ papers to help them understand why they lost points. I look for new, innovative ways to assess students that encourage critical thinking and make mere memorization of material unsuccessful. I make myself available to the students outside class hours and I encourage them to come to me with any questions they may not have wanted to ask, or had not thought of, in class. This also provides useful feedback regarding which topics were not well understood.

Since many students go on to find employment outside the subject, a good education in Astronomy/Physics should provide training in transferable skills such as formulating hypotheses, developing the means to test them, and presenting a well-reasoned argument.
clearly but concisely. Furthermore, many students choose to take an introductory level astronomy class as the only science course of their college career. For these students, my main aim is to introduce the concepts of science and its methodology. One cannot claim to be educated without having some appreciation of what science and technology is. Perhaps of more obvious benefit to the students, the processes of scientific thinking actually do apply to aspects of virtually any career students wish to consider. It is this philosophy that led me to volunteer for the General Education Taskforce at MU.

In addition to the programs aimed at MU students, I was part of a statewide curriculum alignment initiative which developed competency expectations for high schools and higher education statewide. I have also developed a vibrant outreach program, including observatory tours and public talks, which touch many people across the State. Outreach programs are simply teaching to a non-traditional audience, and the process of developing materials to engage that audience further improves my research and teaching skills generally. For example, my public talk series, Cosmic Conversations provides an opportunity for both me and my students to investigate a new audience. Likewise, radio interviews (e.g. Thinking Out Loud and Paul Pepper on KBIA) and community events such as the Columbia 20-20 event at Rag Tag cinema allows me to experience the material in new ways and gain a better understanding myself. Furthermore, outreach events are fantastic opportunities for undergraduate and graduate student development. Students learn to explain science and interact with an extremely broad audience. I require all my graduate students to be involved in science public outreach.

My experience with developing the MU Astronomy program as well as our outreach program has led to visiting scholarships at both University of Denver (Marsico Visiting Scholar) and University of Texas at Austin (Beatrice M. Tinsley Visiting Scholar). In both cases, my invitation was driven partly by interest in my educational activities. As an elected member of the American Astronomical Society (AAS) council, I am now involved in science education and public policy at a national level.

Finally, I continue to work to improve my own knowledge of educational practice and theory. I endeavor to find new ways to engage in learning for me and for my students, for research, teaching and outreach.
Teaching Responsibilities at MU (Last 5 yrs only):

Courses:

- **Spring 2013**  ASTRON/PHYSICS 3010  Introduction to Modern Astrophysics
- **Fall 2012**  Leave to recover from partial nephrectomy
- **Spring 2012**  ASTRON/PHYSICS 4250  Stellar Astrophysics
- **Fall 2011**  ASTRON/GEOL/PHYSICS 4180/7180*  Solar System Science
- **Spring 2011**  ASTRON 3010  Introduction to Modern Astrophysics
  - GN HON 2462H*  The Honors College Science Sequence: The Warm Little Planet

- **Fall 2010**  ASTRON/PHYSICS 4550/7550  Cosmochemistry
- **Winter 2010**  Research Leave
- **Fall 2009**  ASTRON/GEOL/PHYSICS 4180/7180*†  Solar System Science
  - PHYSCS 4985*  Issues in Modern Physics & Engineering (Writing Intensive Capstone Course)
  - GN HON 2462H*  The Honors College Science Sequence: The Warm Little Planet
- **Winter 2009**  ASTRON 1010 ‡  Introduction to Astronomy
- **Fall 2008**  ASTRON/PHYSICS 4550/7550  Cosmochemistry
- **Winter 2008**  ASTRON 1010  Introduction to Astronomy
  - ASTRON 1020  Introduction to Laboratory Astronomy

* indicates team-taught;
† indicates courses taught while on research leave;
‡ Prof. Aigen Li was the instructor for this course. However, I spent the whole semester working with Aigen to develop his skills in the introductory course. I provided materials and instruction on learner-center techniques, was in the classroom with Aigen for 35/45 lectures and debriefed with him after most lectures.

In all semesters I have continued to supervise and develop the content, materials and methods for non-majors Astronomy courses ASTRON 1010 and 1020, and in several semesters I was effectively (although unofficially) the instructor.

**ASTRONOMY 1010: INTRODUCTION TO ASTRONOMY (4 credit hours)**
This is an introductory level course designed for non-science majors with an enrollment of 150-200. Many of the students have little experience with math or physics and therefore the challenge is to break down astronomical problems to a level that is not so intimidating, and a form that is more conceptual and less overtly quantitative. This course was converted from lecture-only to a lab-credit class in Winter 2008. Consequently I redesigned the course to include the appropriate “laboratory” experience, which was challenging as we do not have adequate physical laboratory space or TA availability. This course now runs smoothly as a combined lecture/lab course.

**ASTRONOMY 1020: INTRODUCTION TO LABORATORY ASTRONOMY (2 credit hours)**
This is a companion to Astronomy 1010 (3 hours lab) and is mostly computer-based. This largely consists of projects using planetarium software such as Redshift, Starry Night and other interactive software such as Project CLEA to reinforce ideas and concepts learned in the
lecture-based course. In collaboration with a PhD student who has since graduated (Lanika Ruzhitskaya, now a Postdoc under my supervision), we have renovated this course and developed our own computer-based laboratory projects.

**ASTRONOMY 4180/7180 (also PHYSICS/GEOLOGY 4180/7180): SOLAR SYSTEM SCIENCE**
This is an upper level undergraduate/graduate level course which investigates physical states, interior structures and comparative geology of solar system bodies: terrestrial and Jovian planets, moons, asteroids, comets and the sun as well as solar system formation and evolution. It is co-taught with Professor Alan Whittington from Geological Sciences. Due to the mixture of geology and physics students, the emphasis throughout is on the nature of science - how we know what we know (and what we don’t know) - regarding the physical processes that have shaped our solar system. This course will be part of a newly-proposed Online Minor in Astronomy.

**ASTRONOMY 4550/7550: COSMOCHEMISTRY**
Cosmochemistry explains the composition and evolution of material objects in the universe. The aim of this course is to present a broad picture of the chemical and nuclear history of matter, from the creation of matter shortly after the big bang to the composition of the present solar system. In order to study this, we need to know what the composition of the universe is, as we see it today, on a variety of scales, and then we need to understand the reasons why it has that composition. Furthermore, we need to understand the techniques by which we can study all aspects of the history and evolution of these solid materials. This course introduces physical science students to the basic principles of geochemistry and mineralogy, and explains how to apply them to astronomical/astrophysical problems. This course will be part of a newly-proposed Online Minor in Astronomy.

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NOTES ON TABLE ENTRIES

All scores are out of 4 (for the year FS07-WS08 the scores were originally out of 5, but have been scaled/normalized to a maximum of 4 for ease of comparison)

*Most of Prof. Speck’s courses are only taught by her. Consequently, when comparing the 4000/7000-level course evaluations, the Dept average evaluation score given is that for all the 4000-level elective PHYSCS courses – not just this individual course. However, the dept average is not weighted to account for the year in which the scores were out of 5, and thus this dept average is marginally higher than reality. Since the average is taken for all 4000-level courses since 1998, the difference is small.

†The departmental average for ASTRON 1010 is for all instructors since 1994.
‡I had surgery in the middle of this semester, which was somewhat disruptive.

ASTRON 1020 is a laboratory class. Evaluations are done for the TAs only.

PHYSICS 4985 was co-taught with Prof. Haskell Taub (Physics & Astronomy) and is both Writing Intensive and the Physics BS Capstone course. Because of the size of the class and the nature of the course it is not possible to do separate evaluations’ for the two instructors.

ASTRON/PHYSICS/GEOL 4180/7180 is co-taught with Prof. Alan Whittington (Geological Science). Separate evaluations were done for each instructor.

GN HON 2462H is a team taught course. I gave 3 or 4 lectures to cover the astronomy part of the course and am currently working with Sarah Humfeld to revise the astronomy portion of the course in line with teaching how we know what we know.

My teaching evaluations are consistently above the department average and particularly high in the upper level astronomy courses. I have maintained a high evaluation score since achieving tenure. This is very gratifying, as I try to bring in new techniques to my teaching every semester.

Selected comments from End-of-semester evaluations of teaching:

FROM: ASTRON 1010 (Introduction to astronomy – gen. ed. for non-science majors) – WS08

What aspects of the teaching or content of this course do you feel were especially good?

“I really like Dr. Speck’s teaching style. She uses the powerpoints as an aid rather than a crutch. I love that this class is serious but I don’t stress out about it because I know help is always available.”

“..., at first I hated the idea of the clickers, but in the end I really liked them because it gave a more interactive fell in the classroom.”

“She had excellent examples for everything and all the material she presented was fun to learn. I liked her style of teaching a lot, too. The course content was amazing.”

“Professor Speck is an awesome teacher. She’s enthusiastic, interesting and not intimidating or condescending when approached with questions – I’m not a science major, but I found the course enjoyable and not tedious”

What changes could be made to improve the teaching or content of this course?

“Everything’s great”
“I am happy”
“I really can’t think of any changes, Angela was a great instructor and I felt like I was in a small classroom environment instead of a giant lecture hall”
“I really don’t feel like anything needs changing”

From ASTRON/PHYSICS 4000/7000 level courses (Cosmochemistry/Solar System Science) – FS08/FS10

What aspects of the teaching or content of this course do you feel were especially good?
“All of it”
“Great lecture slides. Makes students think, so that they learn. Amazing Professor”
“Dr. Speck’s classes are always great. She is an amazing teacher and actively cares about whether students learn.”
“Very enthusiastic. Good ability to explain/offer other perspectives. Good course content as well.”
“Lectures were exceptional. Very enjoyable class!”

What changes could be made to improve the teaching or content of this course?
“None. Great Class”

DEVELOPMENT OF LEARNER-CENTERED INSTRUCTIONAL MATERIAL

In collaboration with Dr. Lanika Ruzhitskaya, I have been extending the use of technology to develop teaching tools specifically for astronomy. We have jointly developed a laboratory exercise on observing stars that has been presented at several conferences since 2007. In addition, work with Lanika (and her co-advisor Prof. J. Laffey) includes an NSF-funded project to develop 3-D virtual reality environments to aid in understanding of astronomical concepts and to test the impact of these 3-D environments on learning. We also have ongoing projects in which we test existing software for educational efficacy. Lanika and I gave a seminar on the use of computer-based simulations and animations in the classroom for the Conversations in College Science Teaching Seminar on campus. We continue to find innovative ways to use technology in our classrooms. We will be implementing an iPad-based version of the ASTRON 1020 course in Spring 2013.

GRANTS

In collaboration with Lanika Ruzhitskaya and Jim Laffey (SISLT), I have been awarded an NSF CCLI grant to develop 3-d virtual reality environments for teaching astronomy:

A new NSF TUES proposal is currently under development for submission to the January 2013 deadline. We propose to perform research and development on the new Inclusive Design for Learning Course.
I am in the final year of an NSF CAREER Award: $488,558 “CAREER: A multi-faceted investigation of the astromineralogy and evolution of dust around low- and intermediate mass evolved stars” (05/15/07 – 04/30/12)

I also received an REU supplement to an NSF CAREER Award in order to involve undergraduates in research: NSF REU Supplement: $21,315.00; (05/01/2009 – 04/30/2010).

Furthermore I have been a visiting scholar at both University of Denver (Marsico Visiting Scholar) and University of Texas at Austin (Beatrice M. Tinsley Visiting Scholar). In both cases, the rationale for my invitation to visit these institutions was partly driven by the opportunity to begin new research collaborations, and partly by interest in my educational activities. My purview was to provide insight into teaching with technology.

AWARDS
William T. Kemper Fellowship Award for Excellence in Teaching (2013)
Member of Omicron Delta Kappa Honor Society (honorary inductee, 2010)
Honorable Mention, MU Excellence in Advising Award (Twice!), Office of the Provost.
MU Provost’s Outstanding Junior Faculty Research and Creative Activity Award, $1000, 2008.

TEACHING ACROSS THE CURRICULUM
I have taught one of the few large introductory (non-science major) classes offered by the department, in addition to classes for physics majors and astronomy minor.

ASTRO/GEOL/PHYSICS 4180/7180 Solar System Science. I developed and team-teach this class in collaboration with Dr Alan Whittington of Geological Sciences. The combination of the two different perspectives leads to different views of science for both Physics and Geology majors, who make up the majority population of the class. The class also attracts astronomy minors and people (primarily from engineering) who are “just interested”.

Guest appearances:
GN HON 2462H: Warm Little Planet is an honors course which essentially covers physical science in a nutshell. I covered the essentials of astronomy in four lectures during Winter 2009 and Spring 2011. I will be appearing again this coming Spring.

TDP 4630: Teaching Science in the Secondary School. I have participated in the debriefing following the class’s studies of the moon for the past several years, and plan to continue being involved. I help judge the students’ experiments to understand the moon and then place their studies into the perspective of what we know about the moon.

GEOL 3300: Introduction to Geochemistry. I have been a guest lecturer at the beginning this course of this course several times since arriving at MU. I teach a single lecture on nucleosynthesis (creation of elements) the origin of elements and isotope inside stars.

I am involved in the A Time of Physics First program at MU, wherein 9th grade physics teachers engage in activities which improve their leadership skills, pedagogy and content knowledge for
teaching high school physics. In collaboration with others on the team, I have developed, and continue to develop the planetary motion unit.

As part of the MU Extension program, I co-taught Cosmic Conversations with Val Germann at Osher Life Long Learning Center in Spring 2010. This course provided me with another new non-traditional audience.

OUTREACH:

As part of my efforts to develop the astronomy program, MU now offers significant outreach including monthly public talks. We also started providing outreach statewide – with talks around the state, and groups from across the state visiting the campus observatory.

I deal with large number of astronomy-related inquiries each year, including providing information for local journalists, and advice for locals on the best place to view astronomical events. I am also a regular source for scientific/astronomy-related stories for the local press including the newspapers, radio and television in Columbia and further afield (mostly Kansas City). I participated in a talk show on KCUR and was interviewed on KBIA for Thinking Out Loud and Pepper and Friends (twice). I have also been features in interviews for several magazines including Columbia Home & Lifestyle and Click (a science magazine for kindergartners). I have even given advice and calculated planetary positions for people wanting astronomical tattoos!

Public speaking is an important part of science outreach. In 2003 I was one of the first speakers in what was then a new public talk series: Saturday Morning Science. Then in 2007 I introduced a new talk series focused on astronomy-related topics. Cosmic Conversations, which has now been running for over 4 years and has been a huge success. This series covers both the science of astronomy and astronomy’s impact on culture and society. See: http://stardust.astro.missouri.edu/CosmicConversations/ for a list of previous talks/speakers. I have given many public talks: 6 Saturday Morning Science talks; 7 Cosmic Conversations talks and others across the state. These events are also fantastic opportunities for our own undergraduate and graduate student development. Students learn to interact with and convert science to an extremely broad audience. I require my graduate students to give a Cosmic Conversations talk, after we have gone through a process by which the talk is developed and polished. Undergraduates can volunteer to give public talks, and have been very successful.

In October 2011, I was the inaugural speaker in the local “Pecha Kucha” series. Columbia 20-20 (http://www.2020columbia.com/2011/10/) is a bimonthly event held at RagTag cinema in collaboration with Mizzou Advantage. Talks cover a wide range of topics, but all must the 20 slides, which only appear for 20 second each. I gave a 400 second talk on why astrology is nonsense.

Moreover I provide tours of the Laws Observatory to groups ranging from the general public to High School, Middle school and even Preschoolers. Schools have visited from Columbia, Jefferson City and Sedalia and we average one school-group visit per month.

In addition to campus events, I have participated in events around Columbia, including several at Rockbridge High School, a talk for the Math Club at Hickman high school, career day and Gentry Middle School, and the Invention Festival at Lee Elementary School, where I provided an exposition on telescopes. In Fall 2011 I gave the keynote speech to the Science Teachers of Missouri meeting (held here in Columbia) which further advertised outreach provisions in astronomy available locally.

For the International Year of Astronomy (IYA2009) I collaborated with the MU Recreation Service division to have monthly “Dark Skies” events which coincided with our Cosmic Conversations schedule. During 2009, on the first Wednesday of each month, the lights on
Stankowski Field were switched off in order to facilitate observatory viewings of the heavens. I continue to work with Recreations and also Athletics in order to keep providing Dark Sky events.

I have recently developed a program involving undergraduates in internships at the St Louis Science Center (SLSC). These students then bring their experiences to Benton Elementary School here in Columbia. Benton has recently become a STEM (Science Technology, Engineering and Math)-focused school. Our first intern (Lucas Miller, now a graduate student at UC Boulder) worked at SLSC in summer 2011 and presented his work on taking science demonstrations to the elementary school at the American Astronomical Society meeting in Austin in January 2012. This year, we have a new intern, Aaron Kaberline, who worked at SLSC last summer and is currently working with Benton. He will help select the next intern.

I have also involved the Laws Observatory in many campus events including the MEHA mingle and campus museum crawl. We have also appointed an artist-in-residence (Meridith Gray) who produces art based on images from the Hubble Space telescope. We have had several joint events where we can show how science meets art.

**SERVICE IN EDUCATION**

In addition to my classroom, media and outreach activities I have taken on various leadership roles in furthering education. I am currently an elected member of the American Astronomical Society (AAS) Council whose mission is to enhance and share humanity’s scientific understanding of the Universe. This role allows me to contribute to astronomy-related education of public policy efforts at a national level. Furthermore, MU has recently (in 2011) entered a network of universities: CIRTL – Centers of the Integration of Research Teaching and Learning. Since the philosophy behind this network matches my own I was delighted to get involved. I am currently the MU Institutional Lead for CIRTL (see www.cirtl.net).

Missouri Senate Bill 389 included what is now known as the Curriculum Alignment Initiative (CAI) and mandated the development of statewide competencies for students entering college and for college-level general education courses. I was instrumental in developing the entry level competency for physical science and three of the four subject-specific physical science competencies (i.e. astronomy, geology and physics). I also served on the steering committee of the CAI as the deputy liaison for physical sciences.

At the campus level, I was a member of the campus wide General Education Taskforce. And I was involved in the MU NSF ADVANCE program, both as a mentor and a mentee. I am also the Faculty Advisor for two MU student organizations: Society of Astronomy Students, and “Color Me Wild”.

I have also been involved in local education efforts: I am a member of the Columbia Public Schools grades 9-12 Science Program Evaluation team (2010 – present). This team is responsible for evaluating the Columbia Public Schools current high school science program (courses, content taught, pedagogy, etc.), researching best practices, and making recommendations to the CPS Central office/School board.
Publications and Presentations Concerning Teaching.

Peer-reviewed papers:

Conference Proceedings Papers:

Conference Abstracts (not subsequently converted to proceedings papers)
1. Inclusive Design for Learning – Making Your Classroom Accessible – ORAL Angela Speck; Gina Ceylan American Astronomical Society Meeting 222, Indianapolis, IN, June 2013, #201.02
2. Cosmic Conversations: Training STEM Students to Speak to the Public – ORAL Angela Speck, Lanika Ruzhitskaya Communicating Science, Tucson, AZ, August 2012
4. 3D Virtual Reality for Teaching Astronomy – ORAL Angela Speck, L. Ruzhitskaya, J. Laffey, N. Ding American Astronomical Society Meeting 219, Austin, TX, January 2012, #227.03
8. Guided Versus Unguided Learning: Which One To Choose? - ORAL
   Whittington, A.G., Speck, A.K., Witzig, S.B., and Abell, S.K.,
   EGU Annual meeting, Vienna, Austria. 2010

10. Virtual Jupiter - Real Learning – POSTER
    Ruzhitskaya, Lanika†, Speck, A., Laffey, J.
    American Astronomical Society Meeting 215, Washington, DC, January 2010, #466.06

11. Focusing on the Processes of Science Using Inquiry-oriented Astronomy Labs for Learning Astronomy - ORAL
    Speck, Angela, Ruzhitskaya, L.†, Whittington, A., Witzig, S.

12. Incorporating inquiry into upper-level homework assignments: The mini-journal. – POSTER
    AGU Fall meeting, San Francisco, CA, 2009.

13. What do students in an introductory astronomy course believe science is? – POSTER
    Hanuscin, D., Speck, A., & Ruzhitskaya, L.
    American Association of Physics Teachers. Chicago, IL, February 2009.

    Ruzhitskaya, Lanika†, French, R. S., Speck, A.
    American Astronomical Society Meeting 214, Pasadena, June 2009, #312.03

15. Misconceptions in Astronomy: Before and After a Constructivist Learning Environment - ORAL
    Ruzhitskaya, Lanika†, Speck, Angela

16. Innovations in Inquiry-Based Laboratory Exercises for Non-Majors Astronomy Courses: Connecting Undergraduates with the Enterprise of Science - ORAL
    Speck, Angela, Ruzhitskaya, Lanika†, Weaver, Jan
    American Astronomical Society Meeting 213, Long Beach, CA, January 2009, #353.03

17. Project CLEA - The Moons of Jupiter: Understanding the Kepler's Laws in Astronomy 101 - POSTER
    Ruzhitskaya, L.†, Speck, A.
    American Astronomical Society Meeting 212, St Louis, MO, June 2008, #40.02

18. Stellar Properties in the Classroom: From Parallax to Radius - ORAL
    Ruzhitskaya, Lanika†, Speck, A.
    American Astronomical Society Meeting 211, Austin, TX, January 2008, #70.07
ADVISING

Graduate Advisor in Department of Physics & Astronomy

1. Matthew Reel       M.S from May 2013
2. Hannah Groom       Ph.D from August 2012
3. Bradley Mills      Ph.D from August 2012
4. Sean Balbridge     Ph.D from August 2011
5. Nelson DeSouza     M.S. from August 2011; graduated May 2013
7. Arielle Newgard     Ph.D from August 2009; left program
8. David Arrant       Ph.D from November 2006: anticipated graduation Dec 2013
9. Suklima Guha Niyogi Ph.D. graduated December 2011
10. Menzi Mchunu       Ph.D graduated December 2011
11. Daniel Caputo      M.S. graduated May 2010, now at Leiden University
12. Adrian Corman      Ph.D graduated April 2010, now postdoc at WashU.
13. Josh Tartar        M.S. became director of astronomy for CPS*, August 2009
15. Kyle DePew         M.S. graduated May 2006: went on to get PhD at MacQuarie U.
16. Duane Hamacher     M.S left to go to MacQuarie, Australia January 2006

*CPS = Columbia Public Schools

Graduate Advisor for other students

Lanika Ruzhitskaya, Ph. D. School of Information Science and Learning Technologies (SISLT). I was Lanika’s co-advisor for her Ph.D. research which involves using computer simulations to improve teaching and learning in astronomy. Lanika graduated in Summer 2011.

Undergraduate Advising

1. Lucie Williams      from May 2013
2. Lacey Daniels      from May 2013
3. Matt Reel           from Fall 2012 graduated May 2013
4. Jacob Williams      from Fall 2012 left December 2012
5. Adam Eshein         from Fall 2012 graduated May 2013
6. Colby Lisle         from Fall 2012
7. Nick Parmley        from Fall 2011 graduated December 2012
8. David Nash          from Fall 2011 graduated May 2013
9. Alex Buffard        from Fall 2011 graduated May 2012
10. Aaron Kaberline    from Summer 2011 Part time for personal reasons
11. Laura Hosmer       from Fall 2010 graduated May 2013
12. Jordan Wheeler     from Fall 2009 graduated May 2012
13. Lucas Miller       from Summer 2009 graduated May 2012
14. Corinne Fletcher   from Summer 2009 graduated May 2011
15. Kyle Williams      from Summer 2009 graduated May 2011
16. Josh Shocklee      from January 2008 graduated December 2010
17. Stephen Messenger  from January 2008 graduated May 2010
18. Alex Mulia         graduated Dec., 2009 grad student at U of Toledo
19. Cindy Randolph     graduated Dec., 2009 now working for textbook company
20. Matthew Taylor     academic year 2007-8 anticipated graduation December 2011
21. Daniel Caputo      graduated May 2008 also earned MU-MS, now PhD student abroad
22. Caleb Wheeler  graduated May 2009  now graduate student at ASU
23. Tikki Davis-Ab Rahim  from September 2006, left program.
26. Anthony Smith  graduated May 2009  now graduate student at U of Colorado
27. Josh Tartar  graduated May 2005  joined Army Fall’06, came back as grad student
28. Adrienne Dove  graduated May 2006, now graduate student at U of Colorado
29. Grant Thompson  graduated Dec., 2005, now graduate student at U of Kentucky
31. R. Bryan Reid  graduated May 2005  ---
32. Blake Miller  graduated May 2004, graduate school at UMKC
33. Danielle Moser  graduated UIUC 2003, now at NASA Marshall SFC.
34. Melvin Mora  KIA – Iraq June 2004
   *Ben Vega-Westhoff  worked summers before (2006) and after (2007) freshman year at UIUC, now graduate school at UC-Berkeley
   *Emma Myers  summer 2008  high school student (now at U of AZ)
   *Julie Wood  summer 2009  high school student
   *Jennifer Ortega  advised on career paths in astronomy as undergraduate
   *Sarah Bird  advised on career paths in astronomy as undergraduate

- Currently advisor to 1 postdoc, 4 doctoral students, 1 masters student and 7 undergraduate students.
- Research advisor to 4 postdocs, 16 graduate, 32 UG and 3 high school students since Winter 2002.
- Graduated 4 Masters and 4 PhD.
- Supervised >100 (both national and international) conference presentations by students.