

**ANGELA K. SPECK**  
**EXECUTIVE SUMMARY**

**Goal:** My overarching goal in life is to have a positive impact on education at all levels, in order to produce a better-informed society. I would like to take on a leadership role in graduate and postdoctoral education because our graduate students and postdocs are the future faculty who will teach the next generation of college students across all disciplines. By ensuring that our next generation of faculty is well prepared, we will improve education at all levels.

**Philosophy:** My philosophy of life is one of integration. As a faculty member I believe there should be a strong synergy between the research, teaching and service components of my work. 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 and academics, education is the thread that binds my research, teaching and service together. As a scientist in academia, I am responsible for training well-rounded graduates. As Director of Astronomy at MU, I have used astronomy as my tool to achieve this goal, with considerable success. My work has been recognized by a Kemper Fellowship for Excellence in Teaching, MU's highest teaching award.

**Program development:** Until my arrival in 2002, the Physics & Astronomy department at MU offered only introductory astronomy courses and had no active astronomy research outside of cosmology. I led an effort to develop the Astronomy program, which now includes several faculty members offering many upper-level undergraduate and graduate courses, and a vibrant and well-funded research program, including many graduate students and undergraduate researchers. The program now includes an Astronomy minor, and an "Emphasis" in Astronomy for Physics majors, which is effectively a degree in astrophysics in all but name. Most recently I have taken MU into the WIYN consortium, providing us with guaranteed telescope time, which is essential for both research and training of students. 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, student recruitment and advising, and outreach. 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 instill this knowledge and philosophy that all aspects of my academic life influence all other aspects in my students and colleagues.

**Centers for the Integration of Research Teaching & Learning (CIRTL):** In 2011 I took my program development skill to the next level and become the MU Institutional Leader for CIRTL. CIRTL is a network of 23 research intensive universities who also espouse my synergistic approach to research, teaching and service for STEM (Science, Technology, Engineering, and Math) students. The goal is to provide graduate students with preparation in teaching, advising, mentoring and other skills relevant to modern academia. Since joining, MU has been building up our local program as well as participating in online, cross-network activities. In addition to simple pedagogy courses, we have developed courses which instill into students the importance of diversity and how to manage a diverse classroom. Teaching-As-Research is also an important pillar of CIRTL because students need to recognize that education is a scholarly pursuit and that we can test the efficacy of our teaching methods.

**Education Research:** I have completely renovated the introductory (non-science majors) 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, as a researcher and as an

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advocate for education. 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. For example, we have an NSF-funded project to develop 3-D virtual learning environments to aid in understanding of astronomical concepts and to test their impact on learning.

**Outreach:** As an educator, my “students” include all constituencies, from pre-school through to faculty and from academics to the general public. Outreach programs can be viewed as teaching to non-traditional audiences. In addition to training students and postdocs to be excellent researchers, they must also be able to convey the importance of academic research to a recession-burned public. Furthermore, at the public level, it is important to convey the intricacies and joys of learning and academic study, what we know, how we know it and what we don’t know. Astronomy has provided ample opportunity to engage the public, and explore the nature of science as well as its content. For example, I have developed a monthly public talk series on campus, “Cosmic Conversations”, conducted many radio interviews (e.g. Thinking Out Loud and Paul Pepper on KBIA) and participated in community events such as the Columbia 20-20 event at Rag Tag cinema. These activities allow me and my students to convey scientific material in new ways that engage different audiences. Outreach events are fantastic opportunities for student and postdoc development, because 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 and I am responsible for the outreach portion of MU’s IGERT program.

**Service to the Profession:** 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 since 2011, and an appointed member of the Astronomy and Astrophysics Advisory Committee (AAAC) since 2013, I am now involved in the application of science research, education and public policy at a national level.

**New Ideas:** In my most recent funding proposals I advocate for cross-disciplinary courses that will promote both arts and science. These courses include a course in which art and science students pair up to teach art through science and science through art. Another proposal includes developing museum exhibits as a way to develop communication skills across disciplines. Yet another proposal combines research and outreach by using MU Architectural Studies’ iLab to both investigate 3-D structures in space and to develop outreach tools. In developing new programs for graduate students and postdoctoral researchers more crossovers between academic and professional programs can be pursued. For instance, generating collaboration between MBA students and future faculty will be beneficial for both. Future faculty are expected to run a business (research group) whereas, MBA students will gain a broader perspective.

My professional experience thus far has equipped me with the skills of research, teaching, outreach, mentoring, advising and much more. I have developed skills in bridging departments across arts and sciences, and in understanding the diverse ways in which different disciplines approach their research and teaching. Moving forward I want to apply these skills to improving education at large by improving graduate student education and pedagogical training.