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EDUCATION

September 2007 - December 2011	Ph.D, Physics/Astronomy, Brigham Young University
September 2005 - August 2007	M.S., Physics, Brigham Young University
September 2000 - August 2005	B.S., Physics/Astronomy, Brigham Young University

EMPLOYMENT

Assistant Professor (Lecturer), University of Utah Physics & Astronomy, Jan. 2012 - Present

- Faculty appointment began 1 March 2012
- Developing physics curriculum, demonstrations, learning activities
- Assisting in Lecture Demonstration area
- Developing and implementing astronomy public education and outreach program

Adjunct Instructor, Utah Valley University Physics Dept., Jan. 2007 - Dec. 2011

- Taught one to two sections of Introductory Astronomy each semester
- Developed astronomy curriculum, demonstrations, learning activities

Planetarium Assistant Director, Brigham Young University, Sep. 2005 - Apr. 2008

- Position part of research assistantship
- Programmed with planetarium software
- Developed astronomy curriculum for use in planetarium
- Developed and presented live planetarium shows
- Programmed and operated analog and digital star projectors
- Developed and implemented planetarium outreach program
- Trained faculty and students on use of planetarium

Research Assistant, Brigham Young University Physics & Astronomy, Sep. 2003 - Dec. 2011

- Operated telescopes at BYU's West Mountain and Orson Pratt Observatories
- Operated telescopes at Dominion Astrophysical Observatory
- Photometric optical observations, data reduction, photometry
- Spectroscopic optical observations, data reduction
- Wrote grant proposals

Teaching Assistant, Brigham Young University Physics & Astronomy, Sep. 2003 - Dec. 2011

- Taught labs for astronomy classes
- Homework tutoring and grading

TEACHING PHILOSOPHY

I believe that students are capable of being self-motivated, independent learners, and that acquiring such skills and habits will be very valuable to them throughout their lives. Evidence in education research shows that certain practices that stray from the “traditional” lecture increase students’ understanding and performance and create a more desirable learning environment. I structure my classes with the following objectives:

- Motivating students to be independent learners
- Enhancing student enjoyment of science learning
- Creating an open and interactive classroom environment
- Having students review the lecture material before class
- Having the class discussion driven by real-time feedback from students
- Being respectful of students

I use the following practices to achieve my objectives:

- Largely “flipping” my classroom (i.e., taking the “lecture” out of the classroom)
- Allowing students to correct midterm exams to earn a percentage of points back
- Feedback-driven class discussion (i.e., using clickers during class to further assess understanding and encourage discussion)
- Online pre-class quizzes to assess student understanding on the discussion topic before class

By obtaining frequent and real-time assessment of student understanding, I am able to use class time more efficiently and can focus on the topics that the students do not understand as well. Evidence of the success of these practices in my classes include:

- Positive student evaluations with above average ratings
- A higher percentage of class attendance
- Students interacting and participating in class discussion
- Students gaining a good understanding of the subject material
- Very few students requesting changes made to their end-of-semester grades

Taking the “Lecture out of the Classroom

I have largely “flipped” most of the classes that I have taught. Taking the “lecture” portion outside of the classroom allows me to use class time for application, demonstration, and further review on topics that the students choose. As part of “flipping” my classes, I have been creating videos (50+ so far) on general physics topics and posting them on YouTube for my students and others to view (https://www.youtube.com/channel/UCY1tKqYKGOAE6kM_dsV0kaw/videos). A video lecture has the advantage of being able to be paused and skipped around in, so a student may go back and repeat segments. My students have found these videos to be very helpful and very often prefer the discussions in them to those in textbooks. Whether there are videos or reading available, I structure my classes so that my students will have some initial exposure to the material before our class discussion. Then the things that I can provide to the students in the classroom (e.g., clarification of ideas, applications of concepts, digging deeper into the material, and practicing scientific thinking and problem-solving techniques) become enhancements to the basic lecture.

Assessing Student Understanding Before Class Discussion

I hold my students accountable for previewing the lecture material with an online quiz due usually the evening before class. As part of this quiz, I ask students to tell me what topics they would like to review or discuss further. In this “Just in Time Teaching” method, I then use their responses as a guide in preparing for the class discussion.

Feedback-Driven Class Discussions

The active learning in my classroom mostly involves peer instruction and discussion, as well as some group assignments and interaction with physical demonstrations. Guided by their quiz responses, I try to prepare several questions to present to the class as multiple-choice “clicker questions”. The procedure that I use in presenting the questions facilitates discussion and peer instruction: I first ask a question and have students independently respond with their clickers without talking to each other. I then show them the results of the poll and, before telling them the correct answer, I ask each to discuss the question with a neighbor and argue their selections. After polling the class again and displaying the new poll results, I then present the correct answer through discussion or demonstration. I try to structure things so that class time truly becomes a discussion with everyone for most of the time.

Student Exam Corrections

Another innovation that I have been implementing is to allow students to make corrections on their midterm exams. I allow them to earn some points back (typically up to 33%) by correcting problems and submitting them to be graded again. They are therefore motivated to review the things that they miss on the exams, and they report gaining a better understanding of the material through this exercise.

Conclusion

My practices make the students more accountable for their learning, and they also seem to feel more in control of what and how they are learning. The students largely feel that these practices facilitate their learning more effectively and provide a positive learning environment in which they are treated fairly and feel comfortable asking questions and seeking help. I have also had some success in getting students to learn outside the classroom prior to class, which has historically been challenging.

COURSES TAUGHT

Fall 2016,	Observational Astronomy (ASTR/PHYS 2060/4060)
Spring 2016,	The Universe (ASTR/PHYS 1060)
Spring 2016,	General Physics II (PHYS 2020) (2 sections)
Fall 2015,	Astronomy for Teachers (PHYS 6950)
Spring 2015,	The Universe (ASTR/PHYS 1060)
Fall 2014,	Physics for Scientists and Engineers II (PHYS 2220) (2 sections)
Spring 2014,	General Physics II (PHYS 2020) (2 sections)
Spring 2013,	General Physics I (PHYS 2010) (2 sections)
Spring 2012,	General Physics I (PHYS 2010) (2 sections)
Spring 2007 - Fall 2011,	Introductory Astronomy (10 semesters, Utah Valley University)

UNIVERSITY SERVICE

2014 - Present, Society of Physics Students Faculty Advisor, Physics & Astronomy
2014 - Present, Crocker Science Center Committee member, College of Science
2013 - 2016, Curriculum Committee Member, Physics & Astronomy
2013 - 2016, Student Advisory Committees Faculty Advisor, Physics & Astronomy
2012 - Present, Astronomy Task Force Committee Member, Physics & Astronomy
2012 - Present, Coordinating Astronomy Public Education & Outreach
2012 - 2016, CoS Science Day Committee Faculty Representative, Physics & Astronomy
2012 - Present, Assisting Adam Beehler with Lecture Demonstrations for classes
2012 - Present, Public Outreach Committee member, Physics & Astronomy
2012 - 2015, Undergraduate Research Opportunities Program Application Reviewer

PUBLIC OUTREACH

2012 - Present	Developing and implementing astronomy public outreach program
2000, 2005 - 2011	Developing and giving public planetarium presentations, BYU
2005 - 2006	President of BYU's Astronomical Society
2004 - 2005	Vice-President of BYU's chapter of the Society of Physics Students

I have formalized an astronomy outreach group in the department (The AstronomUrs), which I advise and work with. Our group also includes a part-time staff member, a few paid student TAs, and volunteers. We hold free public star parties at the South Physics Observatory every clear Wednesday night; give presentations and take telescopes off campus to schools, workshops, scout groups, and other community groups; and present to groups that come to campus. We occasionally host very large outreach events, such as our event for the annular solar eclipse in 2012, where we estimate that about 2000 people came to our South Physics Observatory, and a live broadcast of the Mars Curiosity rover landing, with over 500 people attending our midnight event! We estimate that about 2000 people attended our weekly star parties last year, and we presented to over 75 additional groups, reaching upwards of 10,000 people last year. The student TAs in our group greatly benefit from their experience, as they learn and practice presenting and communication skills. They also learn to develop curriculum through activities and demonstrations in physics and astronomy topics. Through our outreach program, I have developed good working relationships with outside organizations, including the Clark Planetarium and the Natural History Museum of Utah, with whom our group works to coordinate several large public outreach events and programs.

OTHER SERVICE

2015 Served as a reviewer for an online textbook platform for Macmillan Ed.

2015 - Present: In 2015 I worked with the Clark Planetarium to design and develop planetarium shows that are complementary to the curricula in our introductory astronomy classes. The shows illustrate topics that are much more easily explained and understood on a domed ceiling representing the sky than on a two-dimensional screen or chalkboard. I work as a liaison between the University and Clark to have arrangements made for the introductory classes to attend these shows each semester at the planetarium.

RESEARCH

I have an interest in stellar processes and have worked to understand in particular the physical and chemical processes that trigger star formation, as well as how forming stars evolve and develop planetary systems. My most recent work has been in searching for and characterizing young stellar objects in star-forming regions in the Large Magellanic Cloud (LMC). I found evidence in support of self-propagating stochastic star formation in one star-forming region of the LMC, and plan to extend my study to other, nearby regions through the analysis of color-magnitude diagrams, spectral energy distributions, source morphologies, and environments, to better understand the star-formation mechanisms in these regions.

AWARDS

Jan. 2009 Chambliss Astronomy Student Achievement Award, American Astronomical Society
Dec. 2007 Research Presentation Award, Brigham Young University Graduate Studies
Dec. 2006 Research Presentation Award, Brigham Young University Graduate Studies

FELLOWSHIPS

Oct. 2009 Women in Science Leadership and Professional Conference Scholarship, BYU
Sep. 2009 Graduate Research Fellowship, BYU

GRANTS APPLIED FOR

Jan. 2013 SPIE Education Outreach Grant, **awarded**
May 2012 NASA ROSES, Application 12-ADAP12-0156, **not awarded**

MOST RECENT TELESCOPE TIME AWARDED

Nov. 2012 McKellar 1.2-m, 4 nights, Dominion Astrophysical Observatory
Sep. 2012 McKellar 1.2-m, 4 nights, Dominion Astrophysical Observatory

OTHER RESEARCH-BASED OBSERVATIONAL EXPERIENCE

2009 - 2011 Various photometric observations, 0.9-m telescope, WMO
2004 - 2006, 2009 Spectroscopic observations of variable stars, McKellar 1.2-m, DAO
2004 - 2006, 2009 Photometric observations of variable stars, Plaskett 1.8-m, DAO

RECENT MEDIA CONTACTS

October 19, 2016 @theU, public star parties
July 14, 2015 Fox 13 TV interview, P&A Pluto Palooza outreach event
August 8, 2012 Utah Public Radio, Access Utah show, Mars rover landing
August 5, 2012 Fox 13 TV interview, Mars rover landing outreach event
August 4, 2012 Salt Lake Tribune Newspaper, Mars rover landing outreach event
June 14, 2012 Daily Herald Newspaper, Springville Library outreach event
May 2012 KNRS radio interview, Rod Arquette Show, annular solar eclipse
May 2012 KUER radio interview, annular solar eclipse
May 18, 2012 ABC 4 TV interview, annular solar eclipse

SOCIETY MEMBERSHIPS

2005 - 2016 American Astronomical Society
2007 - 2016 American Physical Society
2012 - 2016 American Association of Physics Teachers
2012 - 2016 Astronomical Society of the Pacific

REFEREED JOURNAL ARTICLES

Barth, Aaron J., Pancoast, Anna, Bennert, Vardha N., Brewer, Brendon J., Canalizo, Gabriela, Filippenko, Alexei V., Gates, Elinor L., Greene, Jenny E., Li, Weidong, Malkan, Matthew A., Sand, David J., Stern, Daniel, Treu, Tommaso, Woo, Jong-Hak., Assef, Roberto J., Bae, Hyun-Jin, **Buehler, T.**, and 12 more coauthors. "The Lick AGN Monitoring Project 2011: Fe II Reverberation from the Outer Broad-line Region", 2013, *Astrophysical Journal*, 769, 128.

Pancoast, A., Brewer, B. J., Treu, T., Barth, A. J., Bennert, V. N., Canalizo, G., Filippenko, A. B., Gates, E. L., Greene, J. E., Li, W., Malkan, M. A., Sand, D. J., Starn, D., Woo, J.-H., Assef, R. J., Bae, H.-J., **Buehler, T.**, and 19 more coauthors. "The Lick AGN Monitoring Project 2011: Dynamical Modeling of the Broad-line Region in Mrk 50:", 2012, *Astrophysical Journal*, 754, 49.

Barth, A. J., Pancoast, A., Thorman, S. J., Bennert, V. N., Sand, D. J., Li, W., Canalizo, G., Filippenko, A. V., Gates, E. L., Greene, J. E., Malkan, M. A., Starn, D., Treu, T., Woo, J.-H., Assef, R. J., Bae, H.-J., Brewer, B. J., **Buehler, T.**, and 32 more coauthors, "The Lick AGN Monitoring Project 2011: Reverberation Mapping of Markarian 50.", 2011, *Astrophysical Journal*, 743L, 4B.

Bush, T. C., and Hintz, E. G., "Rotational Velocity Determinations for 118 δ Scuti Variables", 2008, *Astronomical Journal*, 136, 1061-1066.

Hintz, E. G., Rose, M. B., **Bush, T. C.**, and Maxwell, A. A., "Establishing Observational Baselines for Two Medium Amplitude δ Scuti Variables: V1438 Aquilae and V966 Herculis", 2006, *Astronomical Journal*, 132, 393-400.

Hintz, E. G., **Bush, T. C.**, and Rose, M. B., "Monitoring Three Less Studied δ Scuti Variables: GW Ursae Majoris, BO Lyncis, and AN Lyncis", 2005, *Astronomical Journal*, 130, 2876-2883.

PROFESSIONAL MEETING ABSTRACTS

Bush, T. C., and Hintz, E. G., “Rotational Velocity Determinations for 118 δ Scuti Variables”, 2009, American Astronomical Society, 41, 301

Bush, T. C., “Rotational Velocities of delta Scuti Stars”, 2007, American Astronomical Society, 210, May 2007

Moody, J. W., Joner, M. D., Hintz, E. G., Lawler, J., **Bush, T. C.**, Moncrieff, K., Leishman, T., “General Astronomy Education Using the BYU 39’ Planetarium”, 2007, American Astronomical Society, 210, May 2007

Bush, T. C., and Hintz, E. G., “Rotational Velocities of delta Scuti Variable Stars”, 2006, American Astronomical Society, 209, January 2007

Bush, T. C., Shepherd, M., and Leishman, T., “Acoustically Enabling a Planetarium to Function as a Classroom”, 2005, American Astronomical Society, 207, 6709B

Bush, T. C., and Hintz, E. G., “Photometric and Spectroscopic Observations of AN Lyncis, BO Lyncis, and GW Ursae Majoris”, 2004, American Astronomical Society, 205, 5415