Teaching Portfolio

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Chapter 1

Teaching Responsibilities

1.1 Physics 140, General Physics I

For the Fall 2004 semester, I will fulfill my role as a Lecturer by teaching six discussion sections for the large introductory calculus-based physics class. Students who enroll in Physics 140 are both entering first-years who may be interested in majoring in Physics, as well as students of any year who intend to fill a science course requirement. The structure of the course includes a large-audience lecture two days a week and two meetings a week with discussion groups of 30 students. Therefore my work as instructor must integrate well with the work of the rest of the teaching team, to provide the students with a clear and efficient approach to the material. Prof. Tim McKay, with whom I have worked closely for four years, is delivering the lectures and establishing the syllabus for the course.

Within the two 50-minute sessions each week, my goals are three-fold: to support and reinforce the ideas presented in the lectures, to create an environment where they learn by activity (not through someone telling them information), and to encourage them to reflect on the implications of their work. I am reading Prof. A. Arons book *A Guide to Introductory Physics Teaching*, and I intend to shape class activities to address the common misconceptions about physics that Prof. Arons has identified. My background in leading discussions on literature will be useful in assisting students to dig deeper than just plugging numbers into formulae; to see the connections between what they've learned and how the world around them functions.

1.2 Physics 465, Senior Writing Seminar

In the Winter term of 2004, I taught Physics 465, a two-credit full-semester course that students may take to fulfill their writing requirement for graduation, in lieu of, or in addition to, writing a senior thesis. Although the exact structure of the course is completely up to the instructor, the course has traditionally been treated as a career training seminar, and I decided not to deviate strongly from this goal. The syllabus I developed is included in Appendix C.1.

The intent of the course is to give the students practice in conveying scientific information through both written and oral presentations. My goal was to make the course as interactive and student-driven as possible. While they began thinking about what topics to choose for their major presentations, I began the activities with a handout that walks them through the creation of a resume or CV. I then arranged for a career counselor from the University's Career Center to come and lead us in a job interview practice workshop. I then established a pattern where each week four of the students give oral presentations, and four of the students submit written assignments. All work is critiqued by both the other students and myself. Written assignments may be reworked before a final grade is assigned. We also attended the department colloquium each week and critiqued it as a group, to study how (or how not to) speak to an audience of physicists and students.

1.3 Physics 105, Origin and Fate of Life, Stars, Galaxies, and the Universe

In the Winter terms of 2003 and 2004, I taught Physics 105. This course is a half-semester, one-credit "mini-course" that is meant to convey the basic concepts behind the standard Big Bang theory of Universal origins, and the implications the laws of physics have for the long-term future evolution of the universe. We cover inflation, the formation of regular matter, the influence of dark matter, the evolution of stars, the accelerating universe, black holes and their dissolution, and the long dark after proton decay.

This is a survey course for interested Freshmen who might become Physics majors, as well as no few Seniors in other majors who are looking for one more credit to graduate. I therefore stressed conceptual understanding over problem-solving, avoided all mathematics more complicated than $c = \lambda\nu$, and shaped the exam to stress the understanding of basic ideas (can they put ten events in the history of the universe in the proper chronological order?) rather than on calculations or derivations. I used multi-media presentations and as many demonstrations as possible to impress upon them the excitement and grandeur of the universe, and how nevertheless everyday experience can help us understand it.

The syllabus for the 2003 course may be found in Appendix C.3. The version for 2004 is included in Appendix C.2, and I describe my revisions in Chapter 4.

1.4 Undergraduate Mentoring

We have several undergraduates working in our laboratory as research assistants. Although I am available for general questions and assistance to any of them, last year I was specifically involved as a mentor to Emily Demarco, a Sophomore who is interested in majoring in Astronomy. Since September of 2003, she has learned how to use the Linux operating system, program in IDL, interact with both tabular and image data sets, and write up her results.

We collaborated with a group at the University of Chicago that wants to constrain the positions of High Velocity Clouds by obtaining spectra of RR Lyrae stars to determine if they lie behind or in front of the clouds. Emily has searched monitoring observations for stars that match the list of candidates provided by the Chicago group. She has identified those stars that have RR Lyrae characteristics, and determined a period and epoch of maximum intensity for each star. She wrote up her work as if it were a journal article, and we provide this writeup to the Chicago group. I include her writeup in this folder. She was also one of four students invited to give an oral presentation at the annual Michigan UROP meeting, and I helped her prepare for that. Her powerpoint presentation can be seen at `http://www.rotse.net/presentations/public/empres`

I tried to encourage her learning by giving her limited and clear assignments, making sure she evaluated and wrote out what she did, and I checked in with her on a regular basis to evaluate progress. It was important for me to act supportive rather than demeaning, and I try to ask her questions when she is stuck, rather than telling her what to do next. I believe these techniques worked well, as she not only learned a great deal, but she put in extra hours and continued to work in the lab part time over the summer. If she had stayed for a second year, my goal would be to have her either write a short article for publication or present at a professional conference by the end of the year. Unfortunately, she chose to devote more time to her sorority instead of continuing in research.

Chapter 2

Teaching Philosophy and Methods

My philosophy of teaching is based on my belief that knowledge is constructed, not received. My experience with teaching has involved large lecture classes, medium-sized discussion sections, small seminars, and individual mentoring. In all cases I have striven to create an environment in which students can be as actively engaged as possible. I generate this engagement by ensuring that classwork is explicitly connected to their experiences, inducing them to recognize that their current understanding is inadequate, giving them tools to construct a new understanding, and creating a safe environment for taking risks. I make my instruction as interactive, as thought-provoking, and as question-driven as possible. Laboratory experimentation with small groups is the most effective way I have found to foster scientific learning, but even a large lecture can be made interactive, with extensive communication and flexible planning. In this essay I will demonstrate how these principles have shaped the way I teach and how my teaching experiences have affected my understanding of how students learn.

My approach to teaching is rooted in the fact that we actively construct our understanding of the world based on our experiences. Classwork must always therefore be explicitly connected to experience. In my introductory class this term I required my students to submit a short paragraph about something they believed at the start of the term that they now understood differently. I wanted them to connect what they were learning to their daily experiences. They expressed amazement that air pressure pushes liquid through a straw into their mouths, that friction with the road pushes their bicycles forward, and that the feeling of weight comes from the floor pushing up on their feet. They were surprised at the incompleteness of their previous conceptions of these processes.

To understand the insights physics provides, students must unlearn many "commonsense" interpretations of physical processes. In class, I create opportunities for students' expectations to be challenged. A few weeks ago I brought my bicycle into class and asked the students what they thought would happen if I pushed backward on the lower pedal. Most predicted the bike would move forward, since they associate rotation of the pedals in that direction with forward motion. They were startled to see the bike move backward.

Once a student has challenged her expectations, it is possible for her to build a new understanding, but changing preconceptions is not simple. Students enter a college classroom with a working model of the universe that has served them well enough for seventeen years or more. One of the insights gained from Hestenes and Halloun's "Force Concept Inventory" (FCI) test is that not only do many students enter college with archaic modes of thinking about forces, but they tenaciously hang on to these models, even as they memorize the formulæ they need for their exams. At the January 1999 meeting of the American Astronomical Society, Prof. Eric Mazur told of the first time he used the FCI at Harvard: he was worried about insulting his students by giving them such an easy test. He realized he was in for a shock when one student asked him if they should answer these questions the way they were taught in class or the way they usually think about these situations. Since all knowledge is constructed, students' first reaction will be to try to force new information into old paradigms. For the backward-moving bicycle, I made sure to induce them to construct an explanation for the bicycle's counter-intuitive motion, rather than just telling them "the answer".

The classroom must be a safe place to take risks and learn from mistakes. If a student is afraid of being wrong, of being made to feel stupid before peers and instructors, the student will never take the risks necessary to progress. I aim to achieve this safety by treating them with respect (I never discount anyone's questions), affirming positive aspects of their perspective (I affirmed that they were associating the pedals' motion with the bicycle's motion), and encouraging them to examine their own thinking by asking probing questions (such as "If that's true, what do you think would happen if I pushed *this* way?"). By meeting them at their current level of understanding, I affirm their questions and encourage them to continue.

When I taught the Senior Writing Seminar last year, I required the sixteen students in the class to evaluate their peers' performances. I affirmed constructive criticism, encouraged active listening by modeling it, and I recast negative criticism in constructive ways. One student's assessment was that I was "always respectful and never condescending toward the students, which makes the discussion and presentations much more open and relaxed." The supportive atmosphere empowered them to see criticism as opportunities for advancement, not instances of personal failing. Students responded enthusiastically; one called the class "a real joy."

To encourage students to take risks, I deliberately evoke (or perhaps re-evoke) a sense of wonder and curiosity about how the world works. I believe we are all born with this sense: children explore the world around them to survive. But by the time we get to adolescence, it becomes easy for us to feel we have an adequate functional understanding of the universe, when what we really have is a hodge-podge of impressions and mutually contradictory conclusions. The student must care about asking questions and finding answers in order to abandon these impressions. Often, this caring can be evoked by showing that the insights and skills they are gaining from a course are relevant to their lives.

The study of physics yields skills for meeting many of life's challenges. To be able to solve physics problems, one must learn to break down a confusing situation, separate the essential from the irrelevant aspects, and then construct a model that allows one to calculate properties or predict behavior. This process allows human beings to consciously shape their environment. I therefore emphasize the process of problem-solving just as much as the result. Whenever I am modeling a problem on the board, I get the class members to tell me what my next steps should be. I exhort them to never be satisfied with an answer: always take a step back from a problem and consider how they figured out what to do. In this way I involve them in the process of asking questions.

Too many textbooks approach physics as the process of being *asked* a question and trying to find an answer, when the act of *doing* physics is much more dependent on discerning what questions to ask. I think the best learning occurs in a question-driven atmosphere. The questions students ask show what is important to them. It is far better to help them ask better questions than to lay out data in front of them. When students come to my office for help with their homework problems, my goal is to ask questions that guide them, not to give them solutions. I have the student stand at the board and explain to me where and why they are stuck, and then we work together to find an answer. My goal is to make sure that the majority of sentences that come out of my mouth in that interaction are questions, not statements or instructions.

Perhaps the most direct way to help students see the importance of asking questions is through laboratory instruction. Laboratory experience is crucial for their seeing see the connections between the calculations they perform in class and the way reality behaves. Richard Feynman told an anecdote about a student who could recite the formula for light scattering from a surface but did not realize he had described the sunset over the ocean outside. Laboratory experience can also convey that science is at least as much about asking questions as it is about finding answers. A laboratory program should stress the creativity behind the formulation of hypotheses, the importance of measurement error, and the connection between calculation and the real world. It is important that students see their knowledge producing concrete results. At MIT I volunteered for two semesters to teach a weekly hands-on astronomy seminar, in which students worked in pairs to learn to use telescopes and photographing equipment. Once they had mastered the mechanics, I encouraged them to follow their curiosity. It was as delightful to see their joy in discovering the Orion Nebula as to see the beauty of the images they recorded.

At the other extreme from laboratory interaction with two or three students is the large lecture. Although the lecture is traditionally seen as a means of transferring information from one person to many, I believe there are ways to make lectures interactive and question-driven. Using effective demonstrations, particularly if audience members can be involved in them, can make the information in the lecture vivid, practical, and visceral. In the reviews of my cosmology course the single most lauded aspect of the course was the reliance on demonstrations. Lectures can also inspire curiosity. When I gave a series of public lectures on X-ray astronomy, my description of a supernova prompted a young boy to bounce up and down in his seat, saying, "This is so cool! This is so cool!"

A lecture, while fun as a performance, is not sufficient in and of itself to teach physics. As I have been emphasizing, teaching must be interactive. In this regard I have been inspired by Prof. Mazur's book *Peer Instruction*. Mazur proposes that the speaker challenge the students with conceptual questions during the class. For example, in my cosmology class, after presenting an overview of the four fundamental forces, I asked if gravity could hold an atomic nucleus together. Students submitted their answers as an electronic vote. The answers were widely spread, with only a third of the class seeing that the electric repulsion of the protons would overpower their gravitational attraction. A third of the class thought the strong force would work against gravity, and most of the other third decided that the electric force would push the neutrons apart. I then modified the class activity in that moment to match the students' needs. Since one of the best ways to learn something is to explain it to others, I had the students talk to each other about it. A second vote brought the majority of the students to the right answer. The Peer Instruction approach converts the students' experience of a lecture from a passive transfer of information to an active process of engagement.

It is also important for an instructor to ensure that teaching does not stop at the classroom door. There should be a steady flow of feedback and questioning between teacher and students, a flow going in both directions. The technology of email and the World Wide Web have expanded the possibilities for interaction beyond the (often initially intimidating) method of inviting students to office hours. In *Just in Time Teaching* Novak et al. outline a method by which students are required to answer a few simple but thought-provoking questions about their reading assignment before the material is dealt with in class. Based on these recommendations, I designed a web site that presents questions to students and tabulates their answers for my inspection. This lets me see in advance what they already understand and where they are having trouble, so I can tailor the in-class material to their needs. I incorporate responses from students into the lecture so that they can see their peers' approaches to the questions. When I asked why low-mass stars do not explode, one woman's one-sentence response hit the main points so concisely, I wanted to share it with the rest of the class. When I asked if I could use her answer as part of the lecture, the student cheered "Yay! Yes, you can use it in class! I finally came up with a good answer!"

The Internet lowers the barrier of intimidation and allows me to achieve the personalized instruction that a large class format inhibits. Many students who engage in productive email discussions would never have come to my office or raised their questions in class. I also included a place on the website for the students to question me, and I emailed them responses. This led to fruitful conversations, which then helped me better explain the material during class time. One student said to me, "I've never had a class that had constant feedback like this. I like the way it works. You actually change your lectures according to the information the students give you. Odd how it took until my senior year to experience a course like this."

Through lectures, small group discussions, and individual mentoring, I have found that the more activity and interaction I have been able to generate, the more students have been engaged with the material, and the more they have taken an active role in their learning. I try to model the process of science and help them develop the ability to ask fruitful questions. If they can recognize unhelpful conceptions of the universe, they can then be open to understanding physics at a deeper level. This is an exhilarating process in which I feel honored to play a part, and, according to the evaluations I receive, my enthusiasm is clearly valued by those I teach. In the words of one student: "Wow! Science is cool AND fun!"

Chapter 3

Student Evaluations

3.1 Physics 105

I taught Physics 105 twice: in the Winter terms of 2003 and 2004. At the end of each term, a standard physics department course evaluation was distributed. Each year, twenty-four of the registered students responded to this questionnaire. The evaluations consisted of six statements to which the students are requested to provide numerical responses indicating the degree to which they agree (5) or disagree (1) with each statement. The Office provides a pool of 898 possible statements, and the Department of Physics chooses a subset of them that they believe are most relevant and useful for each course. For Physics 105 the following statements were chosen, and the students' median responses are given in Table 3.1:

1. Overall, this was an excellent course.
2. Overall, the instructor was an excellent teacher.
3. I learned a great deal from this course.
4. I had a strong desire to take this course.
5. The textbook made a valuable contribution to the course.
6. Examinations covered the important aspects of the course.

Table 3.1: Physics 105 2003-2004 Median Responses to Questionnaire

Statement No	Topic	Median 03	Median 04
1	Course	4.27	4.33
2	Instructor	4.70	4.64
3	Learned	4.58	4.41
4	Desire	3.80	3.93
5	Textbook	3.90	4.23
6	Exam	4.64	4.42

Of course I am delighted with these results. I scored in the top 25% of instructors in the college on the matters of the course that were most under my control. Prof. Fred Adams developed this course in conjunction with his book, *The Five Ages of the Universe*, and I did not feel it was appropriate for me to change the text book. I believe the relatively low score in this category is a reflection of the course's attempt to cover over 10^{100} years of the history of the universe in just six weeks. It's an overwhelming pace of information being thrown at them. Several people expressed dissatisfaction with the pace and amount of material. In 2004, one person expressed the wish that the course be expanded to two credits "so we can cover more material".

Although the high scores are encouraging, I cannot let them go to my head. This was a flashy and somewhat superficial survey course. Although the concepts were challenging, there was little to no mathematics, and I used the class sessions in very dramatic and entertaining ways. Nevertheless, by combining these numbers with the written comments, I think I can draw several positive conclusions. First and foremost, a little enthusiasm goes a long way. The fact that I was both excited about the topic and clearly cared that they understood it was appreciated by the students. Also the fact that I spent the time to interact with them and answer their questions made them feel valued and more invested in the course. Secondly, demonstrations are hugely popular. In teaching the course, I tried as often as possible to tie abstract universal concepts to concrete, tactile metaphors that I could demonstrate in class. These demonstrations were lauded in ten of the twenty-four evaluations. Finally, the techniques of Just-in-Time-Teaching (described in Section 2) really work. It does take the students time to adjust to it, and a few never quite understood why aspects of the course were so designed. A few students asked if they could get copies of my power-point slides in advance, not realizing that I did not have them in advance, since I was tailoring the slides to match what their responses to my web questions revealed. Many people mentioned the preflight questions as a positive aspect of the course.

Here are a few positive comments from their written evaluations:

"More than anything, it was obvious how much time, energy and thought you put into the course, and that made me want to work hard and understand the material."

"I was very impressed with the amount of time and energy that Smith put into this class. It is evident that he really cares about his students and wants them to learn and do well."

"The feedback from professor to student was the best I've ever seen."

"I thought the instructor was great. He really seemed to care about the students. He encouraged office hours and really helped me with my paper."

"The course was well-put together, he made excellent use of technology and example demonstrations to make sure students grasped the important subjects and was available to discuss the coursework with students even outside of office hours. He was one of the best instructors I've had this year."

"This class is fantastic. Dr. Smith's excitement and enthusiasm was absolutely contagious. Physics generally bores me and is over my head, but I was completely engaged by this course."

"Wow! Science is cool AND fun!"

A complete copy of the students' course evaluations can be found in Appendix D.5.

3.2 Physics 465

Since the workshop format of Physics 465 is so unusual, I wanted to be sure that the students were finding it effective before it was too late to improve matters. I therefore designed a World-Wide-Web form, modeled after the official university form described above, but using fourteen statements that specifically referred to individual aspects of the course structure.

Ten of the sixteen students filled in this form. I give these statements and the mean response values in Table 3.2.

In general, students were appreciative of the workshop format. "This course was a real joy" read one final evaluation. They generally valued their fellow students' critiques of their work (one student expressed surprise that she even valued the "bad" comments). I have clearly succeeded in my goal of creating a space where they feel comfortable sharing and being examined, as evidenced by the high score and low dispersion in the responses to statement two. One student said in his or her final evaluation, "there was always a good atmosphere". They also found the critiquing of the department colloquium speaker valuable to their own work. I suspect that there is also a "demystifying" empowerment at play here, as well. If it is acceptable for them, as "mere" undergraduates, to see and name deficiencies in professional scientists' presentations, it makes them feel more capable in their own presentations.

Table 3.2: Mid-Term Evaluations for Physics 465

No.	Statement	Mean	Std. Dev.
1	I found the instructor helpful when I had problems.	4.3	0.8
2	I find the class atmosphere conducive to participation.	4.8	0.4
3	The requirements of the course were made clear to me.	4.2	0.7
4	I found the resume-writing assignment useful.	4.3	0.8
5	The resume worksheet/handout was useful.	4.0	0.4
6	The recommended texts were interesting/useful.	3.2	0.6
7	The job interview session was useful/interesting.	3.9	0.9
8	Critiquing the colloquium speakers has helped my own presentation skills.	4.1	0.9
9	The Russian roulette technique makes sure everyone is prepared to participate.	4.3	0.5
10	My classmates' critiques have been helpful.	4.2	0.4
11	The instructor's comments on my work have been helpful.	4.7	0.5
12	The web page for the course is a useful tool.	4.4	0.7
13	The syllabus is clear and complete.	4.2	1.0
14	The field trip is important to me.	3.5	1.2

Probably the greatest weakness of the course is the complexity of the assignment organization. Although one student lauded the course as being "very well organized, making our lives easier", it was a very complicated schedule. With sixteen students, only a portion of the class can present in a given week. I expended much effort to schedule the written and oral presentations so that no one would have to do both in given week, and each group would always have an unscheduled week between the first two and the second two assignments. I also wanted the order in which each student presented his or her written and oral assignments to alternate. Although I successfully found such a scheme, I struggled to convey the method effectively to the students. As of this writing, we are in the fourth week of presentations, and everyone is participating comfortably. I conclude that active participation can clearly teach the procedure, but it would be better if I could find a more effective way to communicate the complexity in advance. Certainly it would be more pleasant for the students who had to go first. Although the syllabus received a high grade of 4.2 in Table 3.2, there was a relatively wide dispersion, and several students expressed frustration with not having a clear sense of what was expected of them.

It was important to me that the students have a chance to critique each others' written work. The most efficient design to incorporate that goal into the course was to have each group submit their written presentations to a web page. Any other alternative involved either coordinating another meeting mid-week or adding an entire extra week between submission and critique. These options were not acceptable. I designed and wrote a web form that would allow students to paste in their written presentations, which would then be displayed as links for other students to download. However, for the web page to function, the students had to learn LaTeX, as that is the only way I know to submit formatted documents through a generic web form. There was significant resistance to learning LaTeX from those who did not already know it, so I wrote "template" files that would handle the LaTeX formatting, but left the students free to cut and paste their own text into the file. This effort was noted and appreciated. As one student said, " I thought that the instructor saw a potential problem for students and found a solution for it." In the end, the web page received high marks, so I think they have come to appreciate its usefulness.

Although all mean scores were more positive than indifferent, the lowest score was granted to the usefulness of the textbooks. I suspect this is because I recommended general writing aides like *Strunck & White*, but then made no effort to explicitly tie the instructions in the books into the course material. I conclude that more effort is necessary to show how the books are useful for effective communication.

A complete copy of the students' mid- and post-term evaluative comments can be found in Appendix D.2.

Chapter 4

Curriculum Revisions

4.1 Physics 465 – Senior Writing Seminar

This was an extremely fun course to teach. Most of the techniques I attempted were useful and appreciated, but if I have the opportunity to teach it again, there are certainly things I will change. First and foremost, I assumed that the students had already had (in some Humanities course) basic instruction in writing, and that my assignment was to teach them *scientific* writing. This assumption was inappropriate. They did not have a sense of the very basics of how to construct a paragraph, let alone a three-paragraph essay. Although the amount that can be done in the course is strongly dependent on how many people register, the assignments need to be restructured so as to give a grounding in the basics before jumping into writing a full-fledged essay.

To that end, next time I will omit the writing of an abstract as an assignment. Most students felt that the exercise was artificial at best, because a popular science article does not necessarily lend itself to the condensation that an abstract demands. The skills needed to abstract a generalized article are not the same as one needs to abstract a technical paper. So it is not clear to me that this assignment was really teaching them anything useful beyond the importance of concise writing, which can be conveyed in other ways.

I think it would be useful to structure the course as building up to a single essay as the last assignment. The first assignment would be to write an outline, then work on single paragraphs. I would stress the importance of a topic sentence and particularly emphasize writing introductions and conclusions. For the final assignment, they can pull together everything that they have written so far. This approach will be more directly useful, as it stresses the building blocks of writing, and then gives them a chance to put what they have learned into practice.

As described in Section 3.2, the students did not clearly see the benefit of the texts I chose for the course. Next year, I should make Strunk & White, as well as Day, required texts and assign readings from them. I should put more effort into making sure that the writing assignments, and their critiques, be tied into the principles described in those books. I will still include Feibelman as a recommended text.

The structure of our in-class time was mostly successful. It was a good choice to have them stand up and present themselves the first day; it got them comfortable with the idea that this class was not going to be the kind in which you could sit back and watch others. The resume-writing segment went relatively smoothly, but I should do more preparation on "how to write LaTeX." There was some disappointment with the job interview preparation session, and if I do that again, I will work with the Career center to make it more dynamic. Critiquing the colloquium speaker was a much-beloved aspect of the course, and I think the Russian Roulette format was effective, although I should give more guidance on how to lead a discussion.

With the oral presentations, I need to give more guidance in advance on what to do, especially with respect to the second assignment. Many students did not know how to find the correct scope, and gave ten minute talks instead of twenty. Perhaps I should have each of them show me what they have in mind in advance, so I can give them some feedback before they actually get up and give the talk. That would certainly be useful for the first few people to go.

Finally, although it took some time to get used to, the LaTeX web submission approach was definitely the correct way to go. The rotating blocks to determine who would present each week was also unnecessarily confusing. Once the registration list was set, I should have simply worked out the assignments for each week by student name, as I ended up doing for the second assignments. Although this is functionally no different than asking them to remember which group they're in, it does not require them to understand the rotation scheme: they just have to remember which week each of them has been assigned.

4.2 Physics 105 – Origin and Ultimate Fate of the Universe

I have had the opportunity to teach Physics 105 twice here at the University of Michigan. My primary goal for the second term was to apply the lessons I learned the year before to make this year more effective. I therefore deliberately left the primary features of the course the same. I used the "Just in Time Teaching" and "Peer Instruction" techniques described in Chapter 2, but I changed the questions that I felt were less effective last year. I still used as many practical demonstrations as possible, to try to bring the abstract theoretical ideas down to a practical and visceral level.

I made two significant structural changes this year. The first was to offer credit for participation in the in-class ConcepTests. The classroom is outfitted with remote control devices that can be used by the students to indicate their responses to multiple choice questions. Each lecture I asked three or four of these questions to determine if the fundamental concepts of the topic were being conveyed effectively. Last year I did not include participation in these questions as part of the grade, and I noticed that class attendance ranged from 30% to 60% of a 60-student class. Faculty members have assured me that if modest credit for participation were offered, attendance would approach 100%. I wished to test that hypothesis. I found that attendance rates did not change significantly. Apparently four percent of a one-credit course is not enough incentive to increase attendance. I do not intend to do that again, should I teach this course next year.

The second change was to the role and scope of the paper. I found the experience of assigning and evaluating a paper last year to be very frustrating. Since this is not a "writing class", there is no time to explore just how an effective paper is to be written. I assumed that they would know the basics of how to construct a three-paragraph essay, and I found that assumption to be unwarranted. Despite the fact that I spent hours evaluating their work and making suggestions for improvements, over thirty essays are sitting in my file cabinet from last year; their authors clearly uninterested in learning from their experience. I therefore changed the nature of the written assignment. Instead of researching a topic beyond the assigned reading of the course, I asked them to write about a topic they would *like* to pursue further, and why it intrigues them. I moved the dates of the assignments around so that the paper is due before the exam, but then they have the opportunity to rewrite it before the term is over if they are not happy with their grade. I felt that these changes would reduce the workload for the course (See Chapter 3 and Appendix D for students' feelings on the amount of work required for the course), give the students a chance to learn from their writing, and give me a sense of what topics might be interesting to students when I teach my own cosmology course someday.

On the whole, I believe the paper was more successful this year than last. With one or two exceptions, students clearly benefitted from the rewrite. The main weakness of the assignment was that almost no one knew how to respond to my query as to what they would do to further their understanding of the topic. Either they just ignored that aspect of the assignment, or they said some platitudes about reading more books. I conclude that expecting them to have grappled with the topic enough to be able to formulate a plan for exploring what they don't understand is too ambitious. Next year, if I teach this class again, I will simply ask them to present a topic they found interesting and explain why they find it interesting.

I found that designing good questions to test comprehension was a challenge. I altered questions that were too easy or too misleading to better elucidate the principles the question was attempting to address. I incorporated misconceptions that last year's preflight questions revealed into this year's ConcepTests. I also improved the questions I used for the preflight web pages. For example, last year I asked, "Why don't low mass stars explode?" I hoped to get at a functional understanding of supernovae by eliciting an answer like "because their mass is not enough to induce the pressure necessary to fuse atoms of iron in their cores." Instead I received answers like "because they don't have enough mass." Although it's possible that the restatement of the question is an attempt to express sarcasm, clearly the question was worded poorly. I believe my revisions improved the exam. It was much easier to grade this year. The vast majority of answers were clearly right or wrong – I was giving much less partial credit, and the partial credit I did assign was much more consistently distributed. I didn't notice any examples where the intent of question was unclear to a large number of students.

When I first wrote my syllabus for this course, I thought it would be best to make it as simple as possible. I imagined simplicity would translate to clarity. As the course progressed, I realized that the syllabus failed to address all the students' concerns about the course. I clarified and corrected issues as they came up via email messages that I distributed to the students. I have incorporated these clarifications into the syllabus. For example, I required three published sources in the bibliography for their final papers, but I failed to specify that the required text for the course could not count as one of the three. Several students did not read the calendar closely and assumed that the homework assignments were always due on the same day of the week. I have therefore included an explicit warning against this assumption.

The most significant change to the syllabus is the inclusion of a rubric. I had not heard of rubrics before I started teaching this course, and I was dreading grading the papers, because I did not see a way to assign grades that was not hopelessly subjective. A friend who was completing a teaching degree last Spring told me about rubrics, and I decided to try to implement one in the class. I am very excited about the effectiveness of this technique. Two students queried me as to the justification for my grade of their paper, and when I walked them through the exact algorithm I used to determine it, they were satisfied that the grade was fair.

The main problem with the rubric was that I learned of it so late in the course, I was not able to effectively integrate it into my preparations for their paper. Although I certainly gave them all a copy before the paper was due, it was less than a week before the deadline, and there were still several students who did not grasp the priorities of the paper. One student simply wrote a three-page description of the different types of stars. It was important to me, as stated in the rubric, that the paper present an argument, and a list of definitions is not sufficient. I hope to avoid that kind of misunderstanding this year by making the rubric clear from the start and reiterating the requirements several times before the paper is due. I believe this was successful. I did not have the problem of inappropriate formats again this year.

Because of my work in Physics 465 (Section 4.1), I decided to offer the opportunity for students familiar with LaTeX to submit their papers electronically via the web. This was a huge mistake. Students who had absolutely no idea what LaTeX is tried to paste plaintext into the web form, and then they didn't know how to interpret the error messages they were receiving. They concluded they had successfully submitted their papers, whereas I had no idea they had even tried, because I only looked for PDF files. They were then surprised to hear that they received zero credit. Some other students figured out how to use the template file I provided, but did not know how to write formatting instructions or even insert paragraph breaks. I will never do this again for an intro/survey course. It worked well for Physics 465, because there was time for a learning curve, but for a one-time paper as with Physics 105, it is not worth the hassle.

I was also surprised to learn that some students do not read their teachers' emails carefully. After the papers were submitted, I distributed an email with some general comments, and for those students for whom I had received no submission, I added a postscript, that pointed out that I had received no paper from them. Several students told me weeks later they didn't know I hadn't received their attempted submission. Although I think it is ultimately their responsibility to make sure their submission is successful, if I am going to send out confirmation notices, I should send them in separate emails, so that the warnings are not mixed in with many other unrelated comments.

If I were going to teach this course again, I would want to drastically change the format. Instead of a lecture, I would want to make it more like a group discussion/experimentation class. I would keep the "Just in Time Teaching" approach to the text, but for the in class time I would do things like give each of them a demonstration to experiment with, and challenge them to find its relevance to the material. We could meet again at the end and discuss what they found. I would try to draw out their own reactions to what they were reading, and see what questions the cosmology was inspiring. With 30-60 students, there are more productive ways I could engage them than a lecture.

Chapter 5

Goals

In the short term, I intend to ask faculty colleagues at the University of Michigan to observe me in teaching next term, to get feedback and suggestions from experienced teachers in addition to the student evaluations. I hope to use my experiences with the discussions in Physics 465 to improve my own work in shepherding the discussion sections of Physics 140. I hope to improve the questions I pose to the students in class, and spend more time discussing them.

In the long term, I want to work on my skills as a teacher of problem-solving methods for core curriculum classes. Before the Fall term of 2004, the only standard class I have taught was as a graduate student in the Spring semester of 1997, when I taught two recitation sections of a large introductary course in Electricity and Magnetism. I found that the way the course was structured and graded worked against the faculty's stated goals for the course. Students who plugged numbers into formulae, but showed no indication that they knew what the formulae meant, received full credit, while students who clearly expressed their thought processes were penalized, because their mistakes were easy for the grader to identify. I want to develop a curriculum and grading plan that penalizes "plug-and-chug" approches to physics, but encourages deep thinking and clear expression. I have been trying to implement these goals as I teach Physics 140.

Although it is important for science classes to teach problem-solving skills, it seems to me that there is an important aspect to science that traditional classes to not inculcate well. In my experience, one of the gifts of being a scientist is the ability to *ask* questions, not just answer them. In real life, the problems are very rarely posed to us (and even more rarely do they come with an answer in the back of the book). And yet the vast majority of our curricula do not teach the skill of how to ask useful questions. I would like to work on a science curriculum that encourages the asking of questions as well as answering them.

I would also like to try to incorporate discussion and critical thinking skills into physics classes by including analysis of classic and current texts. A mechanics class might also read Galileo's *Concerning the Two Chief World Systems*, or a Cosmology course could examine the disappearance and reappearance of Einstein's Cosmological Constant from the literature. Exposure to these historical controverses could demonstrate the importance of asking questions and the danger in simply accepting established views. Also, I believe sincerely seeking the students' opinions will make them feel more valued and more empowered to continue their own investigations.

I intend to make myself more aware of the work being done by researchers in the field of science education. There is no need to reinvent the wheel when many people are devoting their lives to improving the combustion engine. I need to catch up to their work before I can make my own unique contributions. I intend to apply to attend the New Faculty Workshop, a short workshop run by the APS, the AAS, and the AAPT each Fall. This workshop is meant to be a whirlwind introduction to some excellent, practical, and field-tested teaching methods, which I believe will widen my teaching horizons and bring me into contact with a wide variety of people who are passionate about teaching.

Appendix A

Curriculum Vitae

Donald A. Smith

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Career Summary

Fifteen years' experience in astrophysics instrumentation, operations and research in X-ray, optical and radio wavelength bands, as well as high energy particle studies. Instructional experience in both classroom and small group settings, as well as outreach activities to the interested public. Enjoy computer programming and networking: computational, aesthetic, and interactive aspects.

Education

Massachusetts Institute of Technology — Cambridge, MA
Ph.D. degree in Physics, September 1999.
Thesis advisor: Prof. Hale V. Bradt
Title of thesis: "Observations of X-ray Counterparts to Gamma-ray Bursts in RXTE's All-Sky Monitor"

University of Chicago — Chicago, IL
Bachelor of Arts degree in Physics, June 1992.

Teaching Experience

U. of Mich., Dept. of Physics — Ann Arbor, MI

Aug 2004 – May 2005 **Lecturer II**
Taught introductary physics classes. Fostered active learning by encouraging group problem-solving in small discussion sections.

Aug 2001 – Sep 2004 **Post-doctoral Fellow**
NSF Post-doctoral Fellowship for Research and Education in Astronomy and Astrophysics
Taught cosmology for a general audience as well as the senior writing seminar for physics majors. Developed engaging and dynamic approach, applying Peer Instruction and web-based interaction techniques. Wrote a planetarium show for the Exhibit Museum and engaged in outreach activities.

M.I.T., Department of Physics — Cambridge, MA
Teaching Assistant
Fall 1998, Spr 2000 Twice led a hands-on weekly undergraduate astronomy seminar. Topics included orientation to the sky, telescope use, astrophotography and CCD imaging.

Feb 1997 – May 1997 Taught two sections of a larger introductory course in electricity and magnetism. Wrote and graded weekly quizzes. Developed web-based computer tools and animations to help demonstrate physical principles.

Research Experience

U. of Mich., Dept. of Physics Ann Arbor, MI

Post-doctoral Fellow & Lecturer

Aug 2001 – Aug 2004 *NSF Post-doctoral Fellowship for Research and Education in Astronomy and Astrophysics*

Installed ROTSE-III telescopes around the world. Carried out research on early optical behavior of Gamma-Ray Bursts, discovering a new class of light curve profile, perhaps indicative of local absorption. Studied variable stars and optical emission from X-ray Binaries with undergraduate assistant.

Post-doctoral Associate

Sep 2000 – Jul 2001 *ROTSE*

Proposed and carried out research in the study of X-ray binaries and Gamma-Ray Bursts. Developed software and hardware for a world-wide network of fast-response small automated optical telescopes.

M.I.T., Center for Space Research Cambridge, MA

Post-doctoral Associate

Aug 1999 – Jul 2000 *The Rossi X-Ray Timing Explorer*

Carried out research programs in X-ray Astrophysics. Tracked the health and behavior of the All-Sky Monitor and developed programs to improve its efficiency.

M.I.T., Center for Space Research Cambridge, MA

Research Assistant

Aug 1993 – Aug 1999 *The Rossi X-Ray Timing Explorer*

Performed pre-flight testing and calibration of the All-Sky Monitor (ASM). Performed in-flight calibration, monitored detector health, and developed data analysis software. Proposed and conducted investigations in high-energy astrophysics. Developed networking software to parse the real-time ASM observations and report new discoveries, enabling rapid multi-wavelength follow-up observations. Discovered two microquasars and an unusual nova-like event. Proposed and carried out observations of ASM-detected GRBs with the Very Large Array and the Australian Telescope Compact Array.

Max Planck Institute for Extraterrestrial Physics Garching, Germany

Research Assistant

Oct 1992 - Jun 1993 Analyzed observations of the Galactic Center taken with the X-ray satellite *ROSAT*. Discovered X-ray emission from the synchrotron nebula "the Mouse", confirming its nature as the bow shock from a runaway neutron star.

Enrico Fermi Institute, Laboratory for Astrophysics and Space Research

Junior Research Assistant Chicago, IL

Oct 1990 - Jul 1992 *The Ulysses Satellite*

Programmed systems and analyzed data for the High Energy Telescope, part of the Cosmic Ray and Solar Particle Investigation. Studied the propagation of electrons from Jupiter's Magnetosphere through the interplanetary medium.

Enrico Fermi Institute, High Energy Physics Chicago, IL

Junior Technical Research Assistant

Oct 1989 – Sep 1990 *The Chicago Air Shower Array*

Built, tested, and assembled a large array of cosmic-ray scintillator detectors.

Outreach

Saturday Morning Physics: Fall 2001 – held three public lectures on X-ray astronomy that drew more than 250 people each week.

Metropolitan Methodist Church: Detroit, Summer 2001/2002 – gave two lectures on cosmology and Gamma-Ray Bursts to senior citizens' group.

Public Lecture: Raleigh Astronomy Club, Raleigh, North Carolina, 24 September 2004.

Invited Presentations

"ROTSE-III and the AEOS Burst Camera: Rapid Follow-up to *Swift* Alerts", oral presentation, *Swift* Workshop, HEAD Meeting, September 2004.

"Optical Precursors to Microquasar Outbursts", oral presentation, International ROTSE Collaboration Meeting, August, 2004.

"The AEOS Burst Camera", oral presentation to a National Academy of Sciences review panel, Kihei, Maui, May 2004.

"Chasing the Earliest Light from Gamma-Ray Bursts: The World-Wide ROTSE-III Network", NSF Post-doctoral Fellow Symposium, Atlanta, GA, January 2004

"Tracking Celestial Explosions: The World-Wide ROTSE-III Network", AAS Meeting, Albuquerque, NM, June 2002

Max-Planck-Institut für Kernphysik: Heidelberg, May 2002 – "The ROTSE-III Telescope System: Chasing Celestial Explosions."

"Gamma-ray Bursts in the All-Sky Monitor on RXTE", AAS Meeting, San Diego, CA, June 1998

Conference Presentations

"Recent Results and Future Prospects for the ROTSE-III Global Telescope Array", poster presentation, AAS Meeting, New Orleans, LA, September 2004

"The Early Optical Afterglow of GRB 030418 and Progenitor Mass Loss", oral presentation, AAS Meeting, Atlanta, GA, January 2004

"The World-Wide Network of ROTSE-III Telescopes", poster presentation, AAS Meeting, Nashville, TN, June 2003

"ROTSE-III Observations of GRB 030329", poster presentation with press conference, AAS Meeting, Nashville, TN, June 2003

"The ROTSE-IIIa Telescope System", poster presentation, "Gamma-Ray Burst and Afterglow Astronomy 2001: A Workshop Celebrating the First Year of the HETE Mission", Woods Hole, MA, November 2001

"Duration as a Function of Energy for Seven GRBs Observed with the RXTE All-Sky Monitor", poster presentation, AAS - High Energy Astrophysics Division Meeting, Honolulu, HI, November, 2000

"ASM Light Curves for Two Gamma-Ray Bursts", oral presentation, Rossi2000 Meeting, Greenbelt, MD, March 2000.

"Spectral and Intensity Evolution of the Rapidly Variable X-ray Nova V4641 Sgr", poster presentation with press conference, American Astronomical Society Meeting, Atlanta, GA, January 2000

"*RXTE* All-Sky Monitor Localization of SGR 1627–41", poster presentation, AAS Meeting, Chicago, IL, June 1999

"Localizations of Gamma-Ray Bursts by the All-Sky Monitor on RXTE", poster presentation, AAS Meeting, Austin, TX, January 1999

"RXTE ASM observations of BATSE Gamma-ray Bursts", poster presentation, AAS - High Energy Astrophysics Division Meeting, Estes Park, CO, November, 1997

"Gamma-ray Bursts in the All-Sky Monitor on RXTE", oral presentation, 4th Huntsville Symposium on Gamma-Ray Bursts, Huntsville, AL, September 1997

"RXTE ASM and IPN Precise Position of BATSE Burst 5428", poster presentation, AAS Meeting, Winston-Salem, NC, June 1997

"Detection of 1.91 ms Pulsations During a Burst from KS 1731-260", poster presentation, AAS Meeting, Toronto, January 1997

"X-Ray Light Curves from the RXTE All-Sky Monitor", poster presentation, AAS - High Energy Astrophysics Division Meeting, San Diego, CA, May 1996

Computer Skills

Proficient with UNIX/X11, Linux, Windows, and Macintosh operating systems.
Proficient with LaTeX, PERL, C, HTML, JavaScript and CGI programming.
Proficient with packages FTOOLS, IDL, and others.
Experienced with BASIC, FORTRAN, and PASCAL.
Familiar with C++ and Java.

Languages

Fluent in German

Honors and Awards

1986-7 – Congress-Bundestag Exchange Scholarship for one year of study in Germany.
1992-4 – Beinicke Memorial Scholarship. $32,000 for two years at any graduate institution.
1992 – Student Marshals, Maroon Key Society.
2001-4 – NSF Fellowship: 3 years at $55,000/yr.

Community Activities

2002-4 – Volunteer Co-coordinator for Friends' General Conference High School Program. Organized week-long retreat for 150 teenagers. Managed 15-person staff.
2001– Volunteered as lighting and sound technician at The Ark, a non-profit music venue.
1989– Theatrical technical work, amateur and (non-profit) professional.
Positions included master electrician, lighting designer and director.
Winner "Best Lighting Design", Ann Arbor Civic Theater '02-'03 and '03-'04 seasons.
Served on AACT Play Selection Committee for 2004-2005 season.
1994–2002 New England Yearly Meeting Youth Education volunteer. Organized, with a team, retreats for high school students. Planned programs, managed small groups and led discussions.
2001–2003 Founded and led a monthly film discussion group, modeled on the Great Books Foundation's "shared inquiry" discussion format.
1999–2000 Served as volunteer President of non-profit corporation to manage and maintain the Beacon Hill Friends House as intentional community and Quaker center.

Memberships

Phi Beta Kappa, 1992
American Astronomical Society, 1997
Sigma Xi, 2000

Publications

Rykoff, E., *et al.*, "Discovery of CVs ROTSE3 J151453.6+020934.2 and ROTSE3 J221519.8-003257.2", *IBVS*, No. 5559, 2004.

Pedersen, K., *et al.*, "Multi-wavelength Studies of the Optically Dark Gamma-Ray Burst 001025A", *Astrop. J.*, *submitted*, 2004.

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Rykoff, E., *et al.*, "The Early Optical Afterglow of GRB 030418 and Progenitor Mass Loss", *Astrop. J.*, **601**, 1013, 2004.

Smith, D., *et al.*, "ROTSE-III Observations of the Early Afterglow From GRB 030329", *Astrop. J. Lett.*, **596**, p. L151, 2003.

Woods, P., *et al.*, "The 2001 April Burst Activation of SGR 1900+14: Pulse Properties and Torque", **596**, 464, 2003.

Smith, D. A., *et al.*, "The ROTSE-IIIa Telescope System", Proceedings of "Gamma-Ray Burst and Afterglow Astronomy 2001: A Workshop Celebrating the First Year of the HETE Mission", American Institute of Physics Conference Series, **662**, 514, 2003.

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Akerlof, C., *et al.*, "The ROTSE-III Robotic Telescope System", *PASP*, **15**, 803, 132, 2003.

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Kehoe, R., *et al.*, "An Untriggered Search for Brief Optical Bursts", *Astrop. J.*, **577**, 845, 2002.

Smith, D. A., *et al.*, "X-Ray Light Curves of Gamma-ray Bursts Detected with the All-Sky Monitor on *RXTE*", *Astrop. J. Supp.*, **141**, 415, 2002.

Smith, D. A., *et al.*, "Discovery of the CV ROTSE3 J015118.59-022300.1", *IBVS* No. 2556, 2002.

Bradt, H., Levine, A., Marshall, F., Remillard, R., Smith, D., & Takeshima, T., "Observations of Gamma-ray Bursts with the Rossi X-ray Timing Explorer", Proceedings Of The Joint CNR/ESO Meeting, "Gamma-Ray Bursts in the Afterglow Era: 2nd Workshop", F. Frontera, E. Costa, & J. Hjorth (eds.), Springer Verlag (astro-ph/0108004).

Wren, J., *et al.*, "Observations of the Optical Counterpart to XTE J1118+480 during Outburst by the Robotic Optical Transient Search Experiment I Telescope", *Astrop. J. Lett.*, **557**, L97, 2001.

Kehoe, R., *et al.*, "A Search for Early Optical Emission from Short and Long Duration Gamma-ray Bursts", *Astrop. J. Lett.*, **554**, L159, 2001.

Woods, P., *et al.*, "Evidence for a Sudden Magnetic Field Reconfiguration in SGR 1900+14", *Astrop. J.*, **552**, 748, 2001.

Smette, A., *et al.*, "HST/STIS observations of GRB000301C: CCD imaging and NUV MAMA spectroscopy", *Astrop. J.*, **555**, 2001.

Hjellming, R., *et al.*, "Light Curves and Radio Structure of the 1999 September Transient Event in V4641 Sagittarii (=XTE J1819–254=SAX J1819.3–2525)", *Astrop. J.*, **544**, 977, 2000.

Bradt, H., Levine, A., Remillard, R., & Smith, D., "X-ray Transients Monitored by the All-Sky Monitor on *RXTE*: A Tabulation", in "X-ray Astronomy '99; Stellar Endpoints, AGN and the Diffuse Background", G. Malaguti, G. Palumbo, & N. White (eds.), pub. Gordon and Breach, 2000 (astro-ph/0003438).

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Bradt, H. V., & Smith, D. A., “Gamma-ray Burst Positions from the ASM on *RXTE*”, *Astron. & Astrop. Supp. Ser.*, **138**, 423, 1999.

Smith, D. A., Bradt, H. V., & Levine, A. M., “*RXTE* All-Sky Monitor Localization of SGR 1627–41”, *Astrop. J.*, **519**, L147, 1999.

Vreeswijk, V. M., *et al.*, “The X-ray, Optical and Infrared Counterpart to GRB 980703”, *Astrop. J.*, **523**, 171, 1999.

Smith, D. A., *et al.*, “Gamma-Ray Bursts in the All-Sky Monitor on *RXTE*”, in *Gamma-Ray Bursts: 4th Huntsville Symposium*, eds. Meegan, C., Preece, R., & Koshut, T., p. 430, 1998.

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Corbet, R., Peele, A., & Smith, D. A., IAUC 6632
The detection of a 37 d period from X2127+119.

Smith, D. A., *et al.*, IAUC 6718. The ASM localization of GRB 970815.

Smith, D. A., *et al.*, IAUC 6728. A refined position of GRB 970828.

Kippen, R. M., *et al.*, IAUC 6789. Observations of GRB 971214.

Smith, D. A., *et al.*, IAUC 6855. The ASM discovery of XTE J0412+560.

Smith, D. A., Levine, A., & Wood, A., IAUC 6932
The ASM discovery of XTE J1748-288.

Smith, D. A., Levine, A., & Muno, M., GCN Circ 126
The ASM localization of GRB 980703.

Fox, D., *et al.*, ATEL 32. The ASM detects a new Rapid Burster outburst.

Remillard, R., Smith, D. A. & Levine, A., IAUC 7002
The ASM detects an X-ray flare most likely from SGR1900+14.

Smith, D. A., IAUC 7008
The ASM discovers new black hole candidate transient XTE J1550-564.

Smith, D. A. & Takeshima, T., IAUC 7014
The ASM discovers reemergence of 3A 1942+274, revealed to be a 16-s pulsar.

Rutledge, R., Fox, D., & Smith, D. A., ATEL 37
The ASM reveals that XTE J1550-564 flared up to 6.8 Crab.

Smith, D. A., GCN Circ 159. The ASM localization of GRB 981220

Hurley, K., *et al.*, GCN Circ 160
The IPN Annulus intersects the ASM error box for GRB 981220.

Smith, D. A., *et al.*, GCN Circ 275
ASM/IPN error box for GRB 990308 (BATSE No. 7457).

Smith, D. A., Levine, A., & Morgan, E., IAUC 7253
Discovery of X-ray Flare from V4641 Sgr.
Wood, A., Smith, D. A., Marshall, F., & Swank, J., IAUC 7274
Discovery of New X-ray Transient XTE J1859+226.
Corbet, R. & Smith, D. A., GCN Circ 506
ASM Detection of Early Afterglow from GRB 991216.
Smith, D. A., Hurley, K., & Cline, T., GCN Circ. 568
GRB000301C: RXTE/ASM and IPN localizations.
Remillard, R., Morgan, E., Smith, D. A., & Smith, E., IAUC 7389
Discovery of X-ray Nova XTE J1118+480.
Smith, D. A., Levine, A., Hurley, K., & Barthelmy, S., GCN Circ. 665
ASM/IPN localizations of GRB000508B.
Smith, D. A., Levine, A., Remillard, R., Hurley, K., & Cline, T., GCN Circ. 861
ASM/IPN localizations of GRB001025.
Hurley, K., & Smith, D. A., GCN Circ. 921
ASM/IPN localizations of GRB010126.
Akerlof, C., McKay, T., Rykoff, E., & Smith, D., GCN Circ. 1115
GRB011019: ROTSE-III optical observations.
Woods, P., *et al.*, GCN Circ. 1256
RXTE observations of Sgr 1900+14.
Smith, D. & Levine, A., GCN Circ. 1332
GRB020406: RXTE/ASM detection.
Smith, D. & Remillard, R., GCN Circ. 1341
GRB020406: RXTE/ASM refined position.
Remillard, R. & Smith, D., IAUC 7880
Discovery of fast X-ray transient XTE J1901+014
Rykoff, E., & Smith, D., GCN Circ. 1480
Early Time Limits for GRB020813
Smith, D. A., & Remillard, R., ATEL 129 & 130
X-ray Detection of Solar Flare Reflected off of the Moon
Smith, D., & Rykoff, E., GCN Circ. 1952
GRB 030323, ROTSE-III detection of possible optical counterpart
Rykoff, E., & Smith, D., GCN Circ. 1958
GRB 030324, Optical Observations
Rykoff, E., & Smith, D., GCN Circ. 1995
GRB 030329: Optical Afterglow Observations
Smith, D., GCN Circ. 2019
GRB 030329: ROTSE network observes steepening of decay curve
Smith, D., Rykoff, E., & McKay, T., GCN Circ. 2153
ROTSE-III prompt optical detections of GRB 030418
Smith, D., GCN Circ. 2178
GRB 030429: ROTSE-III observations
Smith, D., & Quimby, R., GCN Circ. 2318
XRF 030723, ROTSE-III Early Observations
Smith, D., Akerlof, C., & Quimby, R., GCN Circ. 2338
XRF 030723: Re-analysis of ROTSE-III early images
Rykoff, E., & Smith, D., GCN Circ. 2395
GRB 030913: ROTSE-3c Optical Observations
Remillard, R., Levine, A., Lin, D. & Smith, D., ATEL 204
New X-ray Transient XTE J1748-361
Smith, D. A., GCN Circ. 2595
GRB 040511: ROTSE-III Rapid Optical Upper Limits

Smith, D. A., Yost, S. A., & Rykoff, E. S., GCN Circ. 2692
ROTSE-III Rapid Response to possible GRB 040903
Yost, S. A., Smith, D. A., Rykoff, E. S., & Swan, H., GCN Circ. 2776
ROTSE-IIIa Observations of GRB 041006

Appendix B

Saturday Morning Physics

The University of Michigan sponsors a public outreach program throughout the school year, consisting of open lectures on various aspects of physics. Each Fall three post-doctoral scientists are invited to present three lectures each on any subject they desire. In the Spring, faculty members talk. From two to three hundred people attend, arriving as early as nine-thirty in the morning to ensure a good seat. Although audience members tend to be scientifically literate, their ages range from eight to eighty, with similar diversity in background. Giving a Saturday Morning Physics lecture is therefore a fascinating challenge to bring the complexity of modern physics to a general audience.

I was invited to speak in the fall of 2001. I decided to talk on the general subject of X-ray Astrophysics. I broke the topic into three subjects. My first lecture, *X-ray Vision*, explained what X-rays are, how we observe them, and what kinds of celestial phenomena we study with them. Next, I explained the origin of compact objects by describing *How Stars Die*. Finally, I explored the diversity of behavior in X-ray binary systems in a Halloween talk entitled *Why Neutron Stars Make Bad Neighbors*.

Audience reception was enthusiastic, with people staying up to forty-five minutes after the talk to ask questions. Attendance levels also increased with each talk. One older gentleman approached me before my second talk and shared with me that he had been attending these public lectures since their inception eight years previously. He felt that *X-ray Vision* was the best talk he'd seen in the series.

These talks were recorded and continue to be regularly broadcast on the University's educational cable channel. I obtained video copies of these recordings and converted them into DVD format. A copy of this DVD should be attached to the inside front cover of this binder. The video was compiled and edited by University Audio-visual staff without consulting me, and I disagree with some of their editing choices. Some things they cut for time hurt the pedagogy of my explanations. They also had to cut, for copyright reasons, a movie clip from *Armageddon* that I used for a demonstration. The video from the third talk suffered from technical problems that degraded the image and sound quality. I feel the video for the second talk comes closest to capturing the experience I felt in giving these talks.

Appendix C

Syllabi

Here I present the three syllabi for the courses I have taught as a Postdoctoral Fellow. Section C.1 describes my current work with Physics 465, the *Senior Writing Seminar*. Section C.2 presents the version of the syllabus I intend to use for teaching Physics 105, *Origin and Fate of Life, Stars, Galaxies, and the Universe*, this year, while section C.3 is the syllabus I used for the same course in Winter 2003. See Chapter 4 for a discussion of the changes to this syllabus.

C.1 Physics 465

Physics 465

Senior Writing Seminar – Winter 2004
Final Syllabus – December 21, 2004

Class Time: Fridays, 3-5 pm.
Class location: 3442 Mason Hall
Class web page: `http://www.rotse.net/P465/`
Instructor: Dr. Donald A. Smith
Office: 3215 Randall Laboratory
Office Hours: Monday 11–12, Wednesday, 2:30–3:30 pm
Phone: 763-0457 – Email: `donaldas@umich.edu`
Recommended Texts:
Robert A. Day, *How to Write and Publish a Scientific Paper*, 5th Edition
William Strunk Jr., *et al.*, *Elements of Style*, 4th Edition
Peter J. Feibelman, *A PhD is Not Enough: A Guide to Survival in Science*

C.1.1 Course Overview

This course is intended to sharpen your skills at written and oral communication of scientific information. You will be required to give two oral presentations with the aid of "Power Point" or equivalent software. The course will also include several writing assignments of varying length and complexity. You will need to learn how to use the LaTeX software package, if you are not already familiar with this program.

Class sessions will be interactive, so attendance is imperative! Also, because the class will be small and because students will share both written and oral contributions, the class will be more intimate than a typical physics class. Being critiqued may be intimidating at times, but it is a necessary part of the learning process. Better to be criticized here than in that important job presentation!

You will be expected to attend a scientific colloquium every week. The Physics Colloquium is on Wednesday from 4–5:15 pm in 340 W. Hall. Cookies and conversation are available across the hall in the Don Meyers Commons room at 3:45 pm. In each class period we will examine these colloquia as examples of good (and bad) practice, in order to improve our own communications skills. We will use a "russian roulette" method to determine who will lead the analysis of each week's colloquium.

Written assignments are due by 8 pm on the Tuesday evening prior to the class. You will paste your raw LaTeX file into a form on the course web page, and the server will convert it into a PDF file that other class members can download. This will allow everyone to read the assignments in time for discussion on Friday. The web site will be password-protected for the students' privacy. Once papers have been critiqued in class, they may be rewritten and resubmitted. The most recent version of a paper submitted by 8 pm on the Wednesday following the class in which it was critiqued will be graded. Papers not submitted by the pre-class deadline will not be considered after the class. The final grade will be based on the combination of written and oral reports and participation in class sessions.

There will be at least one field trip during the semester, details of which will be provided after final arrangements are made.

C.1.2 Course Syllabus

1. **Week 1** – Course orientation. How to write a CV/resume. Short self-presentations. Introduction to LaTeX.
2. **Week 2** – Start Russian Roulette. Sharing resumes. How to do a PowerPoint presentation.
3. **Week 3** – Hand in mini-proposal. Mock job interviews. How to write a scientific paper.
4. **Weeks 4–13** – Russian Roulette. Oral presentations. Critique written papers.

The following table summarizes the assignments for weeks 4–13. Each week one group of four students (labelled A, B, C, or D) will present oral reports, and another group will be responsible for handing in a written report. Each individual student's reports (written and oral) in a given four-week interval will cover the same material. For weeks 4–7, the students will read a "popular science" article or book of their choice and write an abstract of that article. For weeks 8–13, the students will select and read an article from a referreed scientific journal, and write a four page report. Oral presentations will be 12 minutes long for the first report and 20 minutes for the second. Given the time constraints of the class session, only three people will present each week for the second presentation, except for the last week, when there will be only one presentation. Similarly, only three written presentations will be submitted each of those weeks. You will be assigned to a letter group, although you may switch with another student, if both parties agree.

Week	Written	Oral
4	A	D
5	B	C
6	D	A
7	C	B
8–9	D	A
9–10	C	B
10–11	A	D
12–13	B	C

One week's class will be supplanted by a day-long field trip. Most likely to Fermilab. Details TBD.

C.1.3 Russian Roulette

Each week you will be expected to attend the department colloquium on Wednesday afternoon. At the start of class period on Friday (beginning the second week, then continuing from week four), one student will be chosen at random from the class, and that student must give a brief presentation of a critique of the colloquium speaker. This is a very informal presentation, with no visual aides necessary (although you may write on the board if you wish). The presentation should address at least these three questions: what was the speaker's primary message? Where was he or she most effective in conveying that message? What were his or her weaknesses? The presenter should feel free to involve the rest of the class via discussion questions or requests for alternate perspectives. Each presenter's name is excluded from the next week's draw. This section of class time will last no more than 15 minutes.

C.1.4 The Presentations

The bulk of what you gain from this course will be from the critiquing you receive on your written and oral presentations. Although the final grade for each assignment will be given by me, you will be expected to provide a careful and constructive assessment of your classmates' contributions. You will need to write a "mini-proposal" that outlines your choice of topic and how each presentation will develop your theme (due week three). Although each assignment builds on the previous ones, you should not refer back to your own prior work – presentations should be independent.

For each of the two primary assignments, you will give a written and oral presentation of the same material. You do not need to bring a laptop for the oral presentation (although you certainly can), but you should bring your PowerPoint file on a pre-approved device (such as CD-ROM or USB card).

The written presentations must be in LaTeXformat. On the course web page, there is a form into which you can paste your complete text file, and the server will process it into a PDF file that can be downloaded by the rest of the class. Please read your classmates' submissions by class on Friday each week, and we will spend roughly 30 minutes each week discussing our impressions of what we read. I can't guarantee that every paper will get attention each week, as time is against us.

C.1.5 Popular Science

For your first presentation, you will select a piece of "popular science" writing and explain it to the class. Your oral presentation should address the following questions: what is the topic of the paper? What are the strengths and weaknesses of the authors' presentation of the material? Why is this material interesting, important, or relevant? The oral presentation will not be allowed to exceed twelve minutes.

For your written presentation, you should write an abstract for the piece you have chosen. This abstract should not exceed 400 words.

C.1.6 Refereed Journal

For your second assignment, you should find a recent article in a refereed journal that represents a significant contribution to the topic discussed in the piece of writing you used for your first assignment. Your presentation should address the following questions: what did the authors do? How well did they present their results? What are the implications of their work within their field of study? What would *you* do to take the work to the next level?

The written presentation should not exceed four pages. The oral presentation will not be allowed to exceed 20 minutes.

C.1.7 A Rubric

A popular tool for evaluating papers is a rubric. Within a rubric, the goals of the assignment are broken down into a list of criteria by which the submission will be evaluated. These criteria are weighted by how important they are to the evaluator (i.e. how important is proper spelling *quantitatively*?). Then the submission is rated by how well it succeeds within that criterion, and that rating is scaled by the weighting of the criteria. The result is a much less subjective way of grading papers than just professorial whim. On the next page you'll find a sample rubric for a standard "three paragraph essay" that I provide as a guide you could use for examining your colleagues' papers. What kind of rubric would *you* write?

C.1.8 Grading

The grade breakdown for the course is based on performance in the following assignments: Resume (5%, based on clarity, effectiveness, and efficiency), Mini-proposal (5%, no partial credit – simply done or not done), Oral 1 (15%), Oral 2 (30%), Written 1 (15%), and Written 2 (30%).

A Rubric for the Second Presentation

Topic and Score	Description
Clarity of Language (5 pts)	
4	Paper is powerfully written. English is used effectively.
3	Sentence structure is clear with few mistakes
2	Sentence structure has several mistakes, words sometimes misused, meaning is occasionally unclear.
1	Many serious grammatical errors. Meaning is often unclear. Bad spelling.
Organization of Ideas (10 pts)	
4	Whole is well organized with good transitions. Paragraphs fully developed.
3	Fairly well organized. Transitions and/or intro or conclusion need work.
2	Lacks paragraph development, transitions, introduction or conclusion
1	Lacks coherent structure. Serious paragraphing and/or transition problems. Weak or absent intro or conclusion.
Elaboration of Ideas (15 pts)	
4	Student defines and develops ideas in own words. Paper abounds with useful examples, insightful connections, and higher level thinking. Lines of logic are clear and well-supported.
3	Student discusses ideas in meaningful way, occasional insights. Many ideas need to be more fully defined and developed. Steps in presentation are occasionally unclear.
2	Ideas are presented in basic and superficial, but correct, manner. There are few insights. Flow of argument is often vague and hard to follow.
1	Ideas are inadequately discussed. Many factual and interpretive errors. No logical flow to the presentation.

C.2 Physics 105

PHYSICS 105: Winter 2004
Dr. Don Smith
3215 Randall; 763 – 0547; donaldas@umich.edu
Office Hours: Monday 11–12, Wednesday 2:30–3:30
Course meets: Tu/Th 11–12, Dennison 182
Course web page: `http://www.rotse.net/P105/`

TEXTBOOK: *THE FIVE AGES OF THE UNIVERSE: Inside the physics of eternity*, F. Adams and G. Laughlin (The Free Press, New York, 1999).

C.2.1 Course Schedule

Reading assignments from text in square [] brackets; must be completed by the day indicated. Please note that these assignments are **NOT** always on the same day of the week. Lectures will cover material you have already read about.

Th 4 Mar.		Introduction - the Big Bang scenario, large numbers, cosmological decades, into the future, the five ages of the universe.
Tu 9 Mar.	[*Introduction*]	Tools for discussion: the Four Forces of Nature, the fight between gravity and entropy, the types of particles.
Th 11 Mar.	[*Chapter 1*]	Primordial Era I : The expanding universe, matter formation, nucleosynthesis, recombination and the cosmic microwave background radiation.
Tu 16 Mar.		Primordial Era II : The flatness and horizon problems, curved space, vacuum energy density, inflation.
Th 18 Mar.	[*Chapter 2*]	Stelliferous Era I : Galaxy formation, dark matter, star and planet formation.
Tu 23 Mar.		Stelliferous Era II : Stellar evolution and death.
Th 25 Mar.	[*Chapter 3*]	Degenerate Era I : Stellar remnants, degeneracy pressure.
Tu 30 Mar.		Degenerate Era II : collision & relaxation of galaxies, collision of remnants, proton decay.
Th 1 Apr.	[*Chapter 4*]	General Relativity : equivalence principle, time dilation, curved space revisited, black holes.
Tu 6 Apr.		Types of Black Holes, black hole temperature, accretion, gravitational radiation, Hawking Evaporation
Th 8 Apr.	[*Chapter 5*]	The Dark Era : heat death, positronium, annihilation, and cooling through expansion.
Tu 13 Apr.	Exam	
Th 15 Apr.	[*Conclusion*]	Concluding comments and final questions.

Grading: The grade for this course will be based on four contributions:
[1] The exam on Tuesday 13 April 2004 (50% of grade)
[2] A 1–2 page paper due on Friday 2 April 2004 (36% of grade)
[3] A small set of "preflight" questions associated with each reading assignment, which must be answered prior to 8 AM on the day the reading is due. The answers are to be entered via web forms available through the course web site. (10% of grade)
[4] Participation in in-class ConceptTests (4% of grade)

C.2.2 The Exam

The exam will be given during class time on Apr. 13. It will consist of approximately 15 short-answer questions very similar to those given in the preflights and during class sessions. It will be closed book and closed notes. No calculators will be necessary. You can download last year's exam from the course web page if you'd like to get an idea of what you might be expected to know.

C.2.3 The Paper

This course covers a vast amount of material (the whole history of the universe!), at the price of not doing anything in much depth. For your paper, you should pick one topic in your reading that either confused or intrigued you. Your paper should present what you understand about the topic, describe why you chose this topic, and explain what you would like to understand better. That is to say, what next step would you like to take to further your knowledge? Make sure you use your own words and do not copy phrasing from the book.

The paper is due April 2nd. This draft will be graded and returned to you by April 8th. You may then rewrite for a new grade. The rewrite is due April 16th. If you want to receive comments on your rewrite, you must submit a self-addressed, stamped envelope along with your paper. Hardcopy submissions of the paper should either be given to me in person or placed in my department mailbox on the second floor of Randall Laboratory. Electronic submissions will *ONLY* be accepted in LaTeX format via the course web page.

The paper will be graded according to the following rubric. The paper is worth 36 points, and each of three criteria will get a score from 0 to 4. That score is then scaled by how important the associated criterion is. Under each criterion is a description of what constitutes each score in that topic. So when I grade, I will look at each topic, and decide which description best matches your paper, and that's the score you'll get for that criterion. This score is then scaled by the overall weight of that criterion. So someone who gets a 2 in "Clarity of Language" would get 4 points contributed to their final score out of thirty-six. A 1 in "Organization of Ideas" is worth 3 points of the 36, a 3 in "Elaboration of Ideas" is worth 12, etc.

Topic and Score	Description
Clarity of Language (8 pts)	
4	Paper is powerfully written. English is used effectively.
3	Sentence structure is clear with few mistakes
2	Sentences have several mistakes, words are misused, and meaning is occasionally unclear.
1	Many serious grammatical errors. Meaning is often unclear. Bad spelling.
Organization of Ideas (12 pts)	
4	Whole is well organized with good transitions. Paragraphs fully developed.
3	Adequate organization. Transitions and/or intro or conclusion need work.
2	Lacks paragraph development, transitions, introduction or conclusion
1	Lacks coherent structure. Serious paragraphing and/or transition problems. Weak or absent intro or conclusion.
Elaboration of Ideas (16 pts)	
4	Defines and develops ideas in own words. Paper abounds with useful examples, insightful connections, and higher level thinking. Lines of logic are clear and well-supported. Physics are accurately presented.
3	Student discusses ideas in meaningful way, occasional insights. Many ideas need to be more fully defined and developed. Steps in presentation are occasionally unclear. Grasp of physical concepts is adequate.
2	Ideas are presented in basic and superficial, but correct, manner. There are few insights. Flow of argument is often vague and hard to follow.
1	Ideas are inadequately discussed. Many factual and interpretive errors. No logical flow to the presentation.

C.3 Physics 105

PHYSICS 105: Winter 2003
Dr. Don Smith
3215 Randall; 763 – 0547; donaldas@umich.edu
Office Hours: Monday 11–12, Wednesday 3–4
Course meets: Tu/Th 11–12, Dennison 182
Course web page: `http://www.rotse.net/P105/`

TEXTBOOK: *THE FIVE AGES OF THE UNIVERSE: Inside the physics of eternity*, F. Adams and G. Laughlin The Free Press, New York, 1999).

Course Schedule

Reading assignments from text in square [] brackets; must be completed by the day indicated.

Tu 4 Mar.		Introduction - the Big Bang scenario, large numbers, cosmological decades, into the future, the five ages of the universe.
Th 6 Mar.	[*Introduction*]	Tools for discussion: the Four Forces of Nature, the fight between gravity and entropy, the types of particles.
Tu 11 Mar.	[*Chapter 1*]	Primordial Era I : The expanding universe, matter formation, nucleosynthesis, recombination and the cosmic microwave background radiation.
Th 13 Mar.		Primordial Era II : The flatness and horizon problems, curved space, vacuum energy density, inflation.
Tu 18 Mar.	[*Chapter 2*]	Stelliferous Era I : Galaxy formation, dark matter, star and planet formation.
Th 20 Mar.		Stelliferous Era II : Stellar evolution and death.
Tu 25 Mar.	[*Chapter 3*]	Degenerate Era I : Stellar remnants, degeneracy pressure.
Th 27 Mar.		Degenerate Era II : collision & relaxation of galaxies, collision of remnants, proton decay.
Tu 1 Apr.	[*Chapter 4*]	General Relativity : equivalence principle, time dilation, curved space revisited, black holes.
Th 3 Apr.		Types of Black Holes, black hole temperature, accretion, gravitational radiation, Hawking Evaporation
Tu 8 Apr.		Midterm Exam
Th 10 Apr.	[*Chapter 5*]	The Dark Era : heat death, positronium, annihilation, and cooling through expansion.
Tu 15 Apr.	[*Conclusion*]	Concluding comments and final questions.

Grading: The grade for this course will be based on three contributions:
[**1**] The midterm exam on Tuesday 8 April 2002 (50% of grade)
[**2**] A 3–5 page paper due on Friday 18 April 2002 (40% of grade)
[**3**] A small set of "preflight" questions associated with each reading assignment, which must be answered prior to 8 AM on the day the reading is due. The answers are to be entered via web forms available through the course web site. (10% of grade)

Appendix D

Evaluations

D.1 Physics 140, Mid-term Fall 2004

D.1.1 How would you improve the discussion section for the rest of the term?

I would make copies of the worksheets for everyone in the group so we all can have a copy to work on, instead of one person taking over and writing everything. I don't know if this is possible, but I also feel it would be helpful if we were able to work through the problems before coming to class, so we could have the chance to work them out on our own. Then we would still have the opportunity to work out any questions we had with members of our group.

I don't learn well when there are just a million variables and equations on the board....I need to go through things step by step before writing down equations and i think that we should start with easy problems from the worksheet and build into more complicated ones.

I would rather have more presentation and less groupwork in the class - I don't find value in these worksheets because there's not enough time to do any of the problems and have them verified at the end of class. I would much rather have problems assigned in section from the book, and then go over them in the next class. I learn more by watching the instructor do the problems first, or having a lot of time to do them beforehand and then have the answer worked out in class.

D.1.2 What has been your favorite aspect of the discussion section so far?

It's hard to find favorites when you are talking about class...

The examples he gives in the beginning.

The group discussion at the end when we go over everything. Frankly, I try to prepare for discussion but have no idea what is really going on when I do the worksheet. I wish we would go over concepts more before we jump into worksheets.

Learning the concepts or seeing them applied with the stuff we learn in lecture.

D.1.3 What are the instructor's strengths?

Very knowledgeable.

No question to small for him.

He is very approachable and very willing to help; whether, it is in class or at office hours.

He is a genius, he is nice and personable, and he is always willing to help!!

Ability to use demonstrations to explain concepts.

Very clear and consistent in the way he teaches problems, goes thorugh and explains each step so there's no confusion.

D.1.4 What are the instructor's weaknesses?

Can sometimes go fastly through a problem.

Sometimes, I get lost in the variables and equations on the board, and sometimes he skips steps that I need to see written down in order to understand the problems.

D.2 Physics 465, Mid-term Winter 2004

D.2.1 Suggested Improvements on Poorly Rated Aspects of the Course

The syllabus would be more helpful if it listed the deadlines for all of the assignments in a table on one page. It's also not entirely clear from the syllabus what exactly you're looking for on each assignment. The whole upper-limit vs. recommended length for the abstract would have been a good thing to clarify earlier.

The interview session felt more like a plug for the Career Placement Center, and was not prepared to talk about issues of questions with respect to discrimination in interviews.

We really haven't done anything with the texts in class. But since they are for us to read on our own time, this really isn't a problem.

D.2.2 Suggested Changes for Second Half of Course

It seems fine

No changes – It's been a really good class so far. I've developed the most important thing – confidence in my physics knowledge among my peers.

A little more direction with regards to assignments right at the beginning would be nice.

Actually I don't mind how things are right now. There is no confusion as to what is going to happen in the class right now and every other week there is an assignment which doesn't stress us out for the class. No changes. Glad though that we got that new room or else I would probably singing a new tune.

D.2.3 Favorite Aspects of the Course

The interaction with the class.

Giving my presentation was actually pretty fun. Believe it or not, I also really enjoyed hearing what everyone thought – the good and the bad.

The openness of both the other students and the instructor.

I like being able to see mistakes that others may make on their presentations and papers so that I can already know what I should be looking at for my own papers. I like the resumes and job interviews, something practical that I can take with me.

So far, my favorite aspect has been attending the colloquia every Wednesday and critiquing them in class. This has proven to be useful in telling us how presentations should and shouldn't be done.

I have enjoyed the presentations. I have found them interesting and I think they will help me become a public speaker.

It got me going to colloquium, for which I am thankful.

D.2.4 Evaluation of the Instructor or Other Comments

As I believe this is your first time teaching this sort of class, this problem is understandable, but I think your major weakness is either not being sure what exactly you're looking for out of us or not effectively communicating this to us.

Don is awesome. He is very relaxed but respected, and maintains an excellent atmosphere for the exact type of learning that should take place in Physics 465.

It is very helpful that we have been allowed to have a revision so we can figure out what to do in the class. I am a little concerned that the class is becoming slightly repetitive and wish there could be some small lecture section each day on something new between the speaker critique and individual critiques.

I find the class to run smoothly where the instructor allows the class kind of flow on its own. I think that to be a strength in this class where the students are important in class function because after all they have to give constructive criticism of each other. I think the class outline of assignments were clear except maybe the second writing assignment. The instructor is not against advice or opinions of the students which is a strength because then there can be improvement. A mid-term evaluation suggests that they care about the course to want to improve it. Hmm, some weaknesses I found were maybe allowing that there is only one right course to take to papers and presentations. I mean there are some dos and don'ts but some criticism I found that I didn't see as all ways bad. I think like some reading of slides are good because it helps me see where exaclty on the slide the person is talking about rather than having the people read the slide on their own and try to connect the 2 things together. I thought for this course the weaknesses did not come out if there is one because its not like a lecture coures, but like a discussion where must involvment comes from the students. I wished I could give you something more concrete than that. Oh, I did think of something, the LaTeX was a bad idea at first I thought but when you put up a draft and just have to paste in, that really really help out so I thought that the instructor saw a potential problem for students and found a solution for it.

"I don't have any particular weaknesses in mind. As for strengths, I feel the instructor does a fine job in making the class more conducive to participation. He keeps the discussion moving along smoothly."

So far I have enjoyed the course (besides the fact that it is late on Friday). I feel it will help me improve in both writing and speaking.

I think the feedback he gives is most often useful and accurate. He is always respectful and never condescending towards the students, which makes the discussions and presentations much more open and relaxed.

D.3 Physics 465, Final Winter 2004

This course was a real joy. The number of assignments were very well thought out and made good sense . The presentations gave good practice and were quite enjoyable.

I really enjoyed having you lead this course. You did an excellent job getting each member of the class interested in the various topics. I wish you well in the future!

I thought the course went very well. I liked knowing what we were going to do in each class period. Wished we could have gone on a field trip but going out is good too. I think the class improved over the semester.

It was a very enjoyable class. There was always a good atmosphere and the stuff we worked on were all pertinent to our future careers. 1.) I liked working on the resume, getting tops on presentations and stuff. Didn't like having to go to every colloquium. 2.) Not sure.

Good class. It taught us valuable skills such as presentations, papers, listening to colloquia skills, and such. Though I think our work in each area was a bit brief (except listening).

1.) I think Don was very well organized, which made our lives easier with respect to knowing the schedule of the course. He also gave us good advice on how to give effective presentations as well as unite abstracts and effective papers. I would definitely recommend him to teach this course again in the future.

It was a good course. I think you just need to make the assignments more clearly defined at the start.

Good intro to scientific writing. Presentation methods learning was excellent.

1.) I liked the discussions on the first part and I also liked the two articles as well as the presentations. 2.) I think it may be useful to also use/point out the use of some sort of text.

1.) The class atmosphere as well as the approachability of Dr Smith both in class and out of class. 2.) More coursework would have improved my writing skills more.

Hire this man! Best teacher in the department. Don't let him go.

Good job, Don! I learned a lot and enjoyed the class.

1.) Format worked great. 2.) One improvement: add few weeks or additional concurrent assignment that reviews scientific writing as a class.

The individual assignments worked out just fine. However, it'd be useful to do some as a class and think about the challenges and pitfalls together... rather than through the "word of mouth" way the individual assignments did.

1.) I really liked the format of the course. I think by only working on a few people at a time, I learned more. I also thought Don gave good critique of the papers. I liked discussion the colloquium every week. 2.) I think people should be required to give their corrections to papers to the authors. That way each person has more feedback.

D.4 Physics 105, Final Winter 2004

1.) I really love these subject areas and I felt very satisfied with the course. I was impressed by the amount we covered in a 2-hour a week mini-course, which I don't think would have been possible without the work Don obviously put into the course. Every question I had was answered quickly and extremely thoroughly. In-class questions helped keep my focus and gave almost a fun break from a lecture. (The lectures were great, but no matter how interesting, some people must have a break to do something.) I was amazed by the clarity of explanations. Demonstrations and opportunities to volunteer made the class fun. His comments on papers and opportunity to re-write really helped my writing, as short as the paper was. 2.) The only thing that I think would help would be more encouragement of class discussion (which may be difficult in such a large room, but I would have enjoyed an opportunity to discuss things as a whole class once in a while). I was actually disappointed by the lack of enthusiasm of other students, but I believe that to be no fault of the instructor.

Good things: Grades were returned at a remarkably timely fashion. Website is excellent in keeping student informed Questions keep students paying attention. Suggestions: Split the exam into two 30 minute exams, one day basically decides your grade, a bit unfair.

1.) This might be one of the most – if not *the* most – organized classes I have taken at UM. I *really* appreciated how quickly our papers & exams were graded and how in depth the criticisms and corrections were. It is fabulous to have such an enthusiastic teacher! I also appreciate how the grade was split up a bit & not entirely dependent on the exam – being able to submit a rewrite to the paper is very helpful. 2.) Being able to print out the powerpoints before class would have helped me.

The instructor made the material very understandable. The pre-flight questions were helpful to highlight the important concepts of the reading and the lectures provided even more depth. Very good class.

1.) Text was easy to read; lectures were thorough and facilitated understanding the material covered; in class questions were great. 2.) Maybe a little more Physics and mathematics together.

This was a great introductory Physics course for a philosophy major. I liked the in-class questions and actual presentations (examples of concepts) especially. It was nice to be able to view our grade online and to have access to the previous slide. Though I may not have always liked them, the preflight questions at least motivated me to do some of the reading.

1.) Instant gratification in receiving the Final back. Pragmatic nature of course, very hands on.

One thing I would have appreciated is if the paper expectations had been more clearly defined. The online description made it sound much more casual than I think you wanted. Also, I think a longer paper actually would have been easier to write.

1.) The slides & pace of the class. 2.) Too much reading. 1.) Engaging lectures w/ demonstrations, in class response system, pre-flight questions all made retaining and understanding a large amount of material easier.

This has been my most enjoyable class in 4 years at UM. It should be longer for 2 credits so we can cover more material. In class participation through reply system was a great idea, preflights were good too.

The preflight questions were great. Quick, but you still had to have some understanding of the material. The website was also extremely helpful and easy to use. Great course!

Good in class questions and preflights. Good class in general.

Preflights were good idea, but in-class MC questions didn't really help.

Time for preflights to be due – didn't really like – better if due in evenings – then I wouldn't forget! Liked class-interesting Would have liked exam to be multiple choice (like class questions). Liked movie clips.

The class was very interesting. I would recommend that the preflights be due night before class. Also, more in-class demonstrations.

The teacher was great at explaining things. And, more importantly, really seemed to care whether or not we understood. Very nice, kind gentleman. The papers were silly because of their length. I would suggest doing away with them.

1.) The in-class demonstrations.

1.) The demonstrations. 2.) More emphasis on the homework. Test was worth too much, so was the paper.

I found it very easy to forget to do the pre-flights. Online homework (graded) is easier to remember.

D.5 Physics 105, Final Winter 2003

1.) As much as it got on my nerves late at night before class the next day, I'm glad that the pre-flights were part of the course, because they got me to do my reading. The demonstrations in lecture were always helpful, if only to have something cool that you saw to help you remember a concept. More than anything, it was obvious how much time, energy, and thought you put into the course, and that made me want to work hard and understand the material. 2.) Sometimes I felt like lectures skimmed the surface too much. I suppose that has to be the case when you take out all the math. :-) Also, specifically for this course, keeping a timeline of events would have helped me, sometimes the book and lectures went out of time order for the sake of explaining other concepts more clearly. Getting the biggest picture might have helped clarify concepts that can easily get confusing in their own universal proportions.

Overall, I was very impressed by the amount of time and energy that Professor Smith put in to this class. It is evident that he really cares about his students and wants them to learn and do well. Having the exam before the last day of class was great because as it is I already have 2 other exams that day. Having the exam earlier gave me more time to study for it. Although the course was good, I felt it was a lot of work for a 1 credit class. The last one credit class I took had nothing but one exam. This class had a lot of reading, homework, a paper, and an exam. I think that if you cut out the paper, the amount of work would be much more appropriate for the class.

1.) I liked the demonstrations best & I can't wait to hear about Dr. Smith's research.

Wow! Science is cool AND fun!

The whole subject was very interesting more so than some of the geoscience minicourses. It's a great subject! It covered a lot of information. The instructor was very enthusiastic, very knowledgeable, definitely knew the subject thoroughly. What was difficult was that there was so much background info (theory, laws) that needed to be understood in order to understand the subject as a whole. (Possibly too much for a minicourse - I'm sure there's enough for a 3-4-5 credit course.) The demos were great - very helpful to understand certain principles. The powerpoint slides done well in advance + website reflected preparation + very helpful for learning. The test + paper were maybe too much for 1 credit, possibly a longer exam OR slightly longer paper would have been sufficient, in my opinion.

I liked the lectures. Don Smith knew a lot about what he was talking on, and that made it very interesting. Also, his use of demonstrations in the class was very helpful. There is no improving to be done for this class.

1.) The wide range of topics 2.) nothing

Hey Don, Wish I sticked to my UROP project, but my sophomore level courses at the time & my horrible time management skills kinda ruined it. . . hopefully we'll meet again in the future! - your "bad" ex-UROP student

The feedback from professor to student was the best I've ever seen. The preflight questions were a great idea. I still wish I could've had the slides before lecture began, but apparently, I made due. Something I'd suggest, use less demons that take up a lot of time. I hate "idle" time during lectures. Excellent job for your first time!

1.) The experiment/demonstration things really helped clear up ideas as well as making the class very interesting and breaking up the monotony of straight lecture. 2.) I guess the only real complaint is that I seem to want more or to learn about some of the things a little bit more in-depth, maybe you could make it a whole semester course or something.

I really thought that this course was interesting because it was so different from anything I've ever studied before. I thought the instructor was great. He really seemed to care about the students. He encouraged office hours and really helped me with my paper. I thought the exam was *very* fair for those students that came to class. Also, I could tell that he put a lot of time into preparing for class. He also had helpful experiments to demonstrate his points.

I think our professor really cared about the subject material and it showed. The course was well-put together, he made excellent use of technology and example demonstrations to make sure students grasped the important subjects and was available to discuss the coursework with students even outside of office hours. He was one of the best instructors I've had this year.

I really enjoyed the course. I liked the way the class was structured with the preflights. It encouraged me to delve into the chapters which I found interesting and mind-expanding. I think that the instructor did an excellent job explaining some really deep concepts and keeping the class interested.

A very interesting class.The book was fun to read, kind of a sci-fi twist on the history of the universe at times. Lecture also had a good mix of demonstrations, explanation, fun stuff. The pre-flight questions were also quite valuable, especially the open-ended box about questions that we had.

You seem very passionate about the subject matter, but I would suggest using more examples. Good work & good luck.

This class is fantastic. Dr. Smith's excitement and enthusiasm was absolutely contagious. Physics generally bores me and is over my head, but I was completely engaged by this course. Keep up the good work!

1.) Simply the material covered. 2.) This can be difficult, but an approach to such a difficult subject at the 100 level needs to be presented with what will probably be the most common misunderstandings in mind. I'm sure you'll get better at this later in your career. Overall, for a first time, bravo!

Very interesting course. Visual aids were great. Sometimes you went a little fast. I had a hard time writing down the most important parts.

This was a very enjoyable class!

1.) I liked the experiments in class. 2.) More in class questions.

1.) The in-class demonstrations were fun + interesting. 2.) Not sure sice it's such a short class.

It's a good class. The powerpoint lecture is effective, putting them online is a very good idea.