



Teaching Outside the Discipline: A STEM-Related Course in a Non-STEM Curricular Area

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Abstract

Most of us who teach within the Science, Technology, Engineering, and Mathematics (STEM) curricular areas expect to have teaching assignments that directly align with these disciplines. A teaching assignment in a curricular area outside of STEM is much less common. One focus of this paper is to describe a course that is taught by our physics faculty entitled Changing Views of the Universe. Changing Views is a course that is part of our general education core of courses in a curricular area entitled Traditions that Shape the Western World. Courses taught within this curricular area are typically taught by such departments as anthropology, art history, communication, government, history, and philosophy. Students who enroll in this course are non-science majors who are looking to fulfill their general education requirements towards graduation in this particular content area. Because the course is filled with non-science majors, the often technical course content must be presented in a non-mathematical way. Since the course content includes just about everything from the Big Bang to our present-day understanding of the cosmos, teaching these topics without much mathematics presents many unique challenges. A brief overview of the curriculum developed for the Changing Views course will be provided. Particular attention will be placed on some of the unique ways a writing-based approach has been implemented with the ultimate goal of enhancing of student learning. Emphasis here will be placed on a short paper activity designed to elicit student understanding of key topics addressed in class. In addition, strategies such as rubric development and time-saving grading techniques related to the use of these writing-based approaches will be shared.

Introduction

While it is not unusual for physics departments to offer courses that are geared towards the non-major, most often these courses are traditional physics courses and are taught within the Natural Sciences portion of the general education core of courses. Changing Views of the Universe (Changing Views) is a course that is somewhat unique in that it is taught by physics faculty and even has a physics prefix on its listing in our course catalog. The uniqueness of this course is that it is not taught within the Natural Sciences core of general education courses. Rather, Changing Views is taught as part of the Traditions that Shape the Western World portion of our general education core of courses. This curricular area is best described as:¹

“The rich traditions that shape the Western world convey ideas, visions, and cultural practices that are shared, lasting, and tenacious. Some courses in this area examine powerful visions that philosophers, political theorists, historians, religious thinkers, scientists, and social critics have of the Western experience. Others explore competing ideas about human nature, liberty, equality, and the consequences of social change. Through direct engagement with primary texts, you learn to ask questions, debate ideas, and come to understand the ways that the past shapes our present experience.”

The broad learning objectives for this curricular area empower students to:

- 1) explore the diverse historical and philosophical traditions that have shaped the contemporary Western world,
- 2) read and discuss fundamental texts from those traditions, situating the texts in their appropriate intellectual contexts, and
- 3) develop your ability to critically and comparatively reflect on religious and philosophical issues, in dialogue with others both past and present.

Because of its unique place in our general education core, the Changing Views course offers distinctive challenges for physics faculty. The typical curriculum in this course overlaps many fields of specialization including (but not limited to): history, philosophy, astronomy, astrophysics, theology, cosmology, and physics. Many of the course topics rely heavily on a mathematical approach if taught in a traditional physics class. Because the clientele in this course consists of non-science majors, and there is no math requirement to enroll, these topics must be presented in a more non-mathematical way. In a broad sense, topics span all the way from the Big Bang to our present understanding of the cosmos. To discuss a topic such as dark matter or dark energy in a traditional physics class intended for physics majors is one thing; to do so in a non-traditional course populated heavily by non-majors is quite another. Hence, a non-traditional teaching approach is necessitated in the Changing Views course. A non-mathematical collection of assessment strategies go hand-in-hand with this non-traditional approach to teaching.

Studies on teaching pedagogies have clearly demonstrated that traditional techniques often put students in a role of passive rather than active learning²⁻⁶. Furthermore, more traditional methods have been shown to be very inadequate in terms of promoting deep learning and long-term retention of important concepts⁷⁻¹⁰. Students in traditional classrooms often acquire most of their knowledge through passive classroom lectures, textbook reading, and the internet. Passive learning routinely results in students merely trying to learn and regurgitate what the teacher and textbook are telling them. A discouraging fact is, after instruction, students often emerge from our classes with serious misconceptions¹¹⁻¹⁷. Writing can be used to effectively help students confront their misconceptions. In addition, formal writing strategies can provide essential “snapshots” to help uncover what students are really learning as the learning is taking place¹⁸⁻¹⁹.

Traditional examinations and quizzes merely provide an assessment marker after a segment of material has been covered in class. While important as a point for charting progress, these forms of assessment do little to uncover what is actually taking place in the mind of the learner. Astin²⁰ argues that as professors, we may think that we’ve given a very stimulating and thought-provoking lecture, without ever really knowing how much of it was actually understood by the students, how much was retained, or whatever other kinds of effects it may have had on the students. While traditional examinations and quizzes may provide us with some information about what students are learning, this more summative type of feedback really comes a little too late. A carefully crafted writing activity or set of activities can provide a more formative and authentic assessment of student learning; and, give students and professors time to correct any misconceptions or flaws in reasoning as the learning is ongoing.

Following a brief description of the Changing Views fall 2014 course, the focus of this paper will turn to the writing-based assessment strategies used to assess student learning. Because assessment is such a critical part of any course, it is hoped that this discussion will provide incentive for other physics and engineering educators to consider adapting a writing-based approach in their own classrooms.

The Changing Views Course and Student Clientele

The Changing Views course is heavily populated with non-majors. Students who enroll are typically majoring in such areas as international relations, business, history, philosophy, literature, the visual arts, communications, and political science. Since this course satisfies a general education requirement for all students, there are also some students who are majoring in a STEM-related area who enroll in the course. These students are typically majoring in such areas as public health, biology, environmental science, mathematics, chemistry, and of course, physics. The fall 2014 class consisted of 47 students. Approximately 80 – 90% of the students who enrolled were not majoring in a STEM-related content area. In addition, the course was populated by a fairly even distribution of freshman through senior level students.

Throughout the course a broad range of topics are presented and discussed. A single textbook that covers the unique span of topics does not appear to exist. In the fall 2014 Changing Views class the “textbook” that was used was *Coming of Age in the Milky Way* by Timothy Ferris²¹. Additional topic-specific journal articles and other readings were also used throughout the course. A wide range of topics were presented through multiple venues. For example, course lectures focused on such themes as:

- *The Big and the Small of Cosmic and Other Things*
- *The Story of Earth*
- *Ancient Greek Views of the Universe*
- *Medieval Times*
- *The Scientific Revolution: Copernicus, Kepler, Galileo, and Newton*
- *Gravity through the Lens of Newton*
- *Pre-Twentieth Century Cosmologies*
- *What is Light?*
- *Origin of the Universe: Cosmic Space*
- *Everything’s Relative*

A number of guest lecturers were also invited to speak to the class on topics that included:

- *Ancient Greek Views of the Universe from Thales to Plato*
- *Judeo-Christian Creation Myths and the Theologies Behind Them*
- *Creativity and Genius: Inside the Minds of Leonardo, Newton, Beethoven and Einstein*
- *How did the familiar universe of galaxies, stars, and planets come to be? And why do we think we know?*
- *Planet Hunting, Planet Zoo*

Additional topics were explored through two popular video series. These included *The Cosmos: A Space-Time Odyssey*²² hosted by Neil deGrasse Tyson and *Space, Time and the Universe*²³ hosted by Brian Greene.

The topics presented in Changing Views were designed to enhance the course-specific learning outcomes and objectives. These learning outcomes and objectives included the development of an:

- 1) understanding of fundamental historical, philosophical, and physics concepts, principles, and ideas,
- 2) understanding of major ideas and concepts that have shaped and are shaping 21st century scientific thought and discoveries,
- 3) understanding of the connections between the past, present, and future scientific developments and discoveries that have come to shape our conceptions of the universe,
- 4) understanding and an identification of the major contributions of individual philosophers, scientists, astronomers, mathematicians, historians, etc. who have played a role in helping to develop our conceptions of the universe, and
- 5) appreciation for science and the fundamental laws that govern the universe

To achieve these learning outcomes and objectives, students had the opportunity to demonstrate their understanding through several writing-based assessment activities. These activities included several free-writing activities and short writing-based reading quizzes, a creative project, and a short paper activity. Table I shows the distribution of points that made up the students' course grades.

Table I. Point Distribution for Course Grades

Activity	Points Allotted	Percentage of Course Grade (%)
Reading Quizzes	150	21.9
Free-writing Activities	100	14.6
Creative Project	100	14.6
Short Paper	100	14.6
Class Involvement (Attendance)	85	12.4
Final Exam	150	21.9

A brief description of each of the writing-based assessment strategies is included below with particular emphasis on the short paper activity. Following a description of the short paper activity a summary of the strengths of adopting a writing-based approach will be shared.

Writing-based Assessment Strategies

The reading quizzes, free-writing activities, creative project, and short paper, all had a strong writing component. Each will be briefly summarized here. The primary focus of this presentation will be on the short paper activity and its associated assessment strategies.

Free-writing Activities

As part of their homework assignments, students complete approximately 5 - 10 short free-writing activities over the course of the semester. Free-writing and other similar types of activities have been shown to enhance student understanding and motivation to learn²⁴⁻²⁶. Upon submission of these activities students receive brief, but prompt feedback on their writing. Numerous studies have pointed out the importance and value of prompt and thoughtful feedback to students²⁷⁻³⁰. When students take time to reflect on their writing and on the instructor's comments the free-writing activities become a highly effective tool in helping them uncover and then wrestle with their misconceptions while the learning is taking place.

The nature of the free-writing assignments varies depending on the goals and objectives for a particular topic or content area. For example, for some free-writing assignments students are asked to explain a problem or a concept that was highlighted or discussed during a class session. Thus, students essentially have the "answer" to the problem in their hands when they write up this folder assignment. The rationale for this type of activity is that learning can be enhanced when students take on the role of teacher through their detailed responses and explanations.

The assessment strategy for the free-writing activities is unique. Students are not penalized for answering the question incorrectly. Not penalizing students for their mistakes helps to make the writing assignments non-threatening. The students indicate that they value the written feedback they receive and they look forward to receiving it. A typical comment from students regarding this feedback is "I find your written feedback very useful. I learn from my mistakes more than anything else. Feedback helps me establish these mistakes." What is intended is for students to think very deeply about the instructor's written comments and then do whatever they need to do to correct the flaws in their thinking.

In addition to not penalizing students for an incorrect response, students' writing assignments are not assessed for grammar and spelling (unless it is blatantly poor, which seldom happens). If a word is misspelled that will be indicated to the student, but they are not marked down for it. Surprisingly, the papers that students turn in are remarkably well written and grammatically clean. The written feedback provided to the students clearly provides an additional incentive for them to do a good job. Thus, the feedback provided to the students' has an added benefit as it seems to encourage students to put even more thought and energy into what they turn in. In terms of instructor time, to respond to a short free-writing assignment in a class of about 50 students can be accomplished in about 1 – 2 hours, particularly if feedback is given in electronic format. In this instance, Blackboard was used as the vehicle for electronic submission and assessment of the free-writing activities.

Reading Quizzes

Reading quizzes can take many forms. For example they can be given in class or as a take-home assignment. In the fall 2014 Changing Views class, most of these assignments were given as

take-home activities. Allowing students time outside of class to go back through the assigned reading and write up their responses lends itself to more thorough and thoughtful expressions from the students. In addition, assigning these activities as take-home assignments facilitated more thoughtfully crafted responses on the part of the students.

In some instances the reading quizzes demanded that students go back through the assigned reading to find the answers to the questions being asked of them. In other instances, students were asked to outline the chapter or chapters they had been assigned to read. This outline constituted a reading quiz. This type of reading quiz assignment was helpful to the students as they understood that they were really helping to establish for themselves a study tool for the end-of-semester final exam.

Creative Project

A creative project assignment was utilized to allow students an opportunity to creatively express their understanding of a particular topic(s) that had been discussed in class. This activity was given near the end of the semester and in some ways served as a “capstone” project for the students. Students were allowed to select a topic(s) based on the course readings, class lectures and discussions, any of the video segments, or topics brought up through the guest lectures. In addition, students were encouraged to consider the topic of their short paper as a springboard for their creative projects.

Students were required to submit a proposal, in 250 words or less, that included an overview of their proposed project. Abstracts were submitted electronically through Blackboard. In their abstracts students had to make very clear the topic of their project and how it related in some way to topics covered in class. In addition, students had to make clear what the “end product” of their efforts were going to be. Once their proposals had been accepted by the instructor the students set about working on their individual (or in a few cases team) projects.

Students were given considerable leeway as to the type of projects they could do. For example, students were allowed to demonstrate their understanding of their topics through the creation of:

- a piece of artwork,
- some form of musical expression,
- literary piece,
- a scientific model, machine, instrument or piece of equipment that illustrated a specific concept or idea,
- a short skit or play,
- a short PowerPoint presentation,
- a short video, or even
- something edible.

The above is not an exhaustive list but should give the reader a sense for the broad range of project types and styles that the students were permitted to pursue. The creative projects were actually presented during the final exam time slot with the final exam being given during the last week of regular class. By using the extended time during the final exam time slot, each student was given 3 minutes to present their projects to the class. The projects were assessed based on

the original proposal that was submitted, the class presentation, and a 1-page written summary of their projects.

The creative projects developed by the students spanned a wide range of venues. For example, one student wrote a piece of music and recorded his performance. The recorded piece of music was then the backdrop for a short video presentation that was intended to illustrate the creation of the universe. Another student created a computer simulation of some of the planetary models that had been discussed in class. In fact, several students presented projects that dealt with various planetary models. One even included a model that was created using cupcakes. This student also brought enough cupcakes to share with the class. Other edible projects included those that demonstrated nutritional needs of astronauts. Yet another student built a small telescope and another created a model of the Hubble telescope out of PVC materials. This is but a small sampling of the types of projects the students came up with. Upon conclusion of the class presentations it became quite clear that the students were really “itching” to be able to demonstrate what they had learned through a non-traditional means such as the creative project. In terms of assessment the creative project provided a somewhat unique mechanism for the instructor to document what students had learned over the course of the semester.

The Short Paper Assignment

The primary aim of this discussion on the writing-based activities in the fall 2014 Changing Views class is to showcase the short paper activity and its associated assessment tools. A copy of the short paper assignment has been placed in the appendix. Its inclusion is intended to provide suggestions and ideas for the reader who is planning to include a writing-based activity of this nature in their own course(s). The rubric that was utilized to assess students’ papers is also included within the short paper assignment.

Students were given approximately one month to prepare their short papers. As with the creative project, students were given considerable leeway on selection of the topic(s) for their short papers. Students could draw from any of the venues utilized in class such as regular class lectures, assigned readings, video segments, and guest lectures and presentations. Students were allowed to explore a topic or contribution of a particular individual within a given period of time (i.e. Ancient Greece, Medieval times, the Renaissance period, etc.). One goal of the paper was to show how that contribution(s) helped to shape the students’ understanding of the cosmos.

After selecting a topic(s), students were then required to submit a project proposal (in approximately 300 words or less) electronically. In their proposals students were required to identify their topic and its impact on our understanding of the cosmos. Students needed to develop a carefully thought-out thesis for their papers which was to form the backbone of their proposals. At this stage, two independent primary sources of information needed to be cited in the proposal to make clear that they had begun their research and weren’t just making some “fluffy, this sounds good” type of argument for their proposals.

Students were to submit their proposals electronically through an assignment folder set up in Blackboard for this purpose. Once the proposals were submitted, the instructor was able to easily upload each proposal, make comments using the comment feature in Microsoft Word, save the file and upload it to Blackboard. In this fashion, students had prompt access to the instructor’s feedback. In addition, the instructor was able to give the students some general advice, indicate to the students that their proposals had been accepted (or conversely, indicate

that the student needed to refine their topic choice), score the proposal and have the score entered into Blackboard's grade center automatically. To begin the grading process, the instructor can simply go into the grade center and score the submitted proposals. Figure 1 provides an illustration of one of the submissions from the fall 2014 class (used with permission of the student). As one can see, the student's proposal can be easily uploaded.

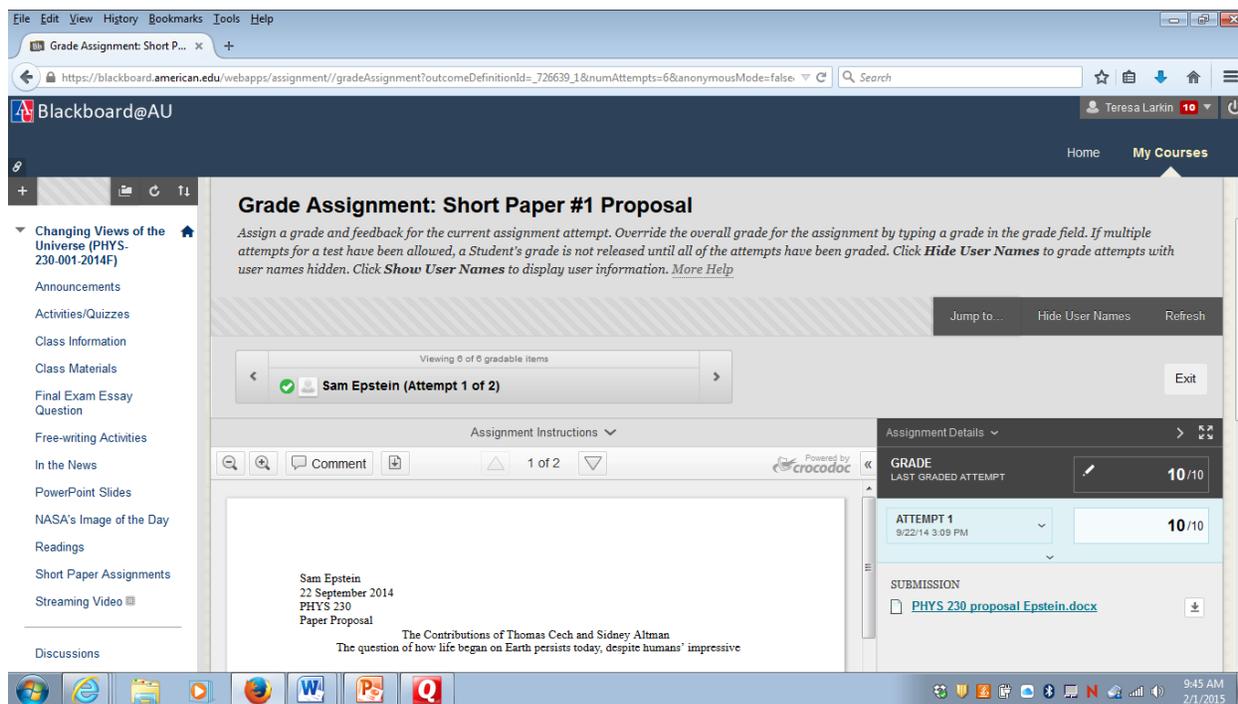


Figure 1. Snapshot of Blackboard's grade center for individual submissions of the short paper proposals.

Once the proposal phase of the paper writing process was complete, the students were reminded of the rubric (shown in the appendix) that would be used to assess their final papers. The papers were limited to 1200 – 1500 words, which translates into approximately 3 – 4 double-spaced pages written in 12 pt. font. Having a word limit on the papers served a couple of purposes. First, the limit forced students to really get to the point and focus on their topics. Second, the word limit helped curb the grading time required. To thoughtfully comment and provide feedback on a well-written paper took approximately 20 minutes per student. Papers that were sub-par took a little longer, depending on what the specific issue(s) were. Fortunately, there were few papers that fell into this category.

Allowing the students to select a topic for their papers also served a dual purpose. Selection of a topic that interested them provided the students with additional motivation beyond the fact that they had to do it because a grade was attached. Further, allowing students a choice in selection of their topics insured that there would be a great deal of variety in paper topics. This fact made the grading process very interesting. Oftentimes, when a paper assignment is given the topic is prescribed to the students and hence, every student submits a paper on the very same topic. In a class of nearly 50 students this would make for a very dull and tedious grading process for the instructor. The variety of paper topics helped keep the grading of the papers fresh and interesting. Some examples of the types of topics chosen by the students include: the Hubble

telescope and its impact on our understanding of the cosmos, the implications of physics on human consciousness, the mythology associated with popular understanding of the Aurora Borealis, blackbodies and Raleigh scattering, and the RNA world hypothesis, just to name a few.

The short paper assignment was worth 100 points and constituted approximately 15% of the students' overall grades in the course. The short paper proposal was worth 10 points and the remaining 90 points came from the paper itself. Using the rubric provided in advance to the students, the short paper assignments were assessed using the guide illustrated in Table II.

Table II. Short Paper Assessment Rubric

	Your Score
Thesis & Argument (Max. = 16)	
Support (Max. = 16)	
Organization (Max. = 16)	
Style (Max. = 16)	
Correctness (Max. = 16)	
Assignment Adherence (Max. = 10)	
Total Points (Max. = 90)	

Overall, the papers submitted by the students were very strong. Perhaps it's the unique nature of the Changing Views course and the wide range of majors of the student clientele that lend themselves to quality writing. The class average score on the short papers was approximately 78/90, which for a relatively large class is quite strong. In addition, throughout the paper writing process, the instructor continued to stress the elements of the paper and the associated rubric during class and during individual meetings with students. It was the impression of the instructor that the students really took ownership of their topics and worked very hard to increase their understanding.

Summary

The unique nature of the Changing Views course necessitated an unusually large spectrum of topics for study and discussion in comparison to a more traditional physics course. These topics ranged from just milliseconds after the Big Bang to our present day understanding of dark matter and dark energy. Because there was no math requirement for the course, the presentation of many of the topics was quite challenging from an instructor's perspective. Students enrolled were hungry to know more about these topics, but most did not have a sufficient math background to allow for inclusion of any sort of numerical problem solving. This fact alone presents numerous challenges for the typical physics instructor who is so used to writing exams

and quizzes that have a strong numerical component. These types of questions were not an option for assessment of the students enrolled in Changing Views.

The use of an integrated writing-based approach allowed for multiple forms of assessment, often in a much more authentic way than through traditional tests and quizzes. In fact, the primary purpose of an exam or quiz is to provide a summative marker of a student's progress in comprehending a subject over a given period of time. At best, a final exam grade provides a single data point regarding student learning. A student's grade on a final exam does not, however, shed much light on the overall process of learning. If one is truly intent on capturing what a student has learned in a given course, other methods of assessment are required. This point was manifestly clear in the Changing Views course. The active process of writing served as a formative vehicle for assessment of student understanding of the course material at various intermediate points along the way.

The use of a variety of writing-based approaches might seem formidable for an instructor whose subject matter lends itself to more traditional problem-based exams and quizzes. However, the significance of a writing-based approach has been widely documented to show that it can enhance student interest and motivation to learn. This enhanced interest and motivation often, in turn, translate into increased student understanding³¹. It is hoped that the examples, illustrations, and time-saving grading techniques, such as the use of an electronic grading format and strict limitations on word length, will provide additional incentive and motivation to other instructors who may be considering adapting a writing-based approach in their own classrooms. The examples illustrated here may be easily reframed and adapted for use in any course, whether it be a more traditional physics, engineering, or other type of STEM-related course.

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Appendix

Due dates:*

Proposal: Tuesday, Sept. 23rd

Short Paper: Tuesday, Oct. 21st

***Both an electronic Word document and a hard-copy version of your proposal and paper submitted by class time on the respective dates are required. Electronic submissions should be made to the corresponding assignment designation within the Blackboard folder called Short Paper Assignments.**

This paper assignment is designed to allow you to explore, in more detail, a topic that we have been discussing or that you have been reading about thus far in *Coming of Age in the Milky Way*. You might also find inspiration from one or more of the guest lectures we have had and/or from one or more of the videos we have watched. Because I want to maximize what you get out of this assignment, I am going to give you considerable leeway in terms of topic selection. For example, if you are interested in exploring a general topic or the contribution(s) of a particular individual within a given period of time (i.e. Ancient Greece, Medieval times, the Renaissance period, etc.) and how that contribution(s) has helped shape our current understanding of the cosmos, you are free to do so. You may also get a little creative. For example, a paper topic such as “Myth vs. Magic vs. Science” as it relates to the cosmos could also be appropriate. I will be asking you to prepare a short proposal to “pitch” your topic to me and to demonstrate that you have done a little library research. If you’d like to discuss potential topics with me before pitching your proposal, you are always welcome to come by during office hours.

Guidelines for Proposal: In approximately 300 words or less, I would like for you to provide an overview for your paper. As you prepare your overview, keep the following items in mind:

- Your overview should clearly identify the topic you are writing about, including the specific connection(s) you will make to its impact on our current understanding of the cosmos.
- A *carefully thought-out thesis* for your paper should frame the backbone of your proposal overview.
- Your overview should include a reference to a minimum of two independent sources of information.
 - Note: A Wikipedia article or other anonymous Internet source may be a good place to start, but it is not an “original source of information.” Typically, this type of “source” is, at best, a synthesis of other popular and scholarly work; and, it often does not have an author whose credentials can be verified. In addition, a link to a general website is not considered a good independent source of information.
 - The library is a great source of information and the librarians there are both awesome and more than willing to assist you. Note that we also live in the nation’s capital where we have access to this thing called the Library of Congress. Please take full advantage of all the resources available to you!

Guidelines for Short Paper: As you prepare your paper, please keep in mind the items listed below:

- Your paper should have a title page which includes: The **paper’s title, your name, your row and seat number, PHYS-230, and the date of submission.**
- The body of your paper should be a **minimum of 1200 and a maximum of 1500 words.**
 - This amounts to a paper that is approximately 3 – 4 double-spaced pages in 12-point font.
 - Please use Times New Roman (or similar) 12-point font style for the body of your paper.
 - It is the word count and not the number of pages that is important.
 - For example, some of you may choose to include a figure or table of some sort that will obviously take up room on the page. That’s fine.
 - A 600 word paper that is 4+ pages long because it is primarily filled with figures and tables will not have met the minimum requirements for the paper.
 - Your paper should have 1-inch margins.
- Your paper should include an abstract.

- An abstract should provide a brief summary of your *major thesis* along with your *main supporting points*.
 - In many respects, your abstract will simply be a “cleaned up” version of your paper proposal.
- The word count of your abstract should be *included* in the 1200 – 1500 range of your paper. Hence, the abstract is NOT “in addition” to this word count.
- Your paper should include a minimum of 4 independent sources.
 - I would expect many if not all of you to cite *Coming of Age in the Milky Way*.
- You should assume the audience for your paper is an **audience of your peers**. Assume that your peers are serious critical thinkers that will not be persuaded by fallacious or weak arguments.
- Be sure to run the spelling and grammar checkers. Proofread your paper several times. Once you have done that I suggest you **read it out loud to yourself**. You may be surprised by how many mistakes you can catch this way! In addition, you might ask a classmate or friend to proofread it as well.
- A portion of your paper may involve opinion. Your opinions should be supported with logical arguments, facts, details, data, examples, and/or other forms of evidence.
 - Don’t try to “prove” opinions. I am always skeptical when I see the word “prove” (or other similar words) in a paper.
- Do not unnecessarily repeat yourself. If you need more material, either provide more detail or consider additional aspects of the topic that could be included.
- There is a maximum of two short quotations allowed. Having no quotations at all is also fine; in fact, preferred.
 - The reason for this restriction is to avoid having you include quotations of things that you might not fully understand. What I’d like is for you to do your best to explain what you do understand in your own words.
- Your paper should be written in **your own words**. The university’s standards for academic integrity will be strictly enforced.
- Your paper should be formatted using APA style. You may use the formal APA style manual or the guidelines for APA style described in the “*easy Writer*” handbook used in all college writing classes at AU.
 - A good description of the APA style formatting guidelines can also be found at: http://bcs.bedfordstmartins.com/easywriter4e/#518364__523266__. There you can also find a link to a sample student essay which should serve as a template for your paper.

Assessment of Proposal and Short Paper:

- A total of 100 points will be allotted to the overall activity.
 - Your proposal will be given 10 points and the remaining 90 points will be given to the paper itself.
 - Note that the submission and acceptance of your proposal is a prerequisite for the paper.
 - To be eligible for full credit on the paper, a proposal must first be submitted on time.
 - Your proposal must be given the “green light” from me in order for you to proceed to writing your paper.
 - The rubric shown on the next page and adapted from the College Writing Program grading criteria, will serve as my guide for assessing your papers. Please review the rubric. A copy of this rubric has also been placed in the Short Paper Assignment folder on Blackboard.
 - Points will be deducted for such things as:
 - Being significantly under the word count range.
 - Blatant spelling and grammatical errors.
 - Incomplete or incorrect citations.
 - Inappropriate or overuse of quotations.
 - Not following the formatting guidelines as described above.
 - Incompleteness.
 - Obvious formatting errors.
 - Omission of an abstract.

Physics 230: Changing Views of the Universe Fall 2014 Short Paper Assignment Assessment Rubric

	The A Paper (Outstanding)	The B Paper (Very Good)	The C Paper (Satisfactory)	The D Paper (Unsatisfactory)	The F Paper (Failing)
Thesis & Argument	The paper's thesis demonstrates ambition, thoughtfulness, and appropriate specificity. The thesis provokes readers to reflect on the topic's subtleties and complexities. Throughout the paper, arguments remain clear, essential, and sound.	The paper has an ambitious thesis but does not fully deliver on its promise, or it may have thoroughly developed and explored a less than demanding thesis. Supporting arguments progress with very few lapses in clarity, soundness, or relevance.	The paper has a thesis, although it doesn't demonstrate ambition or take on a discernible degree of difficulty. The thesis may be too broad to lead to a focused paper. Argumentation in general seems lackluster or obvious; some arguments might be weak due to lapses in logic or insufficient (perhaps irrelevant) evidence.	The paper's unsatisfactory thesis suffers from logical incoherency or facile aims. Argumentation generally suffers from tangential lapses and/or logical fallacies. Evidence is markedly insufficient or irrelevant.	The paper has virtually no discernible thesis or direction. Arguments often bear no relation to other sections of the paper; logical fallacies may abound.
Support	The paper engages a variety of credible perspectives, demonstrating a sophisticated use of support: other views have been carefully considered, sources have been appropriately synthesized, and the analysis offers readers fresh ways to view the source material.	The paper uses substantive support: arguments consistently follow from evidence. The writer effectively illustrates the conversation on the topic. The analysis almost always offers some insights.	The paper's argument is supported but would benefit from more—or better use of—evidence; the paper demonstrates analysis, albeit occasionally superficially. The analysis offers a few insights.	The paper's supporting arguments often suffer from inadequate evidence that is insufficient, irrelevant, or incorrect. Sources may not be appropriate for the assignment. The paper may misinterpret or misrepresent its source material.	The paper's supporting arguments have virtually no evidence or rely disproportionately on inappropriate evidence.
Organization	The paper's organization develops organically from an outstanding thesis. At the global level, the writer reveals a sophisticated awareness of form; locally, paragraphs cohere, and the paper flows without unintended interruptions.	At the global level, the paper's organization reveals a logical, rhetorically effective progression of the argument. On a local level, transitions between paragraphs and sentences create continuity and coherence.	At the global level, the paper's organizational strategies demonstrate basic cohesion and continuity. On a local level, transitions between paragraphs and sentences usually create continuity and coherence, with some exceptions.	At the global level, the paper's unsatisfactory organization results in a paper that confounds the reader. Locally, paragraphs stumble from one to the next and often lack focus and coherence.	The paper's paragraphs lack most defining features of a traditional paragraph: controlling ideas, transitions, unity, and coherence. The same is true of the paper as a whole.
Style	The paper engages the reader through a sophisticated control of diction, syntax, and tone. The language is concise, precise, and appropriate for the subject.	The paper's prose itself, not just the subject matter, interests the reader through effectively varied sentence styles and word choices. The language is usually concise and precise.	The paper's prose is adequate and, despite some awkwardness, communicates clearly through competent syntax and diction. There may be some wordiness.	The writing's lack of precision often confuses the reader through unclear word choice or problematic sentence structures. The writing may also demonstrate substantial wordiness.	The writing prevents readers from engaging with the piece on any level: the sentences resist coherency, word choices resist clarity, and overall the prose ignores the basic demands of an audience.
Correctness	The writing has virtually no grammatical, mechanical, or formatting errors. Sources are appropriately attributed, documented, and cited. At this level, the presentation reveals professionalism and attention to detail.	The writing has few grammatical, mechanical, or formatting errors, and they do not distract the reader from the content. Sources are appropriately attributed and cited with very few errors.	The writing has several grammatical, mechanical, or formatting errors, and some errors distract the reader from the content. Sources are documented and cited, though not always strictly in the required format and with little attribution.	The writing has substantial grammatical, mechanical, or formatting errors that distract the reader from the content. Many sources are incorrectly documented and cited.	The paper fails to meet minimum standards of correctness: errors in grammar or mechanics prevent readers from understanding the paper. Sources receive incorrect or no documentation and citation.
While the preceding elements demonstrate a hierarchical concern, the following discussion regarding adherence or response to the specifics of the assignment must be seen outside that hierarchy. Fundamentally, the question comes down to whether or not the paper properly responded to its assigned goals and other requirements or not. Though a paper may excel at the above elements, one may view a paper's success in the final element below as an equally important concern.					
Assignment Adherence	The paper meets every essential assignment requirement as clearly outlined in the Short Paper Assignment document.		The paper meets the majority of the essential requirements.	The paper fails to meet the essential requirements of the assignment.	

- **The following items provide a synthesis of some of the key aspects of, as well as some additional tips for, what will be considered to be an outstanding paper:**
 - The paper is thoughtful and reflects some of the subtleties, complexities, and even uncertainties relating to the topic.
 - Arguments and explanations are clear, relevant, well-reasoned, and are supported by sound logic, details, examples, facts, or other types of evidence.
 - The paper is well-organized such that the logic flows in a clear and concise way.
 - Sources are appropriately attributed and cited.
 - Words and language are chosen for clarity, appropriateness, and specificity.
 - The writing is not vague, nor is it unnecessarily complicated such that ideas in the paper become obscured.
 - In scientific writing, *clear communication of interesting and important ideas is the essential goal*, not complex or fanciful writing just for the sake of complexity and fancy.
 - The paper is content rich and full of plenty of information, examples, and details.
 - The strengths of any claims made are not unjustifiably exaggerated.
 - When appropriate, the paper acknowledges uncertainties, unknowns, and weaknesses.
 - Writing this paper is not a lesson in politics. I want you to approach your topic through the lens of a scientist or philosopher. Refrain from making polemic arguments.

If you have any questions at all regarding this assignment, please come see me during office hours. I will be more than happy to provide you with assistance and guidance. Finally, please try to select a topic that you will sincerely enjoy spending the next month or so exploring. That way you are sure to get the maximum benefit from this activity.