ASTRONOMY & COSMOLOGIES

The Evergreen State College **Spring Quarter 2013**

Astronomy compels the soul to look upwards and leads us from this world to another.
--Plato

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Dr. E.J. Zita is on medical leave due to a farming accident.

Class Schedule: Tuesdays, 6:00-10:00 CAL
Thursdays, 6:00-10:00 Seminar 2 B 1105
Stargazing after each class, weather permitting
Mondays and Wednesdays Group meetings

Field Trips/Class Events: Friday**, April 19th**; 11:00 am- 4:00 pm University of Washington Planetarium,
Friday, **May 10th**, 7:00-9:00 pm., Craig Bartlett, *Hey, Arnold*! animator, discusses his new science series, *Jet Propulsion.*

The history of astronomy is a history of receding horizons.
-- Edwin Hubble

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I. Description:

This interdisciplinary program will combine science and humanities, as we learn astronomy through lectures, discussions, interactive workshops, and a variety of guest speakers. We will conduct observations using the naked eye, binoculars, and telescopes, as well as through virtual astronomy programs. We will learn about the evolution and structure of our universe, celestial bodies, and other topics. We will study roles of science and of storytelling in human searches for understanding and meaning.

How have people across cultures and throughout history understood, modeled, and ordered the universe they perceive? From sacred stories to modern astronomy, we will explore a variety of cosmological concepts in science, literature, mythology, philosophy, history and/or archaeoastronomy. We will use scientific methods and other inquiry-based learning strategies that engage the imagination. Through readings, lectures, films, workshops, and discussions, participants will deepen their understanding of astronomy, and they will refine their understanding of the role that cosmology plays in our lives through the stories we tell, the observations we make, and the questions we ask. We will develop skills and appreciation for the ways we find our place in the universe through stories and science, imagination and intellect, qualitative and quantitative processes. Finally we will ask, how does our understanding of astronomy and cosmologies influence our understanding of sustainability and the quality of life on Earth?

We will work together as a learning community, in large and small groups. We will read and discuss science texts and do quantitative workshops and homework. Students will build and take home astronomical tools such as spectrometers and solar position finders. Students will: keep observation journals; analyze literary and cultural works related to astronomy and cosmology; write reflective essays on course topics and themes; develop a personal and academic essay or fictional work; complete a group research project and final presentation. We will also share star stories from different cultures. Student teams will meet for pre-seminar discussions, to review each other's writing in peer editing groups, and to work on astronomy assignments. Research teams will explore questions of personal interest through observations, readings, research, and calculations, and will share their findings through final presentations.

See "Weekly Schedule" for details on themes and topics.

The first in time and the first in importance of the influences upon the mind is that of nature. Every day, the sun; and after sunset, Night and her stars. –Ralph Waldo Emerson

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II. Field Trips, and Special Events:

1) Friday, April 19th, 11:00 am-4:00 pm. University of Washington Planetarium (required)

Graduate students in physics and astronomy will give an in-depth presentation on the night sky, astronomical phenomena, and basic physics, etc. This includes: motion of planets; images of planets; stars and galaxies; fly through the universe; information on the Sloan digital sky survey (map of nearby universe; data displayed representing the earliest evolutionary eras of the universe; cosmic microwave background; dark matter/dark energy; etc.)

2) Friday, May 10th, 7:00-9:00 pm., On Campus, Craig Bartlett, *Hey, Arnold*! Animator, discuss his new science series, *Jet Propulsion.* (Required)

As a guest of "Astronomy and Cosmologies," Craig is coming to Evergreen to share how he develops successful animation productions. As one of our nations most successful animators and storytellers, how does he mix words and images to tell engaging stories, such as his popular series, Hey Arnold!, that inspire and entertain?

Craig is one of the modern wizards of animation. After graduating from The Evergreen State College in 1981, he went to work as an animator at the award-winning Will Vinton Studios in Portland, Oregon. In 1987, he moved to Los Angeles to direct the Penny cartoons for "Pee-wee's Playhouse" on CBS. He later created the television and book series "Hey Arnold!" for Nickelodeon. Craig created his second television and book series, "Dinosaur Train," for PBS in 2008.

Craig is currently working with NASA and Jet Propulsion Lab (JPL) and PBS to develop "Jet Propulsion," an educational program on astronomy. How is he bringing science, art, and storytelling together to develop astronomy education for modern audiences?

For more information: <http://blogs.evergreen.edu/evergreenmind/the-stories-we-tell-ourselves/>http://www.evergreen.edu/alumni/travelingseminars/losangeles.htm

3. Optional Field Trip: June -12-14th ?

At the conclusion of the quarter, students are invited to help organize an **optional** observation field trip to an observatory or regions with clearer skies. Students must provide all of their food, camping gear, and equipment, along with field trip costs of up to $300.

The important thing is not to stop questioning. Curiosity has its own reason for existing.
--Albert Einstein

I sometimes ask myself how it came about that I was the one to develop the theory of relativity. The reason, I think, is that a normal adult never stops to think about problems of space and time. These are things which he has thought about as a child. --Albert Einstein

[Humans] must rise above the Earth—to the top of the atmosphere and beyond—for only thus will [they] fully understand the world in which [they] live. **--Socrates**

III. Required Texts:

Chamberlain, Rebecca, Ed. *Astronomy and Cosmologies Reader*: Essays, articles, and resources posted on Moodle each week to supplement course activies, workshops, and readings.

Calvino, Italio. *Cosmicomics.* New York, N.Y.: Harvest Books, Harcourt Brace, 1979. ISBN: 9780156226004

Dickerson, Terence. *NightWatch: A Practical Guide to Viewing the Universe* (newest Edition*).* Buffalo, N.Y.: Firefly Books. 2006. ISBN: 9781554071470

Slater, Timothy F. and Roger A. Freedman. *Investigating Astronomy:* A Conceptual View of the Universe. New York, N.Y.: W.H. Freeman and Company. 2012. (With Starry Night College 6) ISBN 1-4292-1063-X .

Slater, Stephanie, Timothy Slater, and Daneil Lyons. *Engaging in Astronomical Inquiry*. New York, N.Y.: W.H. Freeman and Company. 2013. ISBN 978-1-4292-9392

Staal, Julius, *The New Patterns in the Sky: Myths and Legends of the Stars.* Blacksburg, VA: McDonald Woodward, 1988.

Swimme, Brian, and Mary Evelyn Tucker. *Journey of the Universe*. New Haven: Yale University Press, 2011. ISBN: 0300171900

Zinser, William, On Writing Well. On Writing Well, 30th Anniversary Edition: The Classic Guide to Writing Nonfiction New York: Harper Perennial. ISBN: 0060891548

Your choice of **ONE** the following:

Williamson. Ray A. *They Dance in the Sky: Native American Star Myths.* New York: Houghton-Mifflin, 1987. (Available in the Evergreen bookstore.)

Miller, Dorcas. *Stars of the First People.* Boulder, Co.: Pruett. 1997. ISBN: 9780871088581 (This book is out of print, so you will have to order it online.)

Look deep into nature, and then you will understand everything better. *--Albert Einstein*

Our task must be to free ourselves…by widening our circle of compassion to embrace all living creatures and the whole of nature and its beauty. *--Albert Einstein*

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God is infinite, so His universe must be too. Thus is the excellence of God magnified and the greatness of His kingdom made manifest; He is glorified not in one, but in countless suns; not in a single earth, a single world, but in a thousand thousand, I say in an infinity of worlds.

— Giordano Bruno, *On the Infinite Universe and Worlds*, *1584.*

Giordano was executed by the Inquisition.

IV. Group Work/Learning Communities: Hybrid Learning Model

A key part of our work in this program involves developing learning communities. As a result, you are expected to work in small groups--for a minimum of six hours per week--in person and online. You are required to keep a weekly log of your hours and work each week, and post it in your portfolio (See "Weekly Learning Log"):

1. Group Meetings--In Person:

We will form teams, early in the quarter, around research topic themes and interests. These teams will be responsible to each other on a number of levels, throughout the quarter. As a member of a team, you are expected to meet in small groups each Monday and Wednesday. The primary purpose of these groups is to work as **peer writing groups**, to develop **group research projects,** and to complete astronomy homework. Groups will choose times each Monday and Wednesday to:

-prepare questions for class and seminar discussions
- respond and give feedback on each others' writing in peer-editing groups
-to work on astronomy workshops and homework
-to arrange sessions with our program math tutor, as needed
-to work on final research projects.

Your research group will work together to develop your research questions, to conduct your research, and to develop a professional final presentation--presentable for an academic conference or educational setting--in "power-point" or "keynote." As the quarter progresses, you may spend additional time each week developing your project.

2. Online Feedback & Writing Groups: You are expected to interact online, commenting regularly on other student's reflective essays, and giving feedback on major writing assignments in online peer-editing groups. Along with meetings in person, posting and responding to your writing--along with interaction and community building on Moodle--is an important component of your engagement with the program.

2013 Schedule	CONSULT WEEKLY SCHEDULE FOR DETAILS Check Moodle and Schedule every other day for updates.	Due:
Weekend	*Read, observe, work on projects and homework*	By midnight on Sunday evening Post weekly reflective essay to Moodle
Monday	Groups: Meet your team whenever you like. Work on peer-group editing workshops, Astro homework, prep. for seminar, group projects, schedule time with math tutor. *Individuals: write essays; work on course readings, homework, independent study*	Post responses to peer essays and complete assignments, as scheduled each week.
Tuesday Class	**6:00 – 10 pm** in the CAL: **ASTRONOMY** Lecture, workshops, computer activities, **Seminar.**	10-11 pm outside to OBSERVE after class. Bring your equipment.
Wednesday	Groups: Meet your team whenever you like. Work on peer-group editing workshops, Astro homework, prep. for seminar, group projects, schedule time with math tutor. *Individuals: write essays; work on course readings, homework, independent study*	Post responses to peer essays and complete assignments, as scheduled each week.
Thursday Class	**6:00 – 10 pm, Sem 2 B 1105 Cosmologies: Culture, Literature & Writing** Workshops & Lectures. **Seminar.**	10-11 pm outside to OBSERVE after class. Bring your equipment.
Friday	Field Trips, **April 19th**, **May 10th** *Individuals: Read, write, homework*	Complete log of group and individual hours!

V. Fields of Study/Credits (16):

For students who are interested in astronomy, natural sciences, literature, writing, history, cultural studies, philosophy of science, science, and education.

Students can receive credit for college level work in the following areas. See our covenant for further details. In a 16 credit class you are expected to work on the average of 40 hours a week to earn the following credits:

4 cr: Introduction to Astronomy, with labs and field studies
2 cr: Astronomy research project
2 cr: Philosophy of Science, or Science Education
4 cr: Cosmology: literature, mythology, and cultural studies of the universe
4 cr: Writing: personal, academic, and expository essays.

If we knew what we were doing, it wouldn't be called research, would it? --Albert Einstein

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VI. Special Equipment and Supplies: bring to class every night

Students must provide binoculars, tripod, and supplies (estimated cost $200-300).

1) A BLANK (unlined) Lab notebook from the Bookstore, and a pencil for making drawings, notes, or reflections.
2) Flashlight with RED light. (You can purchase a red light, or you can use **red** nail-polish or tape on the end of a flashlight. Use a string to hang it around your neck.) These are REQUIRED for safe observing on the roof at night.
3) A good pair of BINOCULARS for astronomical viewing.
4) A TRIPOD with a binoculars mount. Buy or borrow the tripod & mount. Then you will be able to see as well as Galileo did with his telescope - moons of Jupiter, etc.
5) A chair or pad to sit and kneel upon.
6) Warm clothes, and a warm beverage in a thermos, for late nights.

The time will come when diligent research over long periods will bring to light things that now lie hidden. A single life time, even though entirely devoted to research, would not be enough for the investigation of so vast a subject. . . . And so this knowledge will be unfolded through long successive ages. There will come a time when our descendants will be amazed that we did not know things that are so plain to them. . . . Many discoveries are reserved for ages still to come, when memory of us will have been effaced. Our universe is a sorry little affair unless it has in it something for every age to investigate . . . . Nature does not reveal her mysteries once and for all.

— Seneca, *Natural Questions* Book 7, c. first century

VII. Assignments:

Writing Projects:

We take writing seriously, and as part of your work in this program, you will learn to write different kinds of essays for different audiences and purposes. During the class, we will read and analyze a variety of essays and literary works, by prominent writers, exploring different approaches to how we communicate effectively in both the sciences and humanities. You will develop, revise, and edit your writing based on feedback from peer writing groups and faculty. You are strongly encouraged to develop your writing through regular visits to the writing center, throughout the quarter. We will cover various conventions in class, and you will consult the Purdue On-Line Writing Lab (OWL) for details.

1. Weekly Reflective Essays (7 total, 1-2 pages): Due by midnight, each Sunday, you will post each on online and print a copy for your portfolio to file under "Weekly Reflective Essays." These are brief, thoughtful, and well-written responses to the required reading assignments for each week, as well as syntheses of program topics, themes, and issues. See "Guidelines for Writing Reflective Essays" and weekly "Reading and Assignment Handouts," for details.

You are strongly encouraged to keep reading notes each week to share with your project groups, and as the foundation for seminar discussions.

2. A Personal Essay (4-6 pages) on the theme, "How do you see yourself in the universe?" As we explore observations and scientific inquiry, how can this data and information inspire us about our role as humans on planet earth? Based on the essays and readings of various writers, and on the scientific studies we are doing, how do you make sense of what you are learning? Using the techniques of the personal essay, which we explore through readings and class workshops, you will develop your essay through several drafts. For details, see "Personal Essay Guidelines."

You will have at least two peer-group editing sessions, outside of class, for feedback as you revise your essay towards a final draft. You will post your essay on Moodle, by the due date, for your peer group to read and respond to online. You will also make copies of your essay for each of your group members for each editing session. See "Personal Essay Assignment" handout for details.

First draft is due: April 17 Second Draft is due: April 24 Final draft is due: May 1

3. An Academic/Expository, or Research Essay (3-5 pages) You will write a short thesis driven academic essay based on some aspect of your research project and interests for the quarter. You will have at least two editing sessions, outside of class, to develop your writing through drafts.

Individual or Collective Authorship? Though you are doing a group project, you will have an individual approach to your work. This essay is a chance for you to develop and share your individual ideas with a larger audience. However, in scientific research it is common for a group to collaborate and write a research paper or article together. Because this essay is based on your group research project, you have the option of working together to write an essay, as if you are writing a peer article. Each collaborator should be listed as an author. The question is: Do you want to work as individual writers, and edit each other's work, or do you want to collaborate on a collective essay?

Whether you are writing your paper as an individual, or as a group, you will revise your paper through three drafts, in peer editing groups, as described above. In addition, you will use all of the formal conventions of APA style and usage for documenting and citing your sources, and for formatting your paper, as outlined at the OWL. See "Academic/Expository, or Research Essay Guidelines" for details.

Due Dates: First Draft: May 15 Second draft: May 22 Final Draft: May 29

<u>Science and Observations</u>

4. **A Fieldwork/Observation Journal:** You will keep an observation and field journal in which you will draw and record your observations, ideas, and reflections throughout the quarter. You will be guided, through workshops, on how to effectively draw and record your observations under the night sky. You will date each entry, record titles and page numbers from the references you consult, along with other details, to help you keep track of your observations. You will also record your personal thoughts and reflections, and you can draw from your field journal for ideas as you develop your personal essay.

Participate fully in field-work: Each night, after class, we will do observations, weather permitting. Everyone will have a chance to set their own goals, to enjoy the stars, and to work with each other, and faculty mentors. You are also encouraged to set up stargazing events on your own.

5. Group Research Project: (Worth 2 credits)

You will work with a group to design and complete a research project and give your findings in a power-point or keynote presentation at the end of the quarter. Using the resources in our astronomy texts and workbook, and various virtual planetarium programs (Starry Night, Celestia, Stellarium), you will identify and develop a scientific research project. Consult the activities in *Engaging In Astronomical Inquiry*, as many of them (starting with #6) can be the basis for a good research project. You will continue to develop and refine your research over the quarter. All research projects will be scientifically rigorous, and projects geared towards a scientific/academic audience will use academic conventions to develop their research and final presentation. Research projects, with an educational or cultural focus, can integrate science, art, and humanities to communicate research findings to a general audience. In either case, your final project presentation, in power-point or keynote, will be of a professional quality that you could give at a scientific conference, or for educational or public programs. You will list the names of all group members, and will use the Purdue OWL to develop an effective presentation, including APA guidelines for references, resources, and research. As you design and complete your research project, you will keep track of notes and research in your portfolio.

Your group will give a presentation at the end of the quarter.
Keep all of your research notes in your portfolio.
You will post or link to your project on Moodle, AND print a hard copy for your portfolio.

Due: Tues. April 9th Research project Ideas. Final Presentation Due: May 30th or June 4th.

6. Star Stories: We will explore star stories and cosmological traditions during class. Find a star story that you'd like to tell informally at one of our evening stargazing sessions. You can choose a star-story from any culture or tradition, or make up one of your own.
Due: April 18, May 2, or May 16.

7. Astronomy Workbook/Homework Assignments:

Individual and Group Study: You will work with your group, individually, with our program tutor, or with faculty, to go through the activities in *Engaging In Astronomical Inquiry.* We will work on some of these activities in class, and others as the basis for your research project. Go through this workbook, at your own pace, and complete as many modules as you can, in conjunction with class lectures and workshops around our text, *Investigating Astronomy.* Set your goals, as an individual or a group and enjoy the process of discovery.

Final Reflection, Synthesis, and Analysis:

8. Academic Statement (750 words) We will address the writing of the academic statement in class, and you will edit your statement in your writing groups--both online and in person. This analysis and synthesis of your overall academic and learning goals is due at the end of the quarter. In the future, it will be required for registration for the coming academic year.

Due: May 8th, First Draft Final Draft: May 30th

9. Self and Faculty Evaluations: You will write self and faculty evaluations to reflect on and synthesize your learning for the quarter. What did you do? How did you do it? What difference did it make? Focus on major readings, themes, or experiences. Print three copies, on official forms, and sign them to include with your final portfolio, or exchange at your final evaluation conference. You are always free to leave the faculty evaluation with the program secretary, but it is required.

Due: In portfolio on May 30th or at final evaluation conference.

10. A Portfolio that includes copies all of your written assignments that are posted online, and outlined in assignments 1-8, above. You will turn your portfolio in for review in Week 5, when your groups meet with faculty for mid-quarter reviews. You will also turn it in on Friday of week 8 or 9?

Due: Week 5: April 30th Mid-quarter Review Week 9: May 30th Final Evaluation

11. Final evaluation Conference: Instructor's office,

Sign up to meet with the instructor for your final evaluation conference.

The cosmos is all that is or ever was or ever will be. Our feeblest contemplations of the Cosmos stir us—there is a tingling in the spine, a catch in the voice, a faint sensation, as if a distant memory, or falling from a height. We know we are approaching the greatest of mysteries.

— Carl Sagan,

***The scorn which I had reason to fear on account of the novelty and unconventionality of my opinion almost induced me to abandon completely the work which I had undertaken. . . . Astronomy is written for astronomers. To them my work too will seem, unless I am mistaken, to make some contribution*.**

— Nicolaus Copernicus,

VIII. Documenting your work Online AND in a Portfolio:

To document your work, and fulfill your obligations to our learning community, each student is required to post all of their written assignments on Moodle, and to keep a hard copy of all their work in a class portfolio throughout the quarter (which organizes all your work, and reflections on your learning). You will turn your portfolio in during the fifth week for review, and during the ninth week of the quarter for evaluation. It will be returned at your evaluation conference.

Include 1) your name, 2) a table of contents, 3) and record the **topic, number, and date of each** item in your portfolio. Each item, in each section, should be arranged chronologically. The portfolio must be kept in a loose-leaf three ring binder with dividers. Chronologically order and date your work, in the following way.

- Put your "Fieldwork/Observation Journal," in the front of your journal, for review.
- Title Page: include your name, course, faculty, dates, TESC, etc.
- Table of contents:
- Course syllabus, covenant, and all class handouts
- Notes on lectures, guest speakers, workshops, seminars, films, field trips, and in-class workshops.
- All weekly reflective essays, 1-7 (also posted to Moodle). Follow the format on "Response Essay" handout for each essay. NOTE: A section of reading notes is strongly recommended, particularly for those interested in doing upper division or future graduate work.
- Personal Essay (4-6 pages) final draft, second draft, first draft, and notes from peer editing workshops. NOTE: All drafts must also be posted on Moodle by their due date!
- Academic/Expository, or Research Essay, (3-5 pages(: final draft, second draft, first draft, and notes from peer editing workshops. NOTE: All drafts must also be posted on Moodle by their due date!

- ❖ Group Research Project and Presentation: Print a hard copy of your presentation for your portfolio. Then include your research notes, observations you make about your work, comments from peers during workshops, and notes for presentations. NOTE: Post your presentation files to Moodle with all group members names.

- ❖ Academic Statement, with final draft, and copies of revisions.

- ❖ Self and Faculty evaluations.

- ❖ Include your Astronomy Workbook in the back of your portfolio. Include any notes or handouts that you've made.

Most people say that it is the intellect which makes a great scientist. They are wrong: it is character.
--Albert Einstein

Relativity applies to physics, not ethics. --Albert Einstein

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IX. Expectations/(See Program Covenant for Details):

1. Faithful attendance and full participation at all class meetings, workshops, films, seminars, and field-trips. Please note –if you miss more than **one** class session you are in danger of losing credit. You must make up all work and assignments, unless excused by faculty. Communicate immediately with faculty if absence is necessary for any reason.

3. Writing expectations are of the highest quality, and students are encouraged to work with the campus Writing Center, and peer-editing groups as they develop their ideas through drafts and stages.

4. Maintain a portfolio of class handouts, notes, papers, research, workshops, and cumulative work for the quarter. These will be reviewed during the fifth week and week nine.

5. Computer and Internet access are required, and students will post work on a Moodle site each week, interact with peers in online groups, and make comments on writings, and reference assignments and readings, workshops, and other resources each week.

6. Full credit and a positive evaluation depend on timely completion and submission of assignments and regular attendance and participation in class.

7. As part of a learning community, group work is imperative to your success in the program and in life. Promote a cooperative, supportive atmosphere within the program; give everyone opportunity for self-reflection and expression. If you miss more than **one** commitment to your group (e.g. a team meeting, or reply to peer's essay) you are in danger of losing credit.

8. Members of our learning community should be engaged with, and demonstrate, the "Five Foci" and "Seven Principles" of good practice in an Evergreen Liberal Arts education: Five Foci http://www.evergreen.edu/about/fivefoci.htm, and Seven Principles <http://wikis.evergreen.edu/ews/index.php/Seven_principles>. Please review these, and keep them in mind as you work.

9. Comply with TESC Student Conduct Code
http://www.evergreen.edu/studenthandbook/oldbook/soccontr.htm