Syllabus

South Portland, Maine 04106

Physical Sciences Department

Title: Intro to Astronomy and Cosmology

Credit Hours: 4

Lecture/Lab

Office Hours – Location:
By appointment

Catalog Number: ASTR 100

Total Contact Hours: 80

Instructor: Professor Kevin Kimball

Contact Information:

kkimball@mainecc.edu

Course Syllabus

Course Description

Astronomy – and Cosmology – is Mankind's First Science.
When humans first looked to the sky and wondered about the true nature of what they were seeing, our quest for a scientific understanding of our place in the Universe began. That sense of wonder continues to this day, and Astronomy is now the last science in which citizen-scientists continue to make significant contributions.
This introductory course will outline the basic concepts of astronomy, its history, its scientific underpinnings, and how, in the last one hundred years, astronomy has inevitably led to the field of Cosmology.
Topics will include but are not limited to: Features of our Solar System, standard units of measurement used by astronomers, direct observation and recording of astronomical phenomena, optics, star formation, galaxies and nebulae, quasars, pulsars, black holes and the Universal Gravitational Constant, electromagnetism, basic wave theory, the Doppler Effect and the Red Shift, the Hubble Law, Special relativity, General Relativity and gravitational lensing, Inflation Theory and the Big Bang, Dark Matter and Dark Energy, KOBE and WMAP discoveries, historical figures in astronomy.
The course format emphasizes guided exploration, quantitative assessment, and critical thinking with particular emphasis of the Scientific Method; students are required to demonstrate an understanding of the material through independent research, written reports, and written examinations.
Prerequisites: ENGL-050, ENGL-075 and MATH-050.

Course Objectives:

Upon successful completion of the course, the student will be able to:

- Describe, in detail, the structure of the Solar System including the characteristics of individual planets, and other key objects (asteroids, comets).
- Demonstrate an understanding of standard measures used in astronomy.
- Articulate the development of astronomy from a geocentric model of the universe to the current model citing key historical figures and societal/cultural views and reactions.
- Explain, in detail, the scale and position of the Solar System relative to the Milky Way Galaxy, the Local Group, and the Universe.
- Describe, in detail, the life cycle of stars
- Use the universal gravitational constant to calculate escape velocity in order to explain the nature of a Black Hole.
- Explain how the Doppler Effect led to the discovery of Redshift and Dark Matter.
- Calculate the (1) distances of celestial objects and (2) approximate age of the Universe using the Hubble Law.
- Compare and contrast the concepts of Special and General Relativity.
- Calculate time dilation using Lorentz transformations to explain the physical obstacle to practical interstellar travel.
- Use quantitative methods to demonstrate why the speed of light is the absolute speed limit in the Universe and its role in defining the "observable universe."
- Compare and contrast the concepts of the "observable Universe" with the "expanded Universe."
- Compare and contrast the "Steady State" model of the universe with the "Big Bang" model
- Describe observed and measured phenomena that support "Big Bang" theory
- Describe "Big Bang" timeline

Topical Outline of Instruction

- A Peek at the Finish Line: Dark Matter, Dark Energy
- Math refresher (math skills needed to succeed in this course)
- Scale of the Universe, Astronomic Measures
- Historical Figures – How Did We Get Here?
- Kepler's and Newton's Laws: Gravity and Calculating Orbits
- Special Relativity, General Relativity
- Star Formation
- Variable Stars, Standard Candles
- Star Death
- Neutron Stars
- Black Holes
- Pulsars – Stellar Zombies
- Distance/Luminosity Modulus – How We Measure Astronomic Distances
- Doppler Effect, Relativistic Redshift, Measuring the Speed of the Expanding Universe
- Hubble Law, the Expanding Universe
- Big Bang

Course Requirements

This course will require the student to do extensive independent reading and study. In addition to regular quizzes and tests, there will be approximately twenty graded homework assignments that will be based on lectures, class notes, and required textbook reading assignments.

Student Evaluation and Grading

There will be quizzes approximately every 1-2 weeks. There will be a final exam. Quizzes will feature both closed-book and open-book/notes formats.
Completion of all lab assignments and Final Exam are required to pass the course.
Your final grade for this course will be based on a combination of the following assessments:

- Unit assignments/tests, Lab Assignments (75%)
- Lab Manual spot checks: lab manuals will be periodically spot-checked **without warning** and graded for completeness and entered in the gradebook as an assignment/quiz.
- Final exam (25%)
- **ATTENDANCE: Three excused absences from lectures are allowed; each subsequent absence will result in 1-point reduction in final course grade**

A: 90-100
B: 80-89
C: 70-79
D: 60-69
F: Below 60

MATERIALS FOR COURSE

REQUIRED, no exceptions:

ASTR 100 Intro to Astronomy and Cosmology Lab Manual, Kimball
(available at SMCC Bookstore only)

Scientific Calculator TI 30X II S
(**NOT** your phone!)

Access to a printer

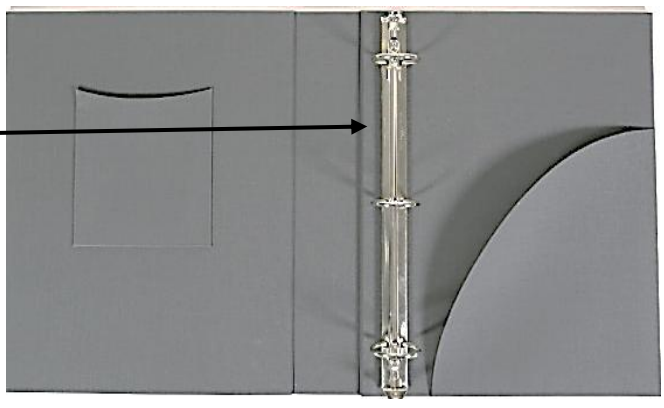
Ability to process Word/PDF documents

NOTE:
The use of cell phones, i-pads, laptops, earbuds, and any other electronic data-receiving/transmitting devices during in-class lectures and discussions
is expressly prohibited unless otherwise specifically authorized.

Text:

Discovering the Universe, 11e, Commins
Achieve with eBook + Physical (Loose Leaf) Copy, ISBN 9781319424398

STRONGLY recommended additional material:
Two (2) three-ring binders with
offset ring mechanism
(to reduce page tearing);
One each for Lab Manual and Text respectively
(Don't combine both into one notebook – you'll need to be able to cross-reference the two simultaneously)



- **Three excused absences from lectures are allowed; each subsequent absence will result in reduction in final grade:**

End-of-Course Evaluation

Students complete evaluations for each course attended at SMCC. Evaluations are submitted online and can be accessed through the student portal. Students can access the course evaluations beginning one week before the end of classes. The deadline for submission of evaluations occurs Monday at 5 p.m. following the last day of the class. You will receive an e-mail to your student e-mail account when course evaluations are available.

ADA Statement

Southern Maine Community College is an equal opportunity/affirmative action institution and employer. For more information, please call (207) 741-5798. If you have a disabling condition and wish to request accommodations in order to have reasonable access to the programs and services offered by SMCC, you must register with the Disability Services Coordinator, Sandra Lynham, who can be reached at 741-5923. Further information about services for students with disabilities and the accommodation process is available upon request at this number. Course policies about online testing are modified to suit each individual's accommodations.

The Learning Commons:

The library, tutoring and writing centers, and reference/research assistance (typically located on the second floor of South Portland's Campus Center and in the Midcoast's LL Bean Learning Commons and Health Science Center) will be fully available online during the fall 2020 semester.
Here you can find free academic support through individually scheduled and drop in, online tutoring. You can also find information literacy/research librarians, and professional academic strategy/planning mentoring online. While the physical space of the Learning Commons will not be available at this time, we can also work with you to set up zoom classrooms for small group study. Services are offered by appointment or as drop-in assistance.
To access services:

- Visit My Learning in My Maine Guide or
- Select the "tutoring needed" button if it appears inside your Brightspace course.

Whether On Site or Online, students have consistently reported that the Learning Commons is a friendly, risk-free, and helpful place to seek academic support. It has also been shown that those who make use of the Learning Commons do better in a course than those who do not. We strongly encourage you to take advantage of this valuable and enjoyable resource.

SMCC Pay-for-Print Policy

Each semester students receive a $20 printing credit. The balance resets at the end of the semester and any remaining credits are removed. The College's pay-for-print system monitors printing on all printers (including those in general access labs, library printers, Tutoring Services, Campus Center Lounge and technology labs). Be sure to log OUT of the system when you've finished your printing, to prevent unauthorized access to your account. Students can check the number of pages they have printed by using

the Printing Balance tool available on SMCC computers (located in the lower right corner of the screen, near the clock). Departments with work study students who need to print documents for the department should contact the Help Desk at 741-5696 to have a special account set up. To find ways to reduce your printing charges, please go to the IT Help tab on My SMCC. If you have questions about the pay-for-printing policy or your printing charges, please contact the Help Desk at 741-5696 or send an e-mail to helpdesk@smccme.edu.

Refunds

Print jobs are eligible for a refund in the event of mechanical or electronic error on the part of the printer, print server, or software used to submit the job. Jobs are not eligible for a refund in cases where the job was not set up correctly, was submitted multiple times, or the student is not satisfied with the result. To request a refund, please bring the offending print to the IT Department in the basement of the Ross Technology Center. Refunds will be granted in the form of a credit to the student's account.

Add-Drop Policy

Students who drop a course during the one-week "add/drop" period in the fall and spring semesters and the first three days of summer sessions receive a 100% refund of the tuition and associated fees for that course. Please note any course that meets for less than the traditional semester length, i.e., 15 weeks, has a pro-rated add/drop period. There is no refund for non-attendance.

Withdrawal Policy

A student may withdraw from a course only during the semester in which s/he is registered for that course. The withdrawal period is the second through twelfth week of the Fall and Spring semesters and the second through ninth week of twelve-week Summer courses. This period is pro-rated for shorter-length courses, usually 75 percent of course meeting times; please check with the Registration Office. To withdraw from a course, a student must complete and submit the appropriate course withdrawal form, available at the Registration Office. This process must be completed either in person or by using SMCC e-mail accounts.

Plagiarism Statement (To include on-line cheating)

If an instructor suspects that a student has knowingly committed a violation defined in the Maine Community College System Policy on Student Grade Appeals and Academic Misconduct, the instructor has the authority to review the alleged misconduct and determine the grade that the student should receive for the assignment and the course. The instructor may assign a failing grade for the assignment or course and may require the student to complete additional work for the course. The instructor may consult with the department chair and/or the College's chief academic officer prior to making such decisions. If a student seeks to challenge an instructor's determination, the student should submit a grade appeal. Grade appeal forms are available in the Advising Office on the South Portland Campus or in the administrative offices in the Learning Commons on the Midcoast Campus. An instructor may also refer the matter to the College's disciplinary officer for review under the procedures of the MCCS Student Code of Conduct.