ASTR 1002-11: Introduction to the Cosmos
SCALE-UP (Fall 2014)

Instructors: Prof. Oleg Kargaltsev (kargaltsev@gwu.edu)
Dr. Blagoy Rangelov (rangelov13@gwu.edu)

Office Hrs: Prof. Kargaltsev: Thursdays 3:00 – 4:00 pm
#311, 725 21st St, NW (Samson Hall)

Dr. Rangelov: by appointment

Class Hrs: *Tues/Thur* 6:00 – 8:00pm Monroe 111

TA: Raju Timsina, timsi1r@gwu.edu (4:00 – 5:00 pm in #311 Samson Hall).

OVERVIEW & COURSE OBJECTIVES

ASTR 1002 encompasses an exploration of our universe with a focus on improved scientific and mathematical literacy. This course is intended for non-science majors. There is no college prerequisite: high school science & math (basic algebra and trigonometry) are sufficient. There are two major goals to this course (with specific examples listed below):

1. **Learning basic astronomical concepts, structures, and processes.**
    - **a.** Concepts:
        - **i.** Laws of nature, e.g. Kepler' s Laws, momentum, energy, conservation laws, gravity, the electromagnetic spectrum
        - **ii.** Theories such as star formation, stellar evolution and "death", galaxy formation, Big Bang cosmology, dark matter and dark energy
    - **b.** Structures:
        - **i.** Atoms and molecules
        - **ii.** Stars
        - **iii.** Galaxies
        - **iv.** The Universe
    - **c.** Scientific Process:
        - **i.** For example: How do astronomers determine the mass, structure and chemical composition of various astronomical objects?, How do astronomers know that black holes actually exist?, How do astronomers develop theories of how the universe was formed?,
2. **Practicing basic problem solving (mathematical and conceptual) in an astrophysical context.**
    - **a.** Mathematical:
        - **i.** Basic algebra (e.g. $y = mx + b$, the equation of a line, or 'distance = rate × time', using given equations to solve for unknown values)
        - **ii.** Basic geometry (surface area and volume)

b. Conceptual:
  - **i.** Scales and conversion factors (e.g. sizes in scaled models, light-years to meters conversion)
  - **ii.** Reasoning/thought problems (applying a law or theory to explain something)

SCALE-UP

The SCALE-UP classroom emphasizes more student centered group-learning and less traditional oratory & lecture. Students learn more in classes where they interact with faculty, collaborate with peers and are actively engaged with the material they are learning. ***The SCALE-UP classroom demands more of students than a traditional lecture class, as you will be expected to be familiar with the basic material prior to class.*** Unlike the traditional lecture-based class in which the instructor repeats the material that is already adequately described in the textbook, SCALE-UP class time can be dedicated to fostering a fuller understanding of the material and learning how to apply that knowledge to novel situations (such as solving problems). ***The payoff for the student is (1) improved conceptual understanding of the material, (2) advanced problem-solving skills, and (3) improved team-work skills.***

GRADING

Your final <u>numerical</u> course grade will be calculated as a weighted average of:

5% Chapter Reading Check Ups (C-RCUs) [*TurningPoint clickers*]
5% Lab Reading Check Ups (L-RCUs) [*TurningPoint clickers*]
10% Labs & Workbook
5% Astronomy Project Presentation [in class]
15% Homeworks [*MasteringAstronomy.com*]
35% 2 Mid-Term Exams
25% Cumulative Final Exam

Numerical course grades translate into <u>letter</u> grades using the following scale:

≥ 94.00	**A**	70.00 – 73.99	**C**
90.00 – 93.99	**A-**	66.00 – 69.99	**C-**
86.00 – 89.99	**B+**	61.00 – 65.99	**D+**
82.00 – 85.99	**B**	55.00 – 60.99	**D**
78.00 – 81.99	**B-**	50.00 – 54.99	**D-**
74.00-77.99	**C+**	≤ 49.99	**F**

EXAMS

Exams will be held during regularly scheduled class time (though in an different location, TBD). *No make-up exams will be given.*

The Final Exam will be given on a date and time TBD. The Final Exam is **<u>mandatory</u>**. *No make-up Final Exams will be given* (except in the event of a Final Exam "hardship" – e.g. a student with more than 3 Finals scheduled on a given day – if you are declaring a hardship you must

contact the instructor by the end of **October** to make alternative arrangements). *Do not make end of semester travel plans until after the Final has been scheduled by the registrar's office.*

CLASSROOM PARTICIPATION

This course is being held in a classroom (Monroe 111) that is specially designed for active learning. We will spend time in small group activities such as scientific/mathematical exercises, laboratory experiments, group projects and discussions. ***Everyone is expected to attend class and actively participate***! This is essential for SCALE-UP classes. Working actively on the material during class time is critical to understanding the concepts being discussed and to improving critical thinking and quantitative reasoning skills. Equally important is ***reading the textbook material before*** the class, not during the class.

When working in a group, please be respectful of your group-mates. Be patient! Get to know each other. Be sensitive to other group members' ideas, thoughts and opinions. It might be helpful at times to assign specific roles to each group member, such as a group leader and a group note-taker**. Be sure to stay on task!** Do not be afraid to speak up and ask question of your fellow group-mates. If you see another member of your group struggling to understand a concept, take the time to teach them the concept before plowing ahead; your will both benefit because teaching someone a concept is a great way to really internalize the concept for yourself.

ATTENDANCE

Because in-class participation is a critical component of this course, attendance is mandatory. **You will lose 5 Lab/Workbook points for every absence (excused or unexcused).** Since absences are occasionally unavoidable, there will be ongoing opportunities to gain extra credit toward your Lab/Workbook score, however…

Missing more than 4 days of class (for any reason) will result in a 0% for the entire Lab/Workbook portion of the class: the lab/workbook, the Lab-RCUs and the Astronomy Project. This represents 20% of the final grade, so that students who are absent for more than 4 days will be unable to earn higher than a B- in the course.

Missing 7 or more days of class will result in a failing grade (F) for the semester.

There are no make-ups for RCUs (Chapter or Lab). If you are absent or tardy on a day when an RCU is administered, you will *not* receive any credit for that RCU. You will also not receive any points for RCUs if you fail to bring your *TurningPoint Clicker* to class.

REQUIRED MATERIALS

1. The textbook: Bennett, Donahue, Schneider & Voit. "*The Cosmic Perspective"*, **7th** Ed. San Francisco: Addison-Wesley, 2013 (ISBN: **978-0321839558**).

2. Students must also obtain a "Student Access Code" to access *MasteringAstronomy* on the web (http://www.masteringastronomy.com/). This generally comes

bundled with the textbook, but may also be purchased separately online.

3. The ASTR 1002 Laboratory Manual, available only through the GWU Bookstore.

4. The ASTR 1002 SCALE-UP Workbook, available only through the GWU Bookstore.

5. You must bring a *stand-alone* scientific calculator to class. No cell phone or computer-based calculators are permitted.

6. A **TurningPoint Response Card** (see image below), this is informally called a "clicker," which will be used to answer in-class RCU questions (as well as other questions during class). These clickers are available through the GWU Bookstore (be sure to buy a *TurningPoint* clicker and not any other brand). The clickers are also the primary mechanism for tracking attendance – your must bring your clicker to class each day and it must be associated with you via BlackBoard registration:

COMPUTER/CELL PHONE POLICY

Personal laptops and cell phones are forbidden in class. You will not be "taking notes" as in a traditional lecture class, so you will not need a personal laptop for heavy note taking during class. If you use a cell phone or personal laptop during class, you will be asked to leave class and not return that class period, resulting in an unexcused absence. Do not rely on your cell phone for calculations. If you have a legitimate reason for needing a laptop during class time, please speak to the instructor.

HOMEWORK ASSIGNMENTS

Homework is assigned both as a way to help you learn the material being covered and as a way for you to explore new material independently. Expect to spend between 1 and 2 hours on homework most weeks, in addition to chapter reading. You will fall behind very quickly if you do not complete work as it is assigned. To that end ***NO LATE ASSIGNMENTS WILL BE ACCEPTED***. All the homework assignments will be available for you from the very start of the semester. *Therefore, getting sick or having an emergency the day the HW is due is not a valid excuse for not completing the HW*. **Don't wait until the last minute!** Homework will be assigned and completed on Mastering Astronomy's website (www.masteringastronomy.com). Registration requires a Student Access Code (which will come bundled with your textbook or can be purchased separately online). Students are encouraged to discuss course material outside

of class, and may help each other with homework assignments. However, copying or cheating of any kind will not be tolerated and will result in Integrity Code violation charges for all involved students and zero credit on the entire homework portion of this course (15% of the final grade).

***** The MasteringAstronomy Course ID for this class is: FALL2014ASTR100211 *****

All homeworks are due at 23:59 on **Fridays**. Consult the MasteringAstronomy.com website for a full calendar of HW due dates.

Additionally, you will complete a group Astronomy project which will result in a presentation given to the class.

EXTRA CREDIT

There will be a number of opportunities through the semester to gain extra credit. Further details of these extra credit opportunities will be provided during the semester (or posted on BlackBoard). These extra credit assignments can, at maximum, boost your final grade by 1.5%.

ONLINE RESOURCES

The course webpage is on the Blackboard system (http://blackboard.gwu.edu/). Course announcements will be posted on this site. Any PowerPoint slides shown in class will be made available online *after* each class. Grades will be posted in the Bb Gradebook on a regular basis.

ACADEMIC INTEGRITY

Under GW's Code of Academic Integrity, academic dishonesty is defined as "cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and fabrication of information." Note that plagiarism covers both *words and ideas*—be sure to use proper citations for both! You may find more information about the GW Academic Integrity Code at http://www.gwu.edu/~ntegrity/code.html.

ABOUT YOUR INSTRUCTORS

Prof. Oleg Kargaltsev is a research and teaching faculty at GWU. He does research in high-energy astrophysics studying neutron stars black holes and extreme explosions in our Galaxy. Prof. Kargaltsev uses Hubble Space Telescope (NASA), Chandra X-ray Observatory (NASA), the X-ray Multi-Mirror Mission (ESA), and Suzaku X-ray Observatory (JAXA) and to study the physics, evolution, and properties of the compact and high-energy objects. He authored or co-authored more than 100 research papers and serves as a Principle Investigator of many observing programs on the above mentioned international space missions. Kargaltsev's other interests include science philosophy and science policy, logical and mathematical puzzles, independent movies, cooking, and science fiction.

Dr. Blagoy Rangelov is a junior research faculty at GWU. He works on studying interacting binary stars (both in our galaxy and outside), pulsar winds, and Very-High Energy gamma-ray sources using space telescopes. Dr. Rangelov is a Principle Investigator on Chandra X-ray Observatory (NASA) and the X-ray Multi-Mirror Mission (ESA) programs and an experienced astronomer working with the optical telescopes including the Hubble Space Telescope (NASA). He likes to spend his free time enjoying a good book, photographing interesting places and events, playing chess occasionally and star gazing.

Schedule & Important Dates:

HW*	Ch	Topics	Tuesday		Thursday	
#1	1	Perspectives, Science	**Aug 26**		**Aug 28**	
#2	4	Physical laws	**Sep 2**	CH 1 & 4 RCU **	**Sep 4**	*(Article Discussion introduction, Astronomy Project Prep.)*
#3	5	Light	**Sep 9**	CH 5 RCU	**Sep 11**	*Article Discussion #1* Lab 1 RCU: Light Intensity
#4	S4	Quantum Mechanics	**Sep 16**	CH S4 RCU	**Sep 18**	*Article Discussion #2* *(Astronomy Project Prep.)*
#5	14	Our Sun	**Sep 23**	CH 14 RCU	**Sep 25**	*Article Discussion #3* Lab 2 RCU: Observing the Sun
#6	15	Stars	**Oct 30**	CH 15 RCU	**Oct 2**	*Article Discussion #4* Lab 3 RCU: Stellar Spectra
#7	16	Star birth	**Oct 7**	CH 16 RCU	**Oct 9**	EXAM #1 (Ch 1, 4, 5, S4, 14, 15, 16)
#8	17, S2	Star death, Spec. Rel.	**Oct 14**	CH 17 & S2 RCU	**Oct 16**	*Article Discussion #5*
#9	S3, 18	Gen Rel., WD/NS/BH	**Oct 21**	CH S3 & 18 RCU	**Oct 23**	*Article Discussion #6* *(Astronomy Project Prep.)*
#10	19	Galaxies	**Oct 28**	CH 19 RCU	**Oct 30**	*Article Discussion #7* Lab 6 RCU: Galaxy Zoo
#11	20	Galaxies	**Nov 4**	CH 20 RCU	**Nov 6**	*Article Discussion #8*
#12	22	Big Bang	**Nov 11**	CH 22 RCU	**Nov 13**	EXAM #2 (Ch 17, S2, S3, 18, 19, 20)
…	23	Dark Matter & Energy	**Nov 18**	CH 23 RCU	**Nov 20**	Lab 7 RCU: Supernovae Type Ia
…	23	Fate of the Universe	**Nov 25**	Astronomy Project Group Presentations (**attendance required**)	*Nov 27*	*(NO CLASS, Thanksgiving)*
#13			*Dec 2*	*(NO CLASS, Make-Up Day)*	**Dec 4**	EXAM #3 **(Cumulative)**

* All homeworks are due at 23:59 on **Fridays**.
** Chapter and Lab RCUs are administered at the beginning of class using the *TurningPoint* clickers. There are no make-ups for missed RCUs.

Dear Faculty, Staff and Students:

The Department of Physics at George Washington University is dedicated to ensuring that students have the best academic experience and get the most out of their education. In order to accomplish this, it is essential that we adapt teaching and learning styles to the ever-changing world.

In the Department of Physics, we do this by analyzing and researching different ways of teaching; what works best, what elicits enthusiasm in students, and how these techniques translate into academic achievement. We conduct ongoing analyses of instructional methods by examining enrollments in physics courses, and by reviewing the grade trends and the valuable survey responses from faculty, staff and students. This research is limited to the review of records, both present and past. We will not request additional effort to be submitted by any member or student of the Department of Physics. You will not be asked to take additional exams, to complete surveys beyond those usually employed or to carry out any supplemental work in order for this research to take place.

No analysis is done with any particular single individual in mind. All analyses are done in an aggregate manner and no identifying information will be published or presented.

If you do not wish to be included in such research, please contact Prof. Raluca Teodorescu (rteodore@gwu.edu) to express your desire to decline participation in such research.

Thank you for your continuing support in our educational growth and development.