

**Topics at the Frontier of astrophysics**  
**AST 353: unique course id – 47990; carries Quantitative Reasoning Flag**  
**Professor Pawan Kumar**  
**T-Th 12:30 P.M. – 2:00 P.M.**  
**Online (Welch 2.310)**

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- **INSTRUCTOR:** Pawan Kumar – Professor of astrophysics, specializing in exploding stars  
Email: pk@astro.as.utexas.edu      **Web:** surya.as.utexas.edu
  - **TA:** Catherine Manea, graduate student, Astronomy
  - **Grader:** Rian Robison (undergrad student majoring in astro/phy)
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**Books (none of these are required)**

1. Astrophysics in a Nutshell, Dan Maoz (suggested)
2. Cosmology: The science of the universe, Edward Harrison (suggested)
3. An Introduction to Modern Cosmology, Andrew Liddle (suggested)

**Course Description**

The goal of this course is to learn about exciting discoveries in astronomy and topics at the forefront of current research. The list of topics we plan to explore together are –

- Cosmology: the big bang origin of the universe, expansion and the future of the universe, dark matter and dark energy, the theory of cosmic inflation and what happened before the big bang, formation of stars and galaxies etc. [12 lectures]
- Einstein’s theory of gravity or general relativity, black holes and gravitational waves [8 lectures]
- Powerful explosions and transients: gamma-ray bursts (the death and explosions of massive stars), stars falling into black holes (TDE) and the last signals we have detected from these catastrophic events, fast radio bursts from exotic objects [5 lectures]
- Exoplanets: finding planets outside the solar system, their properties and the search for life around other stars [2 lectures]

**Grading**

There will be one Final Exam in this course. The grade will be based on homeworks (20%), pop quizzes and class participation (25%), **two term papers** (40%), final exam (15%)

The term paper should explore a current topic in astrophysics in depth. The length of the term paper is expected to be between 7 and 10 typed pages, single spacing. **The due date for the first term paper (initial draft) is October 11, and the final draft of the first term paper**

will be due on October 28. The head-TA will provide comments on the first draft and a tentative grade. The 2nd and the final draft of term paper 1 will be assigned the final grade. The due date for the second term paper (the 1st and the final draft) is December 1.

- **HW submissions and late submission policy:**

Please upload your HW solutions (pdf files) to canvas under the appropriate Assignments. The official solutions will be posted on Canvas one week after the due date. The percentage of HW grade lost when a submission is late by "Nd" days is  $15 \times Nd$ .

- **Review process for term papers:**

For the first term paper, the head-TA will provide feedbacks and tentative grades (via Canvas) within a week after the due date of the term paper. Late submissions (of the first draft) are not considered for review. You can improve your term-paper grade by submitting a revised version to the head-TA before the deadline for the final draft. Please make sure that you describe all the changes you have made to the term paper to address the comments/feedbacks provided by the head-TA; these changes should be described in a typed letter addressed to the head-TA, and attached to the front of the revised term paper. BTW this is a standard practice all scientists follow when they submit their manuscripts to a journal for peer review and publication of their discovery. Because of the end of the semester time crunch no feedback for term paper number 2 will be provided.

Plus/minus grading will be used for the final grade: 59.0 – 63.6 D-, 63.7 – 66.6 D, 66.7 – 69.6 D+, 69.7 – 72.6 C-, 72.7 – 76.6 C, 76.7 – 79.6 C+, 79.7 – 82.6 B-, 82.7 – 85.6 B, 85.7 – 88.6 B+, 88.7 – 92.0 A-, >92.0 A; **this is only an approximate guideline – the final grade will be based on the class performance curve at the end of the semester when all the numerical grades are available.**