An important lesson I want you to take away from this class is the ability to read and enjoy popular astronomy articles. You aren’t expected to understand every little detail of the article, but you should be able to relate it to what we’ve learned in class this summer.

With this goal in mind, you will be writing a research paper on a popular astronomy topic, chosen from the list below. To complete your research you can use the internet, the class textbook, and popular astronomy magazines such as Science, Sky & Telescope, Astronomy, and Scientific American. Many of these have databases online, which should make researching easier. Also note that some of these websites require a subscription, but they should be accessible if you’re on the UC Berkeley network. News stories from CNN and online newspaper sites may also be helpful.

Your paper should be THREE, double spaced pages, typed with 11 point font, and you should have at least THREE CITATIONS. If the resource is a webpage, please include the webpage title and URL. You may use Wikipedia to get started and find other resources, but Wikipedia should NOT be one of your 3 citations.

The paper will be mainly graded on how well you present the opposing viewpoints of your topic, and whether you argue your opinion convincingly. There is no correct answer, but you definitely need to think critically about your subject. The paper will also be graded on the appropriateness of your citations and the writing quality. It doesn’t have to be perfectly polished, but it should be readable, have well-argued opinions, and be spell-checked. No plagiarizing will be tolerated, either from your peers or from the internet. Everything should be written in your own words.

Please choose ONE of the following six topics:

**Topic 1: The Incredible Gamma-ray Bursts**

Gamma-ray bursts (GRBs) are amazing flashes of gamma-rays that are seen in astronomy. They were first detected in 1967 by the Vela satellites, which were actually put in space to monitor whether the Soviet Union was performing nuclear weapons testing. When it was realized that these bursts came from outer space (and not the Earth), astronomers were very excited, but confused—what could be creating such energetic flashes of light? New GRB detectors in the 1990s and 2000s gave us a better understanding of what these events are. This is now one of the most exciting fields in astronomy. There are now thought to be multiple classes of GRBs. Choose TWO of these classes and discuss their properties. What are their origins? Where are they located in the Universe? Are they from the Sun, from other planets, from our Milky Way Galaxy, or from other galaxies? What are the progenitor objects that give rise to each class, and what evidence is there for these progenitors? How often are GRBs now seen? Describe how energetic GRBs are in terms of other things we have discussed in class. GRBs are so energetic in fact that if one occurred close to the Earth it could have dire consequences. How close would a GRB have to be to impact the Earth? What would be the result? How often may this occur? In your opinion, is this something society should be worrying about? Please provide support for your conclusion.

**Topic 2: Astronomy and Its Influence on Civilizations**

Astronomy has had an important influence on many aspects of past civilizations. For example, it influenced the development of the modern calendar, was important for ocean navigation, and the Greeks incorporated the planets into their mythology. Summarize THREE different ways in which astronomy has...
affected civilizations (using examples different from the ones I used above). Was the influence of astronomy positive or negative in each case, and how long lasting was it? How important were scientific advances for allowing astronomy to be influential, or did the influence of astronomy in fact lead to scientific advances?

**Topic 3: The Year of Astronomy**

This year, 2009, has been named the International Year of Astronomy. In honor of this, a number of events are being held all over the world to celebrate the advances made in astronomy, as well as to help spread information about astronomy to the general public. Pretend that you’re on the committee that is deciding how to celebrate the International Year of Astronomy. What are THREE important recent discoveries in astronomy that would be exciting to the general public? Give a short summary of each one, as well as an argument for why this discovery is of general interest. The other important aspect of this celebration is outreach and education. Explain one way in which astronomers can do a better job of educating the general public about their field.

**Topic 4: Is Pluto a Planet?**

On August 24, 2006, the International Astronomical Union (IAU) changed the definition for a planet. This new definition now excludes Pluto, which was considered a planet for almost 80 years (Pluto is now a “dwarf planet”). Research and summarize the IAU’s definitions for a planet and dwarf planet. Do you agree with the IAU’s decision? Explain why or why not. Next, pretend you are a member of the IAU, and suggest a new definition for a planet that WOULD include Pluto. Your definition can include criteria based on a number of factors, including (but not limited to) shape, mass, radius, distance from the sun, composition, or number of satellites (moons). How many planets would our solar system have using your definition? Look up the properties of some of the major asteroids, comets, and “trans-Neptunian” (Kuiper belt) objects. Would any of these objects be considered planets according to your definition?

**Topic 5: The Mysterious Dark Matter**

By studying cosmology, galaxy rotation curves, and gravitational lensing by clusters of galaxies, we know that approximately 90% of the mass in the Universe is “dark matter.” In other words, it is material that does not emit or reflect light, and it is only observable indirectly via its gravitational influence on other things that we can see. This is an outstanding problem in astronomy (and all of physics), since we really don’t know what this dark matter is. Some proposed dark matter candidates include WIMPs (weakly interacting massive particles), neutrinos, MACHOs (massive compact halo objects), primordial black holes, and axions (a hypothetical elementary particle). Research THREE possible culprits, and summarize the main properties for each one. If you were going to design an experiment to detect one of these dark matter candidates, which one would you go for? Your analysis should include the cost and feasibility of the detector, whether or not the experiment/detector would have to be in space, how specific the model predictions are about observable properties (models that don’t make specific predictions aren’t very useful), and how conclusive any detection (or non-detection) by this experiment would be in solving the dark matter problem.

**Topic 6: Heaven and Earth Collide**

Something that has been in the popular media recently is the concern that a near Earth object (such as an asteroid or comet) could collide the Earth. This has clearly happened in the past, and could be catastrophic for life, as demonstrated by the extinction of dinosaurs and many other animals 65 million years ago. How seriously should we be worrying about near Earth objects? Summarize TWO events from the past where the earth was hit by a celestial body. What kind of object was each? What was the consequences of the impact? Next discuss what measures are currently underway (either ongoing or in the planning stages) to prevent or alert us of a future catastrophe. In your opinion, which of these are most effective? In your analysis please consider the cost of each, the effectiveness of alerting us to an impact, and the time over which each will be useful in comparison to the occurrence rate.