Announcements

- **Reading quiz.** There is no reading quiz due for tonight, Thursday November 19. The next one is due next Tuesday night (November 24) at 11:55 PM (see assignment below). It is available to take at the textbook website.

- **Class next Tuesday!** Note that there will be class next Tuesday, November 24 (i.e., the Tuesday before Thanksgiving). Since this class will cover some conceptually difficult material (i.e., general relativity and what it would be like to take a trip to a black hole!), it is strongly recommended that you attend.

- **Exams returned next week.** Your second midterm exams are being graded, and will be returned to you in class next Tuesday, November 24.

### Reading Guide and Homework Assignment

(On-Line Reading Quiz #9 Due: Tuesday, November 24, 11:55 PM)

This week’s and next week’s reading is all about black holes and Einstein’s conception of **gravity**, as embodied in his general theory of relativity. The material presented here is among the most conceptually difficult that you shall encounter in the entire course. Of all of the weeks to be sure to attend lectures, I believe this one to be about the most critical. You will no-doubt notice that the text uses somewhat different examples than I did in class – this is on purpose! By being presented a number of different examples that all lead to the same conclusions, I hope you will be able to better grasp the difficult concepts enshrined in the general theory of relativity. Note that while we will be covering all of the material in Chapter 15, the reading assignments skip around quite a lot in order to follow the presentation order in class.

1. **Text — Chapter 15, Section 15.1.2: The Paths of Light and Matter.**
   Start by finishing up section 15.1 here, by seeing how elegantly Einstein applies the Principle of Equivalence to derive that light should have its path “bent” by gravity.

2. **Text — Chapter 15, Section 15.2: Spacetime and Gravity.**
   In this section, your authors attempt to build up an understanding of “spacetime”, a topic that we only briefly covered in class, so be sure to read this part thoroughly. Then, later on in §15.2.2, comes the description of the distortion of “spacetime” around massive objects that is predicted by the general theory of relativity. Remember, though, that the “embedding diagrams” that are shown, such as the one in Figure 15.6, are just displaying the distortion of space; time is also distorted by the presence of mass, but this distortion cannot be displayed in such a diagram.

3. **Text — Chapter 15, Section 15.3: Tests of General Relativity.**
   As discussed in class, there are a few classic tests of Einstein’s general theory of relativity which, to date, have all been successfully passed. This section describes the first two of them: The advance of the perihelion point of Mercury’s orbit, and the deflection of starlight by the Sun.

4. **On-line reading quiz (Due: 11:55 PM, Tuesday, November 24):** Take this week’s reading quiz by clicking on the “Quiz 9” assignment at the on-line textbook web-site.
BLACK HOLES
Gravitationally speaking, we wouldn’t feel change

I am constantly amazed by the misinformation fed to the public about black holes. Your June 13 editorial “Einstein had it right” did little to help. Characterizing black holes as “gravitational monsters” with “ravenous appetites” tends to obscure a basic tenet of physics: The amount of gravitational attraction one object exerts on another depends only on the masses of the objects and the distance between their centers.

Black holes are no exception. If our sun was suddenly replaced by a black hole of equal mass, absolutely nothing would happen to Earth gravitationally. It would continue orbiting this black hole once per year, just as it did the old sun. We would not be “steadily sucked out of our beds” any more than we are now.

What’s more, current theory suggests that a black hole of this mass, if left to its own devices, would actually evaporate in several billion years.

There is really no reason to believe that “the less we think about black holes, the better we feel.” Rather, separating fact from fiction reveals one of Nature’s most fertile laboratories for challenging everyday notions of time and space, and the careful investigator may well find truth more wonderful and mind-boggling than sound-bites.

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(And just why was your professor so upset on July 4, 1994?)