AST 309L Scalo TTh12:30
Reading assignments, lecture schedule (tentative), and end of chapter suggested problems for Part I of the course, leading to Exam 1.

Chapters 10 and 11 contain the most unified and substantial material for the first part of the course, and will comprise the most numerous questions on the exam (and the most pages you read). You should consider the earlier readings and lectures as building the background you need to understand 10 and 11 (they are not easy chapters). The main questions have to do with what conditions make for a certain kind of (Earth-like) "habitable" planet (ch. 10), and how we can detect planets in general, today, and Earth-like planets, if they exist, in the near-future (ch. 11). Ch. 11 also discusses how we might detect signs of life on such distant planets. When you read the earlier material, notice how they are related to the topics in 10 and 11, which have to do with the kinds of light we should detect from extrasolar planets, matter in solid, liquid, and gaseous form (phase changes), planetary orbits and how we can get masses from orbital motion, and the types of stars at which we should direct our searches for habitable planets. I urge you to look through 10 and 11 as soon as you can, so you will be more motivated to read the "boring physics and astronomy" in chapters 2 and 3. The kinds of answers we obtain from the presentation in chapters 10 and 11 allow us a rough guide to the factor having to do with planets and habitable planets in the Drake equation, our guide to the conditions that have to exist in order that we might detect signs of life or intelligence in the universe—that is why we begin with sec. 12.1.
For end of chapter questions, RQ = "review questions" QQ = "quick quiz" Quantitative = "Quantitative problems."

◆ *Sept. 2*
Lecture 1. Drake equation (sec. 12.1) The Drake equation is only a (valuable) organizing device. Don't worry about "solving" the equation, but understand its implications.
Independent probabilities get multiplied—most factors in the Drake equation are probabilities (e.g. the probability a habitable planet will develop life). Think of a series of events that might be improbable *because they are independent events.* Do you think the factors in the Drake equation can be considered nearly independent? →You should be able to explain why, if we have any hope of contacting a neighbor civilization, the average lifetime of a civilization must be *extremely* long ~ $10^5 - 10^6$ yr.

This course is almost entirely an exercise in "convergence vs. contingency"—understand what these words means. Try to think of important, even life-changing, events in your life, and consider if they seem mostly contingent or convergent. Here are some related words related to each view of the world.

Particularity		Determinism
Randomness		Universality
Chaos	⟷	
Free will		Fate, Inevitability
Contingency		**Convergence**

Ch. 12 end of chapter questions: RQ 1,2; QQ 25, 26, SHORT answer/essay 36. *If you understand the point of the Drake equation, you'll be able to answer it.*

◆ *Sept.4*
Lecture 2A Brief survey (secs. 1.1, 1.2, .1.3, 1.4)
Main Themes (very brief)—*know what our subject is about*
➡Why think "life" is reasonable? (Convergence of biology).
A few reasons: Chemical elements. Common features of life on Earth.
➡ Planetary science: Formation (what is a theory?), extrasolar planets (how to get masses? Review Kepler's 3rd law here), habitable worlds (why a planet? Why water? Why an atmosphere?)
➡ Do we expect biology to be universal? (Convergence?)
` ➡ Where and how to send or receive signals? Biosignatures, intelligence signaling? (Convergent cognition?)
Ch. 1 end of chapter questions: RQ2, 4-7, 10; QQ 11, 12, 14, 17, 19; Web project 24 or 25?

◆ *Sept. 4/Sept. 9*

Lecture 2B. Physics you'll need (Chapters 2, 3)

Ch. 2. History—skip. Just read Copernican revolution and Kepler (2.2)

➡ How does Kepler's 3rd law give us a way to detect extrasolar planets?

Gravity and theories (2.4)

Ch. 2 end of chapter questions: RQ 16, 17; QQ 31, 32;
Quantitative: 52-55: Just see how you would set these up, don't calculate answer. However, you should be able to answer 56.

Ch. 3.

➡ Sizes, distances, time (3.1, pp. 49-57)

➡ Elements from stars [and in interstellar medium] (62-65, 71-80) *Do you understand why this favors convergence?*

Objects in our solar system (3.3, notice Earth's uniqueness: ***In what way(s) is it unique***?)

➡ EZ intro to planet formation theories (3.3) – convergence to Earth-like planets?

➡ Review of physics needed for rest of course – **light, wavelength ranges; Wein's law; phase changes**

We won't spend much time on this review material, but you will have to read it and I will test you on it, in the context of astrobiology. Purchase an old beat-up astronomy text if rusty.

Ch. 3 end of chapter questions: RQ 8, 12, 14, 16, 17, 21, 22; QQ 39, 43, 44.

Be sure to read through the following *before* lecture! *Chapters 10 and 11 are the substantial material for the first part of the course and will comprise the most numerous questions on the exam.*

◆ *Sept. 9, 11*

Lectures 3 & 4 Evolution of habitability (Chapter 10 + 11.1)

➡**10.1** Habitable zone location (3)

10.2 Venus as example—what went wrong? (3)

➡**10.3** Surface habitability (4)

10.4 Future of life on Earth. ***Skip 10.5***

➡**11.1** (phases of stellar evolution, properties, spectral types, stellar masses and lifetimes. *Which stars would make suitable stars for planets with life?*),

Ch.10 end of chapter questions: **RQ 1-14, QQ 29-36; Quantitative: just try 48, 49. Will go over in class.**

◆ *Sept. 14/16*

Lectures 5 and 6. Extrasolar planets—detection and biosignatures (Ch. 11.2, 11.3) *Much* more detail in lectures if time; possible outside reading assignment; "homework assignment" –will be on exam.

About 1/3 of first exam will be on this topic if we get through it.

11.2 Extrasolar planets and biosignatures

11.3 Rare Earth? Could the Earth be nearly unique? **Skip 11.4.**

[Depending on time available, we may have to postpone 11.2 and 11.3 to the 2nd exam material.]

Ch. 11 end of chapter questions (lots): RQ 3-14; QQ 28-35; Quantitative 49-53—Just think about how you might do these, what formulas you would use, but you won't have to actually plug in numbers.

.....Our first exam will occur here (Thurs. Sept. 18) .....