

# 3:30pm

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## PHYS-1060 (2) Introduction to the Stars and Galaxies (CRN: 40353-Kaldon) Western Michigan University

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Class: T R 3:30-4:45am 1104 Rood Hall  
Office Hours: Tu Th @ 11am-3pm or by appt.

Fall 2009  
Version 2.03b

<http://homepages.wmich.edu/~kaldon/classes/ph106-2.htm>

PHYS-1060 has a Laboratory Component – You Must Register for PHYS-1050 separately.  
Your Lab starts the week of Monday September 14<sup>th</sup>; check outside lab door.

For Some of You, PHYS-1060 is the Physics and Astronomy Course You Missed in High School So Attendance is NOT Optional.  
BUT... There is Nothing to Be Scared of – We WILL Get You Through This!

NOTE: We only meet two days a week. One of those days is Tuesday and another one is Thursday. You do NOT want to try to extend your weekends and cut class.

**Three-Times Rule:** It is University policy that the number of times a course can be taken is limited to three (including withdrawals). A student whose current enrollment is in violation of this policy must drop this course as soon as possible and no later than the deadline for no refund of tuition.

**C-or- Better Requirement:** It is Department policy that a grade of “C” or better in a prerequisite course is required before enrollment is permitted in the next-sequence course. A student who does meet this requirement must drop this course as soon as possible and no later than the no-refund deadline.

**Textbook:** *The Essential Cosmic Perspective* / Jeffrey Bennett, Megan Donahue, Nicholas Schneider, Mark Voit (5th Edition) [hereafter known as “BDSV”]

**Supplies:** A standard inexpensive calculator is recommended. One with trig functions (sin, cos, tan) will prove useful, but there is no need to spend \$\$\$ on a fancy graphics calculator, if you have no need for one in another course. (We can help teach you how to use this tool.)

**Math Level:** It is perfectly normal to approach a course such as PHYS-1060 with a certain level of math anxiety. Science so often appears as a numbers game, yet there is a lot of information contained in those numbers. We will work toward a reasonable proficiency of reasonable calculations, consistent with the course content and the abilities of the class. Rote memorization of complex formulas is not part of this course.

**Prerequisites:** MATH-1100 or equivalent. A previous high school knowledge of algebra, and some geometry and trigonometry is expected for this course, but we will go over the details in class. Since Physics is a kind of applied mathematics, many students feel uncomfortable about Physics because they are uncomfortable about their math skills. Although we do not have time to extensively review mathematics in this course, help is available on campus! Don't delay if you need help.

Note: This Syllabus is Updated from files for previous semesters and previous courses. Every attempt has been made to keep it current to the Fall 2009 Semester and PHYS-1060 at Western Michigan University. Please Report any errors or inconsistencies immediately to Dr. Phil.

PHYS-1060(Kaldon-2)

Fall 2009

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### Significant Dates:

Sep. 7 Mon	- Labor Day (No Classes)
Sep. 8 Tue	- PHYS-1060 Begins
Sep. 10 Thu	- Regular Weekly Quizzes Begin (Thursdays)
Sep. 14 Mon	- Drop/Add Ends (100% Refund)
Sep. 14 Mon	- Last Day to Drop without “W”
Sep. 14 Mon	- PHYS-1050 Laboratory Begins This Week
Sep. 29 Tue	- Hour Exam 1
Oct. 27 Tue	- Hour Exam 2
Nov. 9 Mon	- Last Day to Drop with “W”
Nov. 24 Tue	- Hour Exam 3
Nov. 25 Wed	- Thanksgiving Recess Starts @ Noon
Nov. 30 Mon	- Classes Resume
Dec. 3 Thu	- Topic 1 (Book Report) (due by 5pm Thursday)
Dec. 8 Tue	- Grace Period for Topic 1 ends at 5pm
Dec. 11 Fri	- Last Regular Class
Dec. 14 Mon	- FINALS WEEK Starts
Dec. 15 Tue	- Final Exam 2:45pm-4:45pm 12:30pm-2:30pm (2 hours)
Dec. 18 Fri	- End of Fall Session
Dec. 22 Tue	- Grades due at Noon

“All Exam dates are fixed in stone.” See Dr. Phil otherwise.

**ATTENDANCE IS NOT OPTIONAL:** You are expected to attend every class, and make arrangements to get notes, check the website and possibly come by Office Hours if you cannot. *We only meet twice a week, so if you miss a class, you'll miss a lot.* Exceptions are of course noted for official university activities, military duty requirements, religious observations, etc. Please note that Dr. Phil does not get any extra vacation days during the semester – and neither should you. Attendance is more than just showing up. You are expected to be prepared and to participate when requested. Please do not use this class time to work on homework for this or any other class – it is very distracting to both you and to Dr. Phil. In truth, though, we all have days where things happen, classes get missed. If you are sick, take care of yourself first and seek medical help if you need to. Our goal is to keep missed time to a minimum, but we want everyone healthy, too. People do get ill, have deaths in the families or have a “really bad test day” from time to time. Dr. Phil is interested in teaching Physics and looking for progress from people. “It will all work out in the end.”

**Office Hours:** There are scheduled office hours every Tuesday and Thursday – Dr. Phil is only coming in twice a week. A copy of Dr. Phil's schedule is posted on the door to his office, so you can figure out when I am already committed to be elsewhere. You are perfectly free to make office appointments. If you are planning to stop by during a regularly scheduled office hour, I would appreciate a comment from you before or after class, but this is not necessary. Note: Office hours are provided for your benefit. They don't do me any good, but I do get lonely from time to time. Which is really strange come exam time...

**Grading Scheme:**

A	AB	B	BC	C	CD	D	E
%-age	100-90	89-85	84-80	79-75	74-68	67-62	61-57 56-0

**The Million Point Grading Scale:** There has been much talk about grade inflation in recent years. Well, here's an example of grade hyperinflation: the total number of points this semester will be 1,000,000. Seriously, our modern society tends to use a lot of very large and very small numbers, and the million point grading scale is very useful to break some prejudices about grades and have some fun at the same time.

Final Exam	300,000	30%
3 One-Hour Exams (150,000 pts ea.)	450,000	45%
10 Quizzes (15,000 pts each)	150,000	15%
Special Topics (Papers, etc.)	100,000	10%
Laboratory ( <i>see PHYS-1050</i> )	–	0%
<b>Total Points</b>	<b>1,000,000</b>	<b>100.0%</b>

**“The Instructor reserves the right to curve grades.”**

#### PHYS 1060: Introduction to Stars and Galaxies (3 hrs)

This course introduces the student to the origin and evolution of stars, galaxies, and the universe. Topics covered include the basic properties of stars; the birth, life, and death of stars; stellar explosions; the origin of the elements; white dwarf stars, neutron stars, and black holes; the interstellar medium; structure and evolution of the Milky Way and other galaxies; the origin and fate of the Universe. Students must take PHYS 1050 concurrently with PHYS 1060 if they wish to fulfill the requirements of General Education Area VI. **Prerequisites:** MATH 1100 or equivalent

#### PHYS 1050: Stars and Galaxies Laboratory (1 hr)

This is an astronomy laboratory course designed to illustrate and explore some of the topics covered in PHYS 1060 Introduction to Stars and Galaxies. **Corequisites:** PHYS 1060.

**Course Goals:** TO BECOME KNOWLEDGEABLE and FUNCTIONAL in using physical science concepts and conceptual relationships to describe, predict and explain events in the everyday world that surrounds us, and which govern the objects that we see in the night sky. TO UNDERSTAND the basic nature of science, that it consists of two kinds of truths, some observationally true and other truths that are accepted because of supported theories. TO UNDERSTAND how scientists talk about the world and to understand how this differs from how non-scientists talk about the world. TO ACCEPT the importance of the knowledge of “how we know something is so” in science. TO UNDERSTAND the importance of prior conceptions about the physical world in learning (and teaching) physical science and how it interacts with Nature.

**Laboratory:** Lab is an integral part of any serious study of Physics. Lab is handled separately by your lab instructors, and for Fall 2009 is once again registered for as a separate 1-credit course, PHYS-1050. Unless Dr. Phil is your lab instructor (which won't happen this semester), don't bug Dr. Phil with specific questions about the lab. You are, however, free to ask general questions – I just won't be doing your labs.

**The Textbook:** You will very quickly learn that Dr. Phil does not drone on and on, reading straight out of the textbook (BDSV). In this class, the textbook serves as a “second voice” so that you can see the same material presented in a different way, with some different examples or stories. We will not necessarily go in a linear fashion through the book, despite the Topic calendar on the last page of the syllabus. You should keep up with where we are in the textbook as part of your daily study habits. In addition, you should make it a habit to check the class web site, which also includes a brief discussion of what was covered in class, along with some important examples and equations. Plus there may be links to pictures and videos used in lecture – there are a *lot* of really cool images to see in this class! The time to ask questions about differences between what is in your notes (which may or may not be what was on the blackboard) and what you find in BDSV, is the next class period. Most of the differences come from

differences in notation, or from errors in transcribing Dr. Phil's enthusiastic but sometimes illegible scrawl on the board. Occasionally mistakes crop in – you'll notice that Dr. Phil doesn't work from prepared notes, preferring to work “without a safety net” – we try to correct them As Soon As Possible. Bottom line? You *always* have something to do when you use your notes and your books to good advantage. DON'T get behind – the next test is sooner than you think!

**New or Used?** There's no denial – buying a Physics textbook is expensive. The Old Rule was that it was a Significant Investment, part of your growing library of reference tools that you will keep and use throughout your career. One look in Dr. Phil's office should convince you that I have never sold a single textbook. But today, most students “rent” their texts, selling them as soon as they are “out of here”.

**However,** I strongly urge you to get the 5<sup>th</sup> edition and not try to “make do” with an earlier edition. So should you buy New or Used? Here's a hint: You want CLEAN. There have been studies which show that previously marked-up or highlighted textbooks may do you a real disservice: (1) Your eye will be drawn to whatever the previous reader marked, not what is emphasized by the author – remember the author and publisher are being PAID for being professionals, the previous reader is NOT; (2) Different readers mark or highlight differently – some mark only what is important, some mark what is difficult or obscure, some are trying to cross out what they *don't* need – any way you cut it, it is unlikely you would mark it the same way; (3) Simple statistics should convince you that the average marked-up copy you pick up was marked by a less than ace student – we don't hand out A's in Physics, you *earn* them. Now Dr. Phil is NOT trying to tell you to buy new books, but he IS urging you to invest your money wisely. Remember, relying on someone else's marking, when it is YOUR career, your grades and your tuition money you're dealing with, means you should really give this some thought. As far as your own marks – hey, it's your book. But remember that light pencil marks erase easily and Post-It™ notes are removable.

**Homework:** BDSV provides a variety of thought questions and exercises, which are very useful as warm-ups – *this should not take a huge amount of your time!* Additional problems may come on handouts in the form of Sample Exam pages. Which problems should you do for homework? Well... “all of them”. Or at least all that you need to do. It's part of the daily work you need to do to keep up. The study of Physics is also a study of problem solving and practicing the manipulation of variables and formulas. This H.W. will not be turned in, but you will be responsible for it. It does no good to just hand out detailed solutions for all the problems, because then people tend not to actually work on the H.W., they just study the solutions. That's like only reading a book about running in order to prepare to run a race.

**Work To Hand In:** All work that is to be handed in (which includes Quizzes, Exams, Papers, Special Topics) must include your name (you'd think that would be obvious, but...) – PAPERS WITHOUT NAME MAY NOT BE GRADED! **Staples:** Any papers turned in that are supposed to be stapled, but aren't, are subject to a 3000 point penalty. Any papers turned in with a *fold-and-tear* corner will get an automatic 5000 point penalty. **Late Papers:** lose 10% (one letter grade) per day, but it is better to *do the work at all* than turn in nothing.

**Writing Assignments:** There will be outside reading and writing assignments: this includes a science literacy opinion paper on a movie from a list that will be made available in the first week. Complete instructions will be in the Topic 1 handout. The full movie list will be on the class website (to save trees). The paper is due Thursday 3 December 2009 by 5pm. There will be a penalty for each day a paper is late. *A grace period is included in the schedule.*

**Quiz Schedule:** Expect to have a SHORT quiz every THURSDAY (starting September 10th). There will be ten 15,000 point quiz questions and quizzes may be used for the purposes of attendance. Some Quizzes will be Take-Home. In-Class Quizzes are normally given at the END of the class period, so if you know you have to leave early, see me before class. There will be no further adjustment of quiz grades.

**Exam Schedule:** There will be three hour exams, scheduled for **29 September 2009, 27 October 2009 and 24 November 2009 – all these are on TUESDAY. Schedule these dates and times now.** These exams will be closed-book. Each exam is worth 150,000 points. Scores may be adjusted on a curve to meet the Grading Scheme noted above. Exam questions will vary, but will include problems that will test your understanding of and ability to apply the material, not merely recite lists of facts. You may be surprised to hear this, but I do not expect you to be able to do 100% of the exam; in all likelihood, you've probably never taken exams like this before. They won't really get any easier, but you will get used to them. Review sessions for the exams will be scheduled as the exams near.

The Final Exam will **Tuesday 15 December 2009 (2:45pm-4:45pm 12:30pm-2:30pm)** with a REVIEW class on Thursday December 10th. This is our Final Exam date – it is a major inconvenience to produce a final at another time, so plan your Finals Week accordingly. The Final is worth 300,000 points. It is cumulative and will cover the entire course. If a curve is used on any exam, it will only bring grades up. If you have any special needs – see Dr. Phil *early* in the semester!

#### Exam and Quiz Policy

For all exams, you are expected to sit with at least one space between you and the next person in your row. For all exams and in-class quizzes: You are allowed a #2 pencil and an eraser. Dr. Phil can be very generous, but when he calls for all papers to be turned in, you must turn them in – if you want it graded.

#### Make-Ups:

Quizzes cannot be made up. You are expected to attend classes anyway, but this is especially true of laboratories and examinations. Provided you have a valid reason for missing class (illness, etc.), if you miss: (1) a lab you must contact the appropriate instructor as soon as possible to see if you can make up the lab; (2) an exam, you must contact me as soon as possible to let me know you won't be there, and the later to arrange an exam within a few days. *Dr. Phil dislikes having to write up new exams for people.*

**The Professional Concerns Committee of the Faculty Senate recommends that all faculty include the following paragraph in each syllabus that they prepare for the upcoming semester:**

"You (the student) are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate (pp. 271-272) [Graduate (pp. 24-26)] Catalog that pertain to Academic Integrity. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Judicial Affairs. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with me if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test."

**A-H1N1 "Swine" Flu – <http://www.wmich.edu/flu>**

**It's never a good idea to get sick during a Physics class, but be extra careful this fall semester as we see how this A-H1N1 flu virus spreads around. If you think you are getting the flu, go to the Sindecuse Health Center on campus or see your doctor – anti-viral flu medications appear to be effective, but need to be given early in the process. And then STAY HOME / Get Rest!**

#### Introductions

##### Hello, World

In computer programming, one of the first programs you learn to write in a new computer language is a simple one that has the computer printing "hello world" so that you know that you can get information out of the computer. Here are a few thoughts and comments that I include to give you some things to read and think about from the beginning.

**Dr. Philip Edward Kaldon** - Born western upstate New York; Junior High near New York City; High School in Greensboro, North Carolina (1976). B.A. Integrated Sciences, Northwestern University (1980);

M.S. Physics, Michigan Technological University (1986/88); Ph.D. in Applied Physics, Michigan Technological University (1989). Physics Teaching: WMU, KVCC, GVSU, Hope College. Past President—Michigan Section of the American Association of Physics Teachers (MIAAPT). Dr. Phil pursues many science and science literacy efforts as part of his research. He is also building a body of work as a published science fiction writer since attending the prestigious 2004 Clarion Science Fiction and Fantasy Writers Workshop, an intensive six-week boot camp for SF writing. In 2008 Dr. Phil's story "A Man in the Moon" was honored with publication in the Writers of the Future Volume XXIV, which is a very big deal – the anthology launch party is a red carpet Hollywood CA event. No, really! And "The Brother on the Shelf" was published in the May 2009 issue of *Analog* magazine. In August 2009, Dr. Phil sent a SF novel to a U.K. publisher – we'll see. And "No!" – Dr. Phil has no intentions of making you read his fiction as part of this course.

#### What Do We Need A Calculator For?

Although much of what we are trying to accomplish is hands-on experience, we need to use numbers sometimes. And most of you can't tell me what 4/5ths of 137 is off the top of your head anyway... <grin> (me neither). Also we will be dealing with numbers much larger and smaller than you're used to using. On the other hand, we'll be doing things with calculators that many of you have never seen done before! So, it is very important to make sure that you can do all the neat things we have to do.

#### The First Thing You Should Do Each Day When You Come Into Class...

(after getting comfortable and pulling out your notebook and pencil)

...And Making Sure Your Cell Phone and Pager Ringers Are Turned OFF...

(or we will improv some terrible joke about it)

...Is To Take OUT Your Calculator And Have It Ready At All Times

(it doesn't do you any good all closed up in your book bag, or at home)

#### "My Side" of the Table

It's a small point, but the front lab table is divided in Dr. Phil's mind between "my side" and "your side". Please do not ever pick up papers from Dr. Phil's side of the table. Sometimes they are not for your class, sometimes they may be your papers that have not yet been recorded in my grading spreadsheets. (If they are never recorded, then they are still 0's.) You may think that it makes sense to grab graded papers from both sides of the lab table, but that blocks my access to my piles and the blackboard, which slows things down for everyone. So, "stay on your own side of the table" will make things move smoother for all.

#### What's My Grade?

Part of keeping up with the workload in PHYS-1060 is knowing where you stand in the class. There is a delay, however, between when work is handed in and when it gets back to you. We endeavor to get Exams and Quizzes back to you within one or two class days of when they are given. Grades are recorded in a Microsoft Excel 7.0 spreadsheet. After the first exam is graded, Dr. Phil will create The Predictor, which basically fills in all the final grade columns with estimated answers, even though most of the work of the semester has not been actually done yet. The Predictor uses actual Exam and Quiz scores to estimate what their final values will be, based on your past performance. The Topics (such as the Book Report) are automatically given the lowest "B" grade of 85%. Once The Predictor is set up, you can always stop by office and see what your current projected grade is, or send me e-mail (along with your PHYS-104 Personal ID number [PID]) and I will e-mail your current projected grade. Posting grades on Dr. Phil's office door or at the back of the lecture room is usually done around the exams, sorted by your 5 digit PID, but this information has a short shelf-life. Check the Post date on the printout. During Spring 2001, someone kept stealing (or just throwing out) my printouts, which is very odd behavior.

**What's The Answer?**

I am currently making available solutions to the Exams, so that you will know what the correct (or at least Dr. Phil's version) answer to a problem is. Most quizzes will be gone over the next class period, again so that you will have the correct answer. (Check the class website!) This is easiest for the in-class quizzes – take-home quizzes have a tendency to dribble in over a few days, so there's no point in giving people the answer before they get their papers in! I do not usually give out answer sheets to the Sample Exam Problems, on the theory that you don't have the answers on a real exam, so you need to learn how to PTPBIP – and it encourages students to study together, compare notes or even come to Dr. Phil's office hours. Sometimes I feel like the Maytag™ repairman – it's lonely in my office at office hours.

**Extra Credit:**

I don't "do" extra credit. Students who wish extra credit primarily do so because they aren't using their time effectively already, so why would I wish you to divert even more of your valuable time on additional work?

**Some Helpful Information****First Light**

In our everyday world we rush around; stare at the road ahead of us, look down at the sidewalk to keep from stumbling on the cracks, spend hours in front of the television and flood our homes and neighborhoods with artificial electric light. Rarely do we ever look up... and see the stars. Besides, who needs to read the stars when we have calendars and watches?

**What is Astronomy?**

Astronomy is the study of the heavens above us and the objects they contain. It is, in a sense, a study of the entire Universe. Historically, Astronomy has worked to answer the same types of questions that they always tell young reporters to answer in a news story:

**Who/What/Where/When/Why?**

Who sees What in the heavens, Where and When is it located and Why does it happen. You might be surprised to know how well many ancient civilizations and primitive peoples could answer the first four W's. Astronomers have held important positions in cultures as Keepers of the Calendars and Makers of Tables for Use in Navigation. Ships' captains used to seek out astronomers to have them set their clocks for them. (Why should this be so?)

**What is the Relationship Between Astronomy and Physics?**

Physics and Astronomy are so closely related that nearly all Astronomy courses are taught out of a Department of Physics or a Department of Physics and Astronomy. This is not an accident, but becomes an issue only because most people have no idea what Physics is and most could think of a lot of things they would rather do that take a Physics course. The history of Physics is closely related to the first four W's: the triumph of Classical Mechanics (Newton and Galileo, Copernicus and Kepler) came in determining good tables of planetary and lunar positions. But it is the fifth W that showcases Modern Physics and completes the connections in the development of Astrophysics. Don't be scared of the Physics.

**Natural Philosophy**

Physics was once called Natural Philosophy in colleges and the term has some very good connotations. Physics is a study of Nature and how Nature operates. Physics is often a philosophical arena, where meaning and understanding are gleaned, debated and tested from observations of the real world, experiments in the laboratory, with theories and long "what-if?" and "what-about?" sessions. I often suggest to students that "We are here to change the way that you think" and this is borne out in the many students who comment at the end of the course that they do think about and see the world is a different way. Many tell of how sick to death their friends and family are to here them babble on about "this is how that works" or "don't you wonder why that happened?" Most people go through life not thinking

those thoughts or asking those questions. (Or else believe that it must be too difficult for them to understand.)

**If This Is Supposed To Be Non-Mathematical, How Come I Need A Calculator?**

While it is true that we aren't going to fill pages and pages of notes and blackboards with horrible algebra and arcane formulas, Science in general, and Physics in particular, are often very number oriented. So we need to put a handle on the numbers and a calculator is a useful tool. At times I will do a quick calculation that I don't expect you to follow; I am not trying to "show off" my math and physics skills, but rather am trying to show you that the numbers that end up in the textbook are actually a part of a larger system and that it is possible to generate these numbers, even if something is...

**"Beyond The Scope of This Course"**

This is a favorite (and often overused) phrase that can get used in a descriptive/conceptual course like this one. I expect you to have questions and you should raise them. Ah, but the answers come in several flavors: Quick, Essentially Correct, We'll Be Covering That Shortly and Gee I Don't Have A Good Way to Explain That Without Covering the Board In Equations. Over time "Most Models of The Universe Are Fundamentally Wrong", so we really have a lot of leeway to come up with our own analogies for these complex phenomena. And "There Are No Stupid Questions" since there is very likely at least two other people in the classroom who are actually wondering the very same thing you are at the same time. So ask away! (Just don't be offended if I suggest holding on to a question, if we are about to answer it anyway.)

**Theory**

The theories presented in this course have a long and colorful history that is interesting in its own right. Much like case law to the legal profession, current Physics theory has been "tried and proven" over the years. Unlike law, however, it isn't how slick or well-paid your physicist is versus mine, here the burden of proof falls on experimental verification. Even so, "proof" is too strong a word for some in science, rather one might say that something is "true within these limitations". Though the stars and galaxies have been around for A Very Long Time, the material covered in PHYS-1060 is a mixture of ancient and modern knowledge. There are aspects to this course which have changed in my lifetime – and in my father's lifetime, we have gone from living in one universe, to living in one galaxy amongst a bewildering number of galaxies in a much larger universe. Such is the development of science and scientific theory. Yet I also have an 1848 Astronomy textbook that is quite remarkable in how much they got right regarding the Solar System. While some modern physics material may creep into some chapters of this course, new editions of books like BDSV come out because our technology is gathering images and data from around the Solar System all the time, and our understanding is getting better. It's like going to the eye doctor and having them adjust the dials and making the image sharper all the time.

**Experiment**

Years ago I saw a T-shirt that said "If it's Green and Wriggles, it's Biology; If it Stinks, it's Chemistry; And if it doesn't work, it's Physics". We say that the theory developed in Physics has been verified by Experiment, but surely we cannot mean Physics Lab! Still--reading, thinking and calculating can only take you so far; sometimes you have to see and measure for yourself. The purpose of lab is to put the scientific method into practice and see where event, observation and theory meet. But remember! The theory we develop in class has simplified and "cleaned" up Nature, so we cannot expect perfect experimental results; but careful and repeatable experiments will go a long way to helping you "see" the Physics.

**Time Management (Studying)**

Since we have a lot of material to cover, it makes sense that you might want to keep up, instead of just studying the night before an exam. Some of the concepts and questions are combinations of things, rather than just rote memorization and regurgitation. We're talking SCIENCE here. A good rule of thumb in the old days, was two hours of studying for every hour of class, but today's schedules are sometimes too hectic for that. DO take time to read the book before *and after* we cover a topic. Re-read your notes. Look at problems and work them out. But it can go the other way and you can spend hours banging your head against the wall while you are probably making them way too hard. Think basic definitions! If you find yourself spending long hours without getting any benefit, come and see me and we'll try to help. Very few students can get by without doing any work outside of class.

**Time Management (Exams)**

Staring at an exam page is not the time to learn how to do Physics. Good exam time management starts with being familiar with the homework problems, the basic concepts and the material. Beyond that, you should remember that most parts of the test are equally important, so don't spend all your time on one problem or part. Go onto another problem that you can do. Don't worry about what other students are doing. The student who gets up and hands their paper in halfway through the hour has used up as much time as they care to (for good or bad); it should have no bearing on your test. Do look through the whole test when you get it, making sure that yours is complete. Our exams, by necessity, end up being multiple-guess. Do make sure you're filling in the right bubble. Do check to see that your answers makes sense. Don't leave any parts blank if you can help it.

**Still Having Problems?****Killer Equations**

There is no one equation to "Life, The Universe and Everything". Every equation and every concept developed has some built-in limitations and some very real restrictions on when you can and can not use them.

**PTPBIP (Put The Physics Back Into the Problem)**

So you've read the problem, figured out what's given, determined what is being asked for, decided on what equation(s) you need and played plug-'n- chug on your calculator. Or given a list of choices, you grab the first one that you think makes sense and call it your answer. So you're done, right? Well, how do you know if the answer is right? Well, first off, you can check to see if the answer makes sense. This is what I refer to as "PTPBIP", Putting The Physics Back Into the Problem. It is very important, "real" physicists do it all the time. You needn't write anything extra down, but if you expect that a block should go to the right, then it is very satisfying if your answer also says that the block will go to the right. It may be that the block will go to the left, and that the Physics is trying to tell you something, but rarely will a horizontally moving block travel up. That would be a hint that something funny is going on.

**The Physics Keeps on Building!**

One of the most remarkable things about Physics is that the everything we learn, keeps on depending on everything else we've done. In a History class, once you've learned that the Battle of Hastings was 1066 (or whenever it was), that's it. That's the answer. While today's history depends on what happened before, in a History class you might be able to get away with ignoring the 11<sup>th</sup> Century when you get to the Industrial Revolution. But not so here. You might be worried about having a comprehensive Final Exam. But if you've been awake all semester, you'll find that this isn't a crisis – you'll have been using it all along anyway.

**Expectations:**

Make a mental note of two things: (1) the grade you realistically would like to get in PHYS-1060 and (2) the minimum grade that you have to get. If you aren't sure of the latter, now is the time to check with your department (or your school, for those of you not full-time WMU students). These two grades should represent attainable goals, and given your quiz and exam performance you can plan your study schedule accordingly. Week 12 is not the time to realize that your GPA is too low for you to keep your scholarship.

**Dr. Phil to English Translation:**

Speaking of Dr. Phil's handwriting, you should realize that writing on the blackboard is not the same as writing on a piece of paper. I'm only a few inches from my writing – I can see it and read *just fine*. If you can't, then either (1) put on your glasses, (2) sit closer or if you've already done that, (3) jump up and down and shout "Dr. Phil, I can't read THAT!", and Dr. Phil (after he climbs down from the ceiling) will cheerfully go back to writing larger and more legibly. You'd be amazed at how many "lurkers" in the back of the lecture hall have faulty equations, terrible notes and oh-by-the-way have stinky Physics grades. Don't be embarrassed if you can't read my handwriting – I probably can't read yours either! (This is an occupational hazard of typing on a PC so much – I never *write* anymore!)

**Drop Dates:**

You may wonder why drop dates are so prominently mentioned in this syllabus. Actually it is to make everyone's life easier. Let's face it: most of you aren't so interested (right now) in learning some Physics as in surviving the course and putting that grade in the bank. You will have just gotten your second exams back before the last possible drop date. If you are concerned with passing the course, I would be happy to consult with you to give you a quick read on where you stand.

**Overloads:**

It's a Y2K9 college fact: You are probably taking too many classes and working too many hours. In a perfect world, the best way to do Physics is to abandon everything else and just do the Physics. Since you probably can't do that, now is the time to figure out what you can cut out of your schedule. Hey, you'll thank me later if you at the very least arrange a day off before each exam, especially the final.

**Office Hours:**

It will take a few days to shake down everyone's schedule and get into a rhythm. Frankly, I don't get enough business during office hours, but boy do I hear the kvetching about how hard Physics is and how awful the Quizzes are. If my office hours are not convenient to your schedule, then it is up to you to make an appointment.

**Physics is Phun:**

No one ever believes that on the first day. And for some, it never is fun. But we can try! Really!

**Why We Do All This:**

**science literacy** *n.* An exposure to science in a historical context that serves to allow a person to observe the world around them with understanding, deal with technological applications at home and work, appreciate the distinction between fact and speculation in the media and politics, have a working knowledge of numbers and the scale of the universe, and be able to pursue more information if desired, as a function of everyday life.

Philip Edward Kaldon, Fall 1995

This is Fall in Michigan – Land of Driving Adventures.

Dr. Phil has a long commute (154 miles/day) *and* Lake Michigan is a powerful force of nature. Dr. Phil will make gallant efforts to be here on time every day – *but* ultimately all of us have to be intelligent enough to make decisions between *trying to get to class* and oh, say... *living*. Physics is important, but if you or your vehicle can't make it, then you can't make it.

***We Are Here To Change The Way You Think***

**There Are No Stupid Questions  
(Just Ones That Half The Class Wanted Asked Anyway)**

***UNITS Will Save Your Life***

**PTPBIP ! (Put The Physics Back Into the Problem !)**

***Physics is Phun***

***Astronomers Reach for the Real Stars***

**PHYS-1060 (2) (Kaldon) < Tu Th – 3:30-4:45pm – 1104 Rood >** Rev. 8/21/2009, 11/20/2009  
*Chapter assignments are approximate – actual chapters will depend on our actual pace.*

Week	Class Dates	Topic (BDSV · Bennett, <i>et al</i> , 5 <sup>th</sup> ed.)	Special
1.	<b>7 September</b> 8,10 September	<b>Labor Day &lt; No Classes &gt;</b> Introduction to The Stars & The Science of Astronomy	"Quiz 1 (9/10)" Reading Assignments
2.	15,17 September	<b>UNIT I: Introduction and Tools of Astronomy</b> Ch. 1 - Our Place in the Universe Appendices A, B, C	Quiz 2 (9/17) Topic 1 Assigned
3.	22,24 September	Ch. 2 - Discovering the Universe for Yourself Ch. 3 - The Science of Astronomy	Quiz 3 (9/24)
4.	<b>29 September</b> 1 October	Ch. 4 - Making Sense of the Universe: Understanding Motion, Energy and Gravity	<b>Exam 1 – 9/29 Tue.</b>
5.	6,8 October	<b>UNIT II: Light, Matter and the Observed Properties of Stars</b> Ch. 5 - Light: The Cosmic Messenger	Quiz 4 (10/8)
6.	13,15 October	Ch. 6 - Formation of Planetary Systems: Our Solar System and Beyond	Quiz 5 (10/15)
7.	20,22 October	Ch. 10 - Our Star Ch. 11 - Surveying the Stars	Quiz 6 (10/22)
8.	<b>27 October</b> 29 October	<b>UNIT III: Stars: How They Work and Their Life Stories</b> Ch. 10 / Ch. 11 (con't.)	<b>Exam 2 - 10/27 Tue.</b>
9.	3,5 November	Ch. 12 - Star Stuff	Quiz 7 (11/5)
10.	10,12 November	Ch. 13 - The Bizarre Stellar Graveyard	Quiz 8 (11/12)
11.	17,19 November	<b>UNIT IV: Galaxies and Cosmology</b> Ch. 14 - Our Galaxy	Quiz 9 (11/19)
12.	<b>24 November</b>	<b>Thanksgiving Break - &lt;No Classes&gt;</b>	<b>Exam 3 - 11/24 Tue.</b> <b>No Class 11/26 Thu</b>
13.	1,3 December	Ch. 15 - Galaxies and the Foundation of Modern Cosmology Ch. 16 - Dark Matter, Dark Energy and the Fate of the Universe	Topic 1 due – 12/3 @ 5pm
14.	8,10 December	Ch. 17 - The Beginning of Time	Quiz 10 (12/10)
15.	<b>14-18 December</b>	<b>FINALS WEEK</b>	<b>Final Exam - 12/15 Tue.</b> <b>2:45-4:45pm</b> <b>12:30pm-2:30pm</b>
16.	22 December	Grades Due at Noon	