WELCOME to PMU199Y !
The New Black: Dark Matter and Dark Energy

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COURSE DESCRIPTION

The course description at http://hep.physics.utoronto.ca/PekkaSinervo/pmu199y/ gives a summary of what we will be tackling. The official course syllabus says:

> It is now 80 years since astronomers found the first evidence for a form of matter that wasn't part of the stars in our galaxies, but rather is "dark" and has a gravitational attraction to ordinary matter. Other lines of evidence lead us to believe that there is six times more dark matter than the ordinary matter we are familiar with. Despite this, we have no credible, direct evidence for what this dark matter might be. It is one of the biggest puzzles in particle physics and cosmology. In the last decade, we have also discovered that something else is going on – the universe appears to be filled with "dark energy" that causes the expansion of our universe to speed up instead of slowdown. We will discuss what we know about the hypotheses of dark matter and dark energy, and the debates about what might really be going on. Are we seeing science in crisis, with a revolution just around the corner, or is this just the "normal science" talked about by Kuhn and other philosophers of science? Participants will be expected to participate in seminar-style discussions, as well as take the lead on at least one topic of discussion.

We will be structuring our exploration into dark matter and dark energy in the following topics, each covering about 2 hours:

1. What is Science: Introduction
2. What is a Discovery: What really goes on?
3. First hints: Zwicky and galaxy clusters
4. More hints: Galaxies rotating
5. Even more clues: Gravitational lensing
6. Possible explanations: the WIMP Miracle

7. More problems: Measuring the universe
8. Supernovae: standard candles and all that
9. Curvature of the universe: The Universe is expanding
10. Seeing the early universe: The microwave background radiation
11. Looking for direct detection: First attempts
12. Looking for direct detection: An observation (or not)?

HOW ARE WE GOING TO TACKLE THIS AGENDA?

We will prepare for each topic having thoroughly read the assigned readings.

We will typically spend two 2-hour meetings on a topic. The first meeting will be a seminar discussion based on the readings. I may occasionally have some slides to present. We will have a 10-minute break on the hour.

The second meeting will consist of three parts:

1. A 30-minute discussion of the topic.
2. Four 10-minute presentations followed by discussion (each taking about 30 minutes in total) on a topic identified at the first meeting by half the class.
3. A 10-minute quick quiz based on the material discussed.

We will start this two-week structure the second week of classes.

EVALUATION AND GRADING

It is always a good idea to put down agreements in writing; this is as true in academic situations as it is in the rest of the world. A Grading Scheme can be understood as a contract between instructor and students so it warrants a clear statement. The one I suggest is the following:

Class Discussion	20%
Presentations	10%
Essays	30%
Quick quizzes	20%
Final Exam	20%

TIMES

The class will run for two hours on Thursday in LA 340. We start at 10:10 am SHARP (please make every effort to be on time), and finish at 12:00 noon. We will have a 10-minute break at 11:00.

OFFICE HOURS

I will be available Tuesdays 2-4 PM and Wednesdays 3-5 PM in my McLennan Physics Office 814A. You can arrange to talk to me at other times by just emailing or texting.

COURSE WORK

1. Presentations

The presentations will be done in groups (possibly groups of 2) throughout the year. Depending on the number of students, that will mean a presentation on every other topic per group throughout the year.

2. Essays

On the second meetings on a topic when you are not doing a presentation, you will write a short essay on one of the issues identified at the previous meeting. These should be about 600 words in length and handed in electronically via email to Pekka.sinervo@utoronto.ca before the start of class.

3. Quick Quizzes

We will have a quick quizz every other week starting the third meeting. It will consist of six questions drawn from the readings that we are discussing the last two weeks.

4. Final Exam

We will have a two-hour final exam that will consist of a series of multiple-choice questions and short essays.