

Modern Physics Newsletter (Issue #1)

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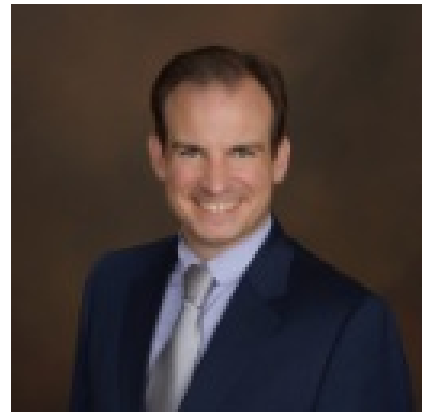
Issue #1 (March 17, 2020)

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Instructor's Corner

It's Spring Break! (or, as one of my colleagues recently snidely remarked, "It's Out-Break!"... ah, to be able to chuckle through a pandemic). I hope all of of you are healthy and happy; I also hope that you are all getting much-deserved rest over this break. As I said in my previous announcements (c.f. Disc. [198966](#) and [199095](#)), we are in an extraordinary period where instruction will move online until at least April 6. Things are moving fast in this pandemic, and all of you would be wise to keep a close eye on the [SMU COVID-19 Blog \(Links to an external site.\)](#).



I wanted to begin a periodic newsletter for the next few weeks to help us remain connected. To that end, I will use this issue to remind you of some things you can do over the break to help remain in touch with your learning, while maybe kinda having a tiny bit of fun in the process. I'll take you on a tour of what the four Grand Challenge Problem teams are up to, so you can see if the grass is greener on the other side of the fence. I'll also lay out what we're in store for in the first week after Spring Break.

Buckle up. This is going to get weirder before it gets normal again.

Bored Now

You've slept in. You've binge-watched every streaming show you missed because you were doing my homework. Now you're bored. What to do, what to do? Well, apart from studying for Exam 2 (seriously... study for Exam 2), here are some things you can do over this break.

- Like reading? Check out my recommendations from announcement Disc. [198966](#). I suggested that you have a look at something like the first half of Richard Rhodes's EPIC "The Making of the Atomic Bomb," which blends physics, chemistry, engineering, and history to tell the story of how the revolutions in special relativity and quantum mechanics led to the first atomic weapons. You have sufficient knowledge from this class to follow the story. I suggested you focus on the tale of Niels Bohr and Werner Heisenberg, and once you feel informed about their research and relationships have a read of the play, "Copenhagen," by Michael Frayn.
- Like movies? I like cheesy physics movies. I also like good physics movies. I'll recommend one in each category. They even have something in common... see if you can spot it!
 - "[Buckaroo Banzai: Across the Eighth Dimension \(Links to an external site.\)](#)"
(1984): a tour-de-force performance by Peter Weller (*Robocop*) and John Lithgow (*Interstellar*), this is the story of a samurai-neurosurgeon-rock star-particle physicist and his adventures with creatures from the 8th dimension. I am not f**king kidding you about any of this.
 - "Interstellar" (2014). including some of the most accurate representations of General Relativity ever attempted, this is the story of a daring mission to a planetary system near a supermassive black hole in a bid to save humanity. Stars Matthew McConaughey, Anne Hathaway, Jessica Chastain, and John Lithgow, among others. Sure, there's a lot of waxing on about love as a trans-dimensional force... but that can be edited out in post-production, right?
- Like audio? Do I have a podcast for you! :-) Check out the "[Uncertainty Principle](#)" [podcast](#), a spin-off project for this course. The first episode takes a look at what Isaac Newton did when he was sent home for over a year because of the Great Plague of London in 1665-1666.

The Grass is Greener: A Look at the Grand Challenge Projects

Just what are all those other students in the class up to on the Grand Challenge Project? Let's put everyone under a microscope!

- **LabRATs (Ramisa Chowdhury, Alex Wallace, Taylor Wallace)**

I'm just gonna quote from their sales pitch to me... *AHEM...* "The year is 2060. There has been a prion outbreak in cows all across the world, and some people have already eaten the beef infected with mutated prions. An anonymous billionaire, who has somehow acquired a monopoly on beef production, has tasked the top three wannabe scientists in the world, who have been bestowed the name "LabRATs," to contain the outbreak. To assist the LabRATs in achieving this goal, this anonymous billionaire has provided the LabRATs with unlimited funding and resources, including advanced biological, biochemical, and physical technology."

Seriously, I can't make this up. That said, the LabRATs are pursuing three scenarios: *Identifying who has eaten the contaminated beef by tagging the prions with "quantum dots" with specific properties; developing a treatment method for humans who have consumed the contaminated beef by attaching gold nanoparticles to the prions in an attempt to use thermal means to destroy them;* and

curing the cows of their prion mutations so that future generations of cows are not mutated by employing short-wave radiation in an attempt to destroy the mutated gene that's causing the problem.

- **LAB Enterprise (Abigail Hays, Lauren Horton, Brian Marquez)**

They are considering astrophysical objects called "pulsars". They are investigating the nature of these objects. With that in hand, they plan to understand how astrophysical data about such objects can be used to determine their distance, size, and other features. They are then going to understand the energy required to form such objects, and available in the surrounding region around one, and think about advanced ideas about utilizing such energy. Finally, they are thinking about what the spin rate of these objects (which is quite high) might imply about time, and what uses such objects might have because of their time-related properties.

- **Team Golf Charlie Papa (Kirubel Moges, Philip Sommers)**

They are exploring the challenges that would be present in a colony ship that has been injected into orbit around a target body (e.g. another planet or a moon). Some aspects that they want to consider are challenges in maintaining communication, especially as relates to various Doppler shifts in communication; food and energy requirements, especially if the energy has to come from solar collection; the need for artificial gravity; and any serious thermodynamic challenges that would be faced.

- **Right-Hand Rulers (Jason Keyser, Nathan Wesley, Larry Yu)**

They are looking into fusion as a power source, and how it's realized in nature compared to the challenges of maintaining fusion in terrestrial laboratory conditions. Regarding the laboratory conditions, they are investigating how to hold matter in the required state to achieve fusion. This involves confining matter using magnetic fields, but instabilities in the hot matter thwart this mechanism and require a lot of physics and engineering creativity. They have narrowed their aspects down to the mechanisms of fusion in general, current methods for doing this in reactors on Earth, and possible future methods for achieving this.

All teams should keep on their topics. Focus on specific calculations for 2 of your 3 aspects. If you get stuck, ask for help!

What's Up, Doc?

Here's a look at what we're in for in the first week after Spring Beak.

- **Tuesday, March 24: Virtual Class Period - 12:30-1:50pm (Zoom: <https://smu.zoom.us/j/523751947> (Links to an external site.))**
 - **Complete the pre-class quiz on Canvas, as usual.** Nothing changes here.
 - I know that all but one of you are in the US Central Time Zone. If those of you outside this timezone will have a hard time connecting because of the time difference, let me know. **Otherwise, I expect everyone to connect to the Zoom room for attendance credit.**
 - The problem-solving demonstration is already recorded and available in the "Class Period 17 Participation and Attendance [WORK]" assignment, where you will **upload your scratch work after the virtual class period for participation and attendance credit.** Uploading your work completes your "attendance" credit.
 - The **numerical answers for the virtual class problems can be entered for participation credit** in a separate Canvas quiz, "Class Period 17 Participation and Attendance [NUMERICAL]".
 - The virtual class problems will become available on Canvas in the Files section after 12:30pm US Central Time. The numerical answers and work upload must be completed by 5pm US Central Time.
 - I will try using virtual breakout rooms for this class period. If you have students you want to be in a breakout room with (e.g. peers you normally work with), let me know and I'll try to arrange that.
- **Thursday, March 26: Exam 2 - 12:30-1:50pm (Zoom: <https://smu.zoom.us/j/523751947> (Links to an external site.))**
 - The Exam will be deployed on Canvas starting at 12:30pm US Central Time. Once started, you have 80 minutes to enter all numerical answers. Your accompanying scanned work must be uploaded to the "Exam 2 [WORK]" assignment by 30 minutes after the end of the exam (2:20pm US Central Time).
 - All students must be connected to Zoom for this exam, so I can be available to answer questions, etc. I'll have you divided into virtual breakout rooms, so you can ask me questions without interrupting others taking the exam.
 - The exam will occur as scheduled. If timezone issues will cause problems, let me know in advance.