Modern Physics

Unit 16: Nuclear Reactions
Lecture 16.3: Final Thoughts

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What have we learned?

Most topics we have discussed were initially developed between ~1880 and ~1930 . . . all without computers, internet, cell phones, ipads, etc.

The underlying principles of quantum theory form the foundation of virtually all of today’s advances in technology!

If the math is good, the predictions (no matter how weird) tend to match experiment!

Learn how to think using the ideas of quantum mechanics is a PRIMARY goal of this course.

✓ We have just scratched the surface.
✓ Distrust easy answers.
✓ Need to be a professional skeptic.
What have we learned? (cont.)

We have primarily focused on the physics of the atom and the statistics that govern particles in a system with quantized energy levels.

Brief excursions into special relativity and nuclear physics.

My hope - that you learned a new set of concepts.

Maybe you didn’t understand everything, but the concepts covered and how they are interconnected will provide a strong foundation as you move forward.
Where we have been

Start of Semester

HyperPhysics
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http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
Many underlying themes, apart from the knowledge

Theme I
Greatest challenge of science is to ask questions that can be reduced to manageable solutions.

Theme II
Time lag between when an issue is first raised and when it is finally resolved often spans 25-50 years.

Theme III
The Rules at the Bottom are quiet different from the Rules at the Top.

Theme IV
We hope you realize your head will not explode if you learn something really new → dispel the “Quantum Weirdness” myth.

Theme V
New course format - more opportunities to think about topics discussed during lecture.
Implications of quantum theory are wide ranging

Quantum mechanics has explained the structure of the atom and the structure of the nucleus.

Without knowing the structure of the atom, most of the physics and chemistry that we know today would not have been possible.

Many of today’s technologies ultimately derive from three basic findings of quantum theory:

- Light is a photon
- Particles have a wave nature associated with their motion
- Both light and particles like electrons possess an intrinsic angular momentum or spin that only have discrete values

Applications of quantum theory in the future are potentially far-reaching.
Anything worthwhile is not easy

The semester has been long and the path has not been easy.

The opportunity to learn something new often comes by only once every so often, and when it comes, it is often disguised as hard work.

Many challenges along the way: making time to view the on-line lectures, taking lecture quizzes, doing homework problems, preparing for exams . . .

For those that stayed the course and didn’t get tired or discouraged or frustrated, the topics we discussed should serve as a solid foundation for your future careers.
I’d like to know what you think . . .

about the course structure, course organization, on-line lectures and web site.

I would greatly appreciate any feedback!

Please take the survey, available during our last regular class discussion. The survey will also be posted as a pdf in Week 16 on the nanoHUB website.
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https://engineering.purdue.edu/Engr/Research/LabsFacilities/NCN
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https://hubzero.org/resources/12
Up Next – Watch for “PHYS 342 Outtakes & Bloopers” Video

May the \(\frac{dp}{dt}\) be with you.

https://www.youtube.com/watch?v=tsTAUs_h_uY