Introductory Nuclear Physics UBC Physics 505, Fall 2018

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Outline: This is an introductory survey of nuclear physics at the graduate level, suitable for students who have not previously taken nuclear physics. The prerequisite is undergraduate quantum mechanics and electromagnetism. Where possible, nuclear physics will be linked to applications in astrophysics and medical physics. Lectures will be given at TRIUMF, but students at other universities may attend the lectures remotely and take this course for credit by arrangement with their own universities. Students in Western Canada should register through UBC and get credit via the Western Deans' Agreement. The syllabus will tentatively be as follows.

1. Introduction to nuclear physics, overview of particles.
2. Nuclear masses, binding energies, liquid drop model, experimental masses
3. Nuclear shapes, form factors of nuclei and nucleons, electron scattering, the discovery of quarks.
4. Shape and sizes of exotic nuclei
5. Parity and parity violation
6. Types of radioactive decay, Beta decay, Alpha decay, Gamma decay with links to nuclear medicine
7. Interaction of radiation with matter; particle detectors
8. Scattering theory, partial wave analysis
9. Nucleon-nucleon force, mesons and exchange currents
10. Isospin, charge symmetry and charge independence.
11. The Deuteron
12. Nuclear shell model
13. Nuclear magnetic moments and applications in chemistry and medicine
14. Hypernuclei; quasi-elastic scattering and nucleon momentum measurements
15. Nuclear astrophysics, Big-Bang nucleosynthesis, hydrogen and helium burning; heavier elements & r-process
16. Neutrino astrophysics

In addition to the material covered in the lectures, each student will research and present oral and written presentations on a topic of their choice, to be worth 25% of the final grade.